7.8 Wildlife and Wildlife Habitat

This subsection presents the existing conditions and results of the assessment of potential proposed Project effects and cumulative effects on the Wildlife and Wildlife Habitat VC. Potential adverse effects on wildlife and wildlife habitat due to changes in wildlife habitat, movement, and health and mortality risk, including both direct and indirect pathways arising from proposed Project activities were assessed during construction, operation, and decommissioning.

The Application has been prepared in accordance with the AIR in which potential effects were identified from waterborne delivery associated with the proposed Project and construction of the MOF. However, as described in subsection 1.5.5, as a result of concerns received during the Application Development phase engagement activities that occurred after the development of the AIR, the proposed Project will no longer utilize any waterborne delivery of modular components and bulk construction materials to the proposed Project Site during construction. As a result, no MOF is required to be constructed or utilized for the proposed Project to accommodate waterborne deliveries. Avoidance of waterborne deliveries are included in the assessment as an avoidance mitigation measure (refer to subsection 7.8.4.1). Implementation of this avoidance mitigation measure has been incorporated into the determination of potential residual effects to Wildlife and Wildlife Habitat from the proposed Project in subsection 7.8.4.2.

In accordance with the AIR, potential effects to wildlife and wildlife habitat from construction of the MOF and barge delivery vessels to the MOF are described in this subsection, and avoidance measures to mitigate identified potential effects from these activities are presented in subsection 7.8.4.1 (that is, no waterborne deliveries).

Table 7.8-1 shows the Wildlife and Wildlife Habitat VC subcomponents, key indicators, measurable parameters, anticipated linkages to other VCs, and the rationale for VC and subcomponent selection.

Table 7.8-1. Wildlife and Wildlife Habitat Subcomponents, Key Indicators, Measurable Parameters, and Rationale

Subcomponents	Key Indicators	Measurable Parameters	Anticipated Linkages to Other VCs or Sections[a]	VC and Subcomponent Rationale
▪ Birds (resident and migratory forest birds, waterbirds, wading birds and shorebirds, and species adapted to human infrastructure) ▪ Mammals (terrestrial) ▪ Amphibians and reptiles	▪ Wildlife Habitat Quality and Quantity ▪ Wildlife Movement ▪ Wildlife Health and Mortality	▪ Loss or alteration of wildlife habitat, including the following: – Habitat disturbance (that is, area and suitability of habitat) – Reduced habitat quality or effectiveness within ZOI – Important wildlife habitat features identified in the proposed Project Footprint or within recommended buffer distances ▪ Change in wildlife movement, including the following: – Duration and extent of barriers to wildlife movement ▪ Increased wildlife health and mortality risk, including the following: – Sources of risk to health and mortality and intensity of effect (qualitative)	▪ Air Quality ▪ Acoustic ▪ Surface Water ▪ Soil ▪ Vegetation ▪ Human Health ▪ Land and Resource Use ▪ Culture ▪ Summary of Biophysical Factors that Support Ecosystem Function ▪ Malfunctions and Accidents ▪ Indigenous Interests	Wildlife and wildlife habitat are an integral component of the Fraser River ecosystem and an indicator of overall health and richness of the estuary. Harvesting of wildlife, such as waterfowl, is important for Indigenous traditional use and cultural purposes. The scope of the assessment of the potential effects on wildlife and wildlife habitat includes the broad range of wildlife species assemblages and habitats that are expected to interact with the proposed Project, grouped into functionally similar subcomponents. The selection of subcomponents for the wildlife and wildlife habitat assessment allows for a focused evaluation of potential effects from the proposed Project on a group of species that inhabit similar ecosystems and are expected to respond to adverse effects of the proposed Project in a similar manner. Three subcomponents are proposed for the Wildlife and Wildlife Habitat VC: (1) birds, (2) mammals, and (3) amphibians and reptiles. Within these subcomponents, various species with the potential to interact with the proposed Project will be assessed, including species at risk and culturally important species. Variation in ecological context and resilience to potential effects for different species within the subcomponents will be included in the assessment, including factors such as different habitat preferences, seasonal ranges, migration, and movements. The subcomponents will be assessed by evaluating the potential effects of the proposed Project on habitat, movement, and mortality risk for the groups.

Table 7.8-1. Wildlife and Wildlife Habitat Subcomponents, Key Indicators, Measurable Parameters, and Rationale

Subcomponents	Key Indicators	Measurable Parameters	Anticipated Linkages to Other VCs or Sections[a]	VC and Subcomponent Rationale
▪ Birds (resident and migratory forest birds, waterbirds, wading birds and shorebirds, and species adapted to human infrastructure) ▪ Mammals (terrestrial) ▪ Amphibians and reptiles (continued)	Refer to previous page	– The overlap of construction activities with sensitive periods for wildlife (such as migratory bird nesting period and amphibian breeding period) – Important wildlife habitat features that may be occupied during construction that have been identified in the proposed Project Footprint or within recommended buffer distances – Reduced water quality in the Fraser River and Tilbury Slough from sedimentation and COCs – Altered air, surface water, and soil quality from air contaminants, odours, acidification, or eutrophication	Refer to previous page	Proposed Project construction, operation, and decommissioning activities have the potential to interact with wildlife and wildlife habitat. If approved, the proposed Project will occur on land that was previously used for industrial purposes; therefore, the potential for direct alteration of wildlife habitat is limited. Potential interactions with wildlife habitat during construction, operation, and decommissioning may occur directly from vegetation removal and ground disturbance or indirectly from noise, light, and activity. Potential interactions with wildlife movement related to habitat loss, changes in habitat quality, and new infrastructure have been evaluated. Potential proposed Project interactions with wildlife or occupied habitats that may result in wildlife mortality during the construction, operation, and decommissioning phases of the proposed Project have also been assessed. Birds and their nests are protected under the *MBCA*, *SARA*, and the B.C. *Wildlife Act*. The assessment will evaluate potential proposed Project interactions and potential effects on resident and migratory forest birds, waterbirds and shorebirds, and species adapted to human infrastructure. The mammal subcomponent will include terrestrial mammal species (that is, nonmarine mammals) with potential to forage within and interact with the proposed Project Footprint, which primarily includes small mammals associated with urban environments. Amphibians and reptiles have been combined into one subcomponent to capture the potential proposed Project interactions and potential effects that might be unique to them.

[a] This subsection will discuss or refer to linked VCs and sections, when applicable, that are expected to interact with Wildlife and Wildlife Habitat. Results of the assessment of the potential effects of the proposed Project on Wildlife and Wildlife Habitat will be integrated into those of other applicable VCs (such as Vegetation) and Application sections, when applicable. Further information on linked VCs and sections can be found in relevant VC subsections.

1

7.8.1 Relevant Statutes, Policies, and Frameworks

Table 7.8-2 outlines the key statutes, policies, and frameworks that were used in the development of the effects assessment of the proposed Project on the Wildlife and Wildlife Habitat VC.

The B.C. CEF and the Conservation Framework have not been incorporated into this Application (Government of B.C. 2016; B.C. MOE 2009). These guidance documents were reviewed and considered but were determined not to be relevant to the effects assessment of the proposed Project on the Wildlife and Wildlife Habitat VC. The south coast region has only completed one CEF project, outside of the Wildlife and Wildlife Habitat RAA and north of the Fraser River. The regional and provincial values identified in the CEF are not applicable to the Wildlife and Wildlife RAA. There is no suitable habitat for the identified provincial indicators, but the proposed Project's CEA may be used by relevant Provincial regulatory agencies to inform future CEAs, as outlined in Information Bulletin #1: Relationship between the CEF and Reviewable Project Environmental Assessment (B.C. EAO 2017b).

Table 7.8-2. Key Statutes, Policies, and Frameworks Relevant to the Wildlife and Wildlife Habitat Valued Component

Regulatory Agency or Other	Statute, Policy, or Framework	Proposed Project Relevance
Federal		
ECCC	*SARA*	*SARA* protects species listed as Extirpated, Endangered, Threatened, or a Special Concern on Schedule 1. Species included on Schedule 1 are established by the Federal Cabinet and are based on recommendations by the COSEWIC and consultation with regulatory agencies, Indigenous nations, and the public. *SARA* applies to federal lands; however, for species also protected under the *MBCA*, *SARA* applies automatically to provincial and territorial lands and waters. The Act may also apply to other lands when provincial protection is deemed inadequate by the Federal Minister of the Environment. As part of the preparation and implementation of a Recovery Strategy for Threatened or Endangered species, the Government of Canada is required to identify Critical Habitat, which is defined in subsection 2(1) of *SARA* as, "the habitat that is necessary for the survival or recovery of a listed wildlife species." The destruction of Critical Habitat within federal lands (for example, federal parks or reserves) is prohibited for Threatened and Endangered species under subsection 58(1) of *SARA*; however, a permit or agreement that authorizes an activity that is expected to affect a listed species or its Critical Habitat may be granted under Section 73 of the Act.
ECCC	*MBCA*	Migratory bird species in Canada are protected under the *MBCA* and the *MBRs*. Under this legislation, "the killing, capturing, injuring, taking, or disturbing of migratory birds or the damaging, destroying, removing, or disturbing of their nests" is prohibited. The *MBCA* is administered through the Canadian Wildlife Service, a branch of ECCC. The *MBCA* does not protect all birds; for example, grouse, hawks, owls, eagles, falcons, and corvids are not protected under the Act, but they may be protected under other legislation. Recent updates to modernize the *MBRs* include specifying that protections for nests of most migratory birds apply when a nest contains a live bird or a viable egg. The nests of 18 migratory bird species (listed in Schedule 1 of the Regulations) that reuse their nests in subsequent years remain protected year round, unless they have been shown to be abandoned (ECCC n.d.c). The amended regulations were published in the Canada Gazette, Part II, on June 8, 2022, and came into force July 30, 2022. ECCC provides guidance on nesting periods of migratory birds for nesting zones across Canada (ECCC 2018). ECCC nesting zone calendars illustrate the proportion of migratory bird species that are estimated to be actively nesting (referred to as nesting intensity) on a given date throughout the year for wetland, forest, and open habitats. The protection of migratory bird species under the *MBCA* and associated nesting periods was used in the development of proposed mitigation measures for the proposed Project and considered as context in the assessment of potential residual effects on wildlife.

Table 7.8-2. Key Statutes, Policies, and Frameworks Relevant to the Wildlife and Wildlife Habitat Valued Component

Regulatory Agency or Other	Statute, Policy, or Framework	Proposed Project Relevance
Provincial		
B.C. ENV	B.C. *Wildlife Act*	The B.C. *Wildlife Act* protects all vertebrate wildlife species (that is, mammals, birds, amphibians, and reptiles) from direct harm, except as allowed under regulation (for example, legal hunting and trapping). A species may be legislated as Endangered or Threatened under the Act by the Lieutenant Governor in Council. Under Section 34 of the Act, a person commits an offence if, except as allowed by regulation, they possess, take, injure, molest, or destroy a bird or its egg; the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl; or any bird nest that is occupied by a bird or its egg. A B.C. *Wildlife Act* permit is required for any trapping or handling of live wildlife (such as amphibian or reptile salvages) or for removing a nest that has year-round protection under the Act (that is, eagle, peregrine falcon, osprey, heron, or burrowing owl). Permits for the removal of active nests are not typically granted. The Act permit requirements and protections were used in the development of mitigation measures for the proposed Project and considered as context in the assessment of residual effects on wildlife and wildlife habitat. The B.C. CDC assigns each species to either a Red, Blue, or Yellow list to help identify the level of concern about their risk and to set conservation priorities (Government of B.C. n.d.c). Red- and Blue-listed species are not protected by specific legislation; however, these lists help to identify species that can be considered for designation as Endangered or Threatened under the B.C. *Wildlife Act*. Any species that is at "risk of being lost" (for example, Extirpated, Endangered, or Threatened) is assigned to the Red list. Species that are of Special Concern are assigned to the Blue list, whereas Species of Least Risk are assigned to the Yellow list (Government of B.C. n.d.a, n.d.c, n.d.e). Species listed by the B.C. CDC and under the Act were considered in the effects assessment for the proposed Project.
BCER (formerly referred to as the B.C. OGC)	▪ *ERAA* (2022) ▪ *EPMR*	The B.C. *ERAA* and associated *EPMR* include protections for wildlife and wildlife habitats. These are administered by the BCER, which is responsible for permitting oil and gas development projects in B.C. The *EPMR* is a results-based regulation operating under the professional-reliance model of the B.C. *ERAA*. Old Growth Management Areas, designated community watersheds, Wildlife Habitat Areas (WHAs), and Ungulate Winter Ranges (UWRs) may be designated under the *EPMR*. Part 2 of the *EPMR* outlines permit considerations and directions of riparian values and wildlife and wildlife habitat. The *EPMR* only applies to Crown land and does not apply to private land or subsurface oil and gas activities associated with an operating area (B.C. OGC 2021a, 2021b). For Crown land applications, the BCER applies the tests and principles of the *EPMR* to confirm proposed activities are in alignment with the statutory requirements and the government's environmental objectives, including wildlife habitat features, WHAs, and UWRs (B.C. OGC 2021a, 2021b). The BCER has the authority to deny a permit or authorization or impose conditions on the permit that they consider necessary to meet the intent of the government's environmental objectives (B.C. OGC 2021a, 2021b).

Table 7.8-2. Key Statutes, Policies, and Frameworks Relevant to the Wildlife and Wildlife Habitat Valued Component

Regulatory Agency or Other	Statute, Policy, or Framework	Proposed Project Relevance
BCER (formerly referred to as the B.C. OGC) (continued)	Refer to previous page	UWRs and WHAs were initially designated under the B.C. *Forest and Range Practices Act* to conserve and manage important habitat for species at risk, regionally important wildlife, and areas necessary to meet winter habitat requirements for certain ungulate species. Under the Act, the *Government Actions Regulation* directs how the Government of B.C. establishes land designations or stewardship measures for forest and range values. Additionally, WHA objectives may be established under the *Government Actions Regulation*. Designated WHAs and UWRs were subsequently adopted under the B.C. *ERAA* and *EPMR*. Legal Orders for designated WHAs and UWRs include General Wildlife Measures. Oil and gas activities regulated by BCER under the B.C. *ERAA* are expected to adhere to applicable General Wildlife Measures for designated UWRs and WHAs. Section 6 of the *EPMR* prescribes objectives for the management and protection of wildlife and wildlife habitat, including WHAs and UWRs, as well as wildlife tree retention areas and wildlife habitat features. The *EPMR* states that activities should not take place within certain designated wildlife habitats, including WHAs and UWRs, unless the activities will not have a material adverse effect on the wildlife habitat and species for which these areas were established. Additionally, the *EPMR* states that activities outside of a WHA should be scheduled to occur during a time and manner that will not result in the physical disturbance to high-priority wildlife or their habitat (including avoiding disturbance during sensitive seasons and critical life stages), and activities should not damage or render ineffective a wildlife habitat feature (as defined in an order under Section 6 of the *EPMR*). The EPMG is a reference document for oil and gas applicants and permit holders (B.C. OGC 2021b). The guideline was developed to assist oil and gas companies and those potentially affected by oil and gas activities to understand the requirements of the *EPMR*. In addition to the guidelines in the *EPMR*, the EPMG provides further guidance for the management and protection of wildlife and wildlife habitat. The proposed Project will be regulated under the B.C. *ERAA* and the *EPMR*. Regulatory requirements under the B.C. *ERAA* and *EPMR*, as well as the guidance provided in the EPMG, were used in the development of proposed mitigation measures for the proposed Project and considered as context in the assessment of residual effects on wildlife and wildlife habitat.
B.C. ENV	B.C.'s Policy for Mitigating Impacts on Environmental Values and the accompanying Procedures for Mitigating Impacts on Environmental Values (B.C. MOE 2014e, 2014f)	These two guidance documents outline a mitigation hierarchy framework for avoiding and minimizing potential negative effects of development projects on environmental values. They provide guidance on the application of this hierarchical process for selecting and implementing mitigation required under existing legislation or for other commitments. The four levels in the mitigation hierarchy include the following: (1) avoid, (2) minimize, (3) restore onsite, and (4) offset. Emphasis on the avoid and minimize stages of the hierarchy has been a priority during proposed Project planning and design. The assessment of residual effects on wildlife and wildlife habitat considers the remaining effects following implementation of the proposed measures applied to avoid, minimize, and restore onsite.

Table 7.8-2. Key Statutes, Policies, and Frameworks Relevant to the Wildlife and Wildlife Habitat Valued Component

Regulatory Agency or Other	Statute, Policy, or Framework	Proposed Project Relevance
B.C. ENV (continued)	Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development (B.C. MOE 2014b)	Develop with Care 2014 was prepared for use by local governments, the development community, landowners, and environmental organizations as a comprehensive, province-wide guide to maintaining environmental values during the development of urban and rural lands. Develop with Care 2014 is one in a series of environmental guideline documents. Complementary documents include Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (B.C. MOE 2013b) and Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia (B.C. MOE 2014a). Guidance related to wildlife, including sensitive timing windows and recommended buffer distances for raptor nests and amphibian breeding sites, was considered in the development of proposed mitigation measures for the proposed Project.
British Columbia Ministry of Water, Land, and Resource Stewardship (B.C. WLRS)	A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia Interim Guidance (B.C. MFLNRO 2014)	The compendium provides recommendations for the mitigation of potential effects to wildlife and wildlife habitat for planning, development, and operation of industrial development. Although developed for the North Area, recommended mitigation, including sensitive timing windows and setbacks for wildlife habitat features, are relevant and were used in the development of proposed mitigation measures for the proposed Project.
B.C. WLRS	Best Management Practices for Amphibian and Reptile Salvages in British Columbia (Ovaska et al. 2004)	The BMPs outline relevant regulatory and permitting requirements and recommended methods for amphibian and reptile salvages in B.C., which informed the development of proposed mitigation measures for the proposed Project.
Regional and Municipal		
Canadian Wildlife Service	A Framework for the Scientific Assessment of Potential Project Impact on Birds (Hanson et al. 2009)	A scientific framework for determining and managing effects of projects in Canada on birds was developed in 2009. This framework was designed to help proponents make scientifically based conclusions on potential and realized projects on birds and to evaluate the effectiveness of mitigation strategies in support of the EA decision-making process. The guidance provided in this report aligns with the former *Canadian Environmental Assessment Act*, the *MBCA*, and *SARA*. This framework was used to develop the effects assessment of the proposed Project on the bird subcomponent.

Table 7.8-2. Key Statutes, Policies, and Frameworks Relevant to the Wildlife and Wildlife Habitat Valued Component

Regulatory Agency or Other	Statute, Policy, or Framework	Proposed Project Relevance
FREMP	FREMP (2003) Fraser River Habitat Colour Coding (FREMP and BIEAP n.d.)	The FREMP was an intergovernmental partnership among Federal, Provincial, and Regional governments and port authorities to coordinate planning and decision-making in the Fraser River estuary. The FREMP developed a management plan for the Fraser River estuary that outlined a framework for integrating the management of human and natural activities in the estuary (FREMP 1994). It aimed to improve environmental quality in the estuary while providing economic development opportunities and sustaining the quality of life in and around the estuary. This management plan was updated in 2003 (FREMP 2003) to reflect the changing landscape, legislation, and policies of the area. Through a joint partnership with the BIEAP, known as BIEAP-FREMP, the shoreline within the lower Fraser River estuary was classified as high, moderate, or low productivity based on values for fish and wildlife function (FREMP and BIEAP n.d.). Portions of the shoreline along the Fraser River and Tilbury Slough within the Wildlife and Wildlife Habitat LAA and RAA have been Red-coded, reflecting high productivity values for fish and wildlife function. The ratings remain informative for determining environmental sensitivity and were taken into consideration for the effects assessment. The shoreline classification was taken into consideration in the development of proposed mitigation measures for the proposed Project by focusing measures on avoiding and minimizing potential effects on habitat features and functions in these areas.
Metro Vancouver	Metro Vancouver's Ecological Health Framework (Metro Vancouver 2018)	Metro Vancouver's Ecological Health Framework encapsulates Metro Vancouver's collective efforts around ecological health and provides guiding principles, goals, and strategies to help achieve the vision of a beautiful, healthy, and resilient environment for current and future generations (Metro Vancouver 2018). The framework emphasizes challenges to maintaining ecological health in Metro Vancouver, such as climate change, habitat loss and fragmentation, invasive species, and environmental contamination. The ecological values and goals summarized in the framework informed the level of importance assigned to potential residual proposed Project and cumulative effects to wildlife and wildlife habitat.
Delta	Delta's Birds & Biodiversity Conservation Strategy (Delta 2018)	The purpose of Delta's Birds & Biodiversity Conservation Strategy is to identify, protect, and enhance biodiversity in Delta, B.C., to verify necessary conditions exist for thriving and diverse native wildlife, with an emphasis on birds (Delta 2018). The strategy establishes Delta's ecological values, goals, and objectives. Within each objective, Delta has identified strategies and actions for maintaining, protecting, and enhancing resilient habitats. The Conservation Strategy actions (such as, "educate the public on the effects of rat poison use on raptors and other wildlife; explore alternative measures and methods for rat control and deterrents" [Delta 2018]) align with the proposed mitigation measures developed to reduce potential adverse effects to wildlife and wildlife habitat from the proposed Project.
	Delta's Tree Protection and Regulation Bylaw	Delta's Tree Protection and Regulation Bylaw supports the preservation of trees in Delta, B.C., and aims to enhance the overall tree canopy. The bylaw tree removal requirements (such as permit fees and tree replacement) were used in the development of proposed mitigation measures for the proposed Project.

Table 7.8-2. Key Statutes, Policies, and Frameworks Relevant to the Wildlife and Wildlife Habitat Valued Component

Regulatory Agency or Other	Statute, Policy, or Framework	Proposed Project Relevance
Other		
Indigenous Land Use Planning Documents		
Hul'qumi'num Treaty Group	Shxunutun's Tu Suleluxwtst – Interim Strategic Land Plan for the Hul'qumi'num Core Traditional Territory (Hul'qumi'num Treaty Group 2005)	The Shxunutun's Tu Suleluxwtst – Interim Strategic Land Plan for the Hul'qumi'num Core Traditional Territory is an interim strategic land and resources plan. The Hul'qumi'num Treaty Group represents Stz'uminus, Cowichan Tribes, Lake Cowichan, Halalt First Nation, Lyackson First Nation, and Penelakut First Nation. The core traditional territory for these Indigenous nations includes southern Vancouver Island, the Southern Gulf Islands, and the lower reaches of the Fraser River. On the mainland, the territory includes the south arm of the Fraser River and adjacent banks up to Douglas Island and the islands of the river, including Westham Island. Subsection 7.4 of the Shxunutun's Tu Suleluxwtst – Interim Strategic Land Plan for the Hul'qumi'num Core Traditional Territory discusses biodiversity and wildlife management. Hul'qumi'num People identified large land mammals such as deer, elk, moose, mountain goat and bear, and numerous birds, including ducks and geese, as culturally harvested species. Hul'qumi'num People are concerned about threats to wildlife populations, particularly elk, deer, and bald eagle; removal of wildlife habitat, particularly forests; and declining access to traditional harvesting sites from resource extraction and urban development activities. Goals for the management of wildlife and biodiversity include the following: ▪ Maintain and restore the productivity and diversity of native plants and animals ▪ Ensure that Hul'qumi'num People have opportunities to hunt, fish, and trap to meet their domestic and cultural needs, in accordance with their customary laws and institutions ▪ Ensure that Hul'qumi'num People have meaningful authority over the management of wildlife and wildlife habitat
		▪ Ensure that Hul'qumi'num People have capacity for effective wildlife management ▪ Ensure that Hul'qumi'num People benefit from jobs and economic activity associated with wildlife management, including wildlife viewing and protected areas management The Shxunutun's Tu Suleluxwtst – Interim Strategic Land Plan for the Hul'qumi'num Core Traditional Territory was considered when assessing potential adverse effects of the proposed Project on wildlife species and their habitat noted as culturally important to Indigenous nations and local communities. It was also considered when assessing potential changes to key habitat for species important to current use of lands and resources for traditional purposes. Indigenous Land Use Planning Documents are one of the sources used when determining the importance of potential residual proposed Project and cumulative effects on wildlife and wildlife habitat.

Table 7.8-2. Key Statutes, Policies, and Frameworks Relevant to the Wildlife and Wildlife Habitat Valued Component

Regulatory Agency or Other	Statute, Policy, or Framework	Proposed Project Relevance
Katzie First Nation	Katzie First Nation Land Use Plan	Following ratification of its Land Code, Katzie First Nation developed the Katzie First Nation Land Use Plan, which is applicable to Katzie First Nation reserves and two parcels of land held as fee simple by Katzie First Nation (referred to as "Katzie Lands") (Katzie First Nation 2019). General objectives within the Katzie First Nation Land Use Plan include providing land for economic development, housing options, recreation space, promoting environmental stewardship, and Katzie First Nation cultural practices (Katzie First Nation 2019). The Katzie First Nation Land Use Plan also focuses on maintaining natural areas to protect important wildlife habitat. Although the Katzie Lands are not in the vicinity of the proposed Project and do not overlap with the Wildlife and Wildlife RAA, the Katzie First Nation Land Use Plan was reviewed and considered when assessing potential effects of the proposed Project on wildlife species and their habitat noted as culturally important to Indigenous nations and local communities. The Katzie First Nation Land Use Plan was also considered when assessing potential changes to key habitat for species important to current use of lands and resources for traditional purposes. Indigenous Land Use Planning Documents are one of the sources used when determining the importance of residual and cumulative effects on Wildlife and Wildlife Habitat.
Leq'á:mel First Nation	Leq'á:mel First Nation Land Use Plan	Leq'á:mel First Nation Land Use Plan was developed to: foster a healthy community; protect and enhance natural resources; support appropriate development of the land; and celebrate culture and tradition. The plan sets forward a path for land and resource development intended to positively contribute to the economic, social, cultural, and environmental well-being of Leq'á:mel First Nation. Specific goals identified in the plan include pursuing economic self sufficiency; creating a healthy and sustainable community; providing certainty for future land development; and protecting and preserving cultural and environmental features (Leq'á:mel First Nation 2015). The Leq'á:mel First Nation Land Use Plan also focuses on maintaining natural areas to protect and preserve important wildlife habitat. Although the Leq'á:mel First Nation Lands are not in the vicinity of the proposed Project and do not overlap with the Wildlife and Wildlife RAA, the Leq'á:mel First Nation Land Use Plan. was reviewed and considered when assessing potential effects of the proposed Project on wildlife species and their habitat noted as culturally important to Indigenous nations and local communities. The Leq'á:mel First Nation Land Use Plan was also considered when assessing potential changes to key habitat for species important to current use of lands and resources for traditional purposes. Indigenous Land Use Planning Documents are one of the sources used when determining the importance of residual and cumulative effects on Wildlife and Wildlife Habitat.

Table 7.8-2. Key Statutes, Policies, and Frameworks Relevant to the Wildlife and Wildlife Habitat Valued Component

Regulatory Agency or Other	Statute, Policy, or Framework	Proposed Project Relevance
Stó:lō Nation	S'ólh Téméxw Use Plan Policy (S'ólh Téméxw Stewardship Alliance 2018)	The S'ólh Téméxw Use Plan is a strategic planning resource summarizing the land use interests and needs of Stó:lō Nation. Stó:lō Nation identified S'ólh Téméxw Use Plan zones representing the areas of S'ólh Téméxw that are most important to Stó:lō Nation in terms of cultural heritage. Each S'ólh Téméxw Use Plan zone has a condition relating to how resources in the zone are used and established by the nation. Although none of the S'ólh Téméxw Use Plan zones are in the vicinity of the proposed Project and none overlap with the Wildlife and Wildlife Habitat RAA, the S'ólh Téméxw Use Plan was reviewed and considered when assessing potential effects of the proposed Project on wildlife species and their habitat noted as culturally important to Indigenous nations and local communities. The S'ólh Téméxw Use Plan was also considered when assessing potential changes to key habitat for species important to current use of lands and resources for traditional purposes. Indigenous Land Use Planning Documents are one of the sources used when determining the importance of residual and cumulative effects on Wildlife and Wildlife Habitat.
Tsawwassen First Nation	Tsawwassen First Nation Land Use Plan	The Tsawwassen First Nation Land Use Plan provides long-term vision, goals, and objectives for development of Tsawwassen Lands. These include employment and economic development, housing opportunities for different housing types, transportation and infrastructure developments, and alternative land holdings. Moreover, the Tsawwassen First Nation Land Use Plan incorporates aspects of cultural priorities such as the development of a sense of place and community building, opportunities for recreational and cultural amenities, opportunities for community and cultural reflection within the built environment, and environmental sustainability (Tsawwassen First Nation and AECOM 2009). Although the Tsawwassen First Nation Lands are not in the vicinity of the proposed Project and do not overlap with the Wildlife and Wildlife RAA, the Tsawwassen First Nation Land Use Plan was reviewed and considered when assessing potential effects of the proposed Project on wildlife species and their habitat noted as culturally important to Indigenous nations and local communities. The Tsawwassen First Nation Land Use Plan was also considered when assessing potential changes to key habitat for species important to current use of lands and resources for traditional purposes. Indigenous Land Use Planning Documents are one of the sources used when determining the importance of residual and cumulative effects on Wildlife and Wildlife Habitat.

Table 7.8-2. Key Statutes, Policies, and Frameworks Relevant to the Wildlife and Wildlife Habitat Valued Component

Regulatory Agency or Other	Statute, Policy, or Framework	Proposed Project Relevance
Tsleil-Waututh Nation	Tsleil-Waututh Nation Land Use Plan	The Tsleil-Waututh Nation Land Use Plan 2018 provides the vision, principles, and guidelines for how land use and development will occur on nation reserve lands over the next 100 years. The Land Use Plan is intended to guide decision-making by council, staff, community members, and others to ensure decisions reflect the community's values in a responsible manner. Use of Tsleil-Waututh Nation reserve lands will prioritize the needs of Tsleil-Waututh Nation members (Tsleil-Waututh Nation n.d.). The Tsleil-Waututh Nation Land Use Plan also focuses on the preservation, restoration, and management of ecological values, such as forest, wildlife habitat (including corridors for wildlife passage), creeks, foreshore, and water and air quality. Although the Tsleil-Waututh Nation Lands are not in the vicinity of the proposed Project and do not overlap with the Wildlife and Wildlife RAA, the Tsleil-Waututh Nation Land Use Plan was reviewed and considered when assessing potential effects of the proposed Project on wildlife species and their habitat noted as culturally important to Indigenous nations and local communities. The Tsleil-Waututh Nation Land Use Plan was also considered when assessing potential changes to key habitat for species important to current use of lands and resources for traditional purposes. Indigenous Land Use Planning Documents are one of the sources used when determining the importance of residual and cumulative effects on Wildlife and Wildlife Habitat.

7.8.2 Assessment Boundaries

The following assessment boundaries have been defined for the Wildlife and Wildlife Habitat VC.

7.8.2.1 Spatial Boundaries

The spatial boundaries for the Wildlife and Wildlife Habitat VC are shown on Figure 6.2-7 and include the proposed Project Footprint, as well as the following:

- LAA – The Wildlife and Wildlife Habitat LAA consists of the proposed Project Footprint plus a 300-m buffer around the proposed Project Footprint and includes both aquatic and terrestrial habitat. The Wildlife and Wildlife Habitat LAA encompasses the proposed Project Footprint and extends beyond it to include the surrounding area, where there is a reasonable potential for proposed Project-specific effects to occur. The Wildlife and Wildlife Habitat LAA considers the wildlife species expected to interact with the proposed Project, the effect pathways, and available information on wildlife sensitivity to disturbance (such as, setback distances).
- RAA – The Wildlife and Wildlife Habitat RAA consists of the proposed Project Footprint plus a 500-m buffer around the proposed Project Footprint and includes both aquatic and terrestrial habitat. The RAA also encompasses the Fraser River for 300 m upstream and 2 km downstream of the proposed Project Footprint, including a 50-m buffer from the high-water mark on either side. The Wildlife and Wildlife Habitat RAA encompasses the proposed Project Footprint, the Wildlife and Wildlife Habitat LAA and the surrounding area, where there is potential for the proposed Project to interact with other activities to result in cumulative adverse effects.

7.8.2.2 Temporal Boundaries

Temporal boundaries identified for the Wildlife and Wildlife Habitat VC include the following:

- Construction phase – Estimated 3- to 6-year duration
- Operation phase – Estimated 40-plus-year duration
- Decommissioning phase – Estimated 2-year duration

Construction is planned to commence as early as 2027, with an anticipated proposed Project in-service date of 2031-plus. A detailed proposed Project schedule is outlined in subsection 1.5.1 (Schedule).

7.8.2.3 Administrative Boundaries

Administrative boundaries refer to the limitations imposed on an EA by political, economic, or social constraints (B.C. EAO 2020). No administrative boundaries exist that limit the assessment of potential adverse effects on the Wildlife and Wildlife Habitat VC.

7.8.2.4 Technical Boundaries

Technical boundaries refer to potential limitations in the ability to predict the potential effects of the proposed Project. The interactions between LNG facility construction, operation, and decommissioning activities on wildlife and wildlife habitat are generally known and have predictable effect pathways and responses. When there are limitations to assessment predictions or conclusions, these are discussed within the characterization of residual adverse effects and cumulative adverse effects under the level of confidence criterion. Limitations are associated with availability of data and research; absence of relevant, accepted, or established biological thresholds by which to quantitively measure the residual adverse effects of the proposed Project; and limitations of available spatial data.

Information on existing conditions was based on a desktop review and field surveys, which provide information on current species composition and habitat use. These data do not provide sufficient information to allow for an understanding of local population trends or information on a timescale required to predict species responses to factors unrelated to the proposed Project (such as future developments, climate change, and catastrophic events). Although population trend information is available for some species at the provincial or federal scale, there is a lack of available information on local species population and distribution trends within the Wildlife and Wildlife Habitat VC LAA and RAA, and the Fraser River delta. This assessment made conservative assumptions regarding population trends, based on provincial and federal species rankings.

7.8.3 Existing Conditions

This subsection characterizes the existing conditions of the Wildlife and Wildlife Habitat VC within the Wildlife and Wildlife Habitat LAA and RAA, including documentation of desktop and field methods used to compile information on historical and existing conditions. The results of the desktop review, combined with field surveys conducted by FortisBC, have gathered data to provide a thorough understanding of the existing conditions to inform the assessment for the Wildlife and Wildlife Habitat VC.

As described in the DPD (FortisBC 2022), existing Tilbury LNG facilities include the original production and storage facility in operation since 1971 (Base Plant), Phase 1A, and ancillary facilities, including power supply, gas supply, and both natural gas and LNG distribution facilities to serve public customers. As a component of the Tilbury LNG Expansion project, FortisBC has made an application to the BCUC seeking authorization to decommission and demolish the Base Plant. These activities will be considered and coordinated with all other activities at the Tilbury LNG facility including operation of and planned expansions of the Tilbury Phase 1 LNG facilities (Phase 1A and T1B) and construction of the proposed Project. It is assumed that the Base Plant facilities will be demolished prior to the commencement of the proposed Project. As such, the infrastructure and facilities currently within the proposed Project Footprint associated with the Base Plant and their demolition were not considered in the existing conditions nor as a potential effect pathway for the Wildlife and Wildlife Habitat VC. There will not be any demolition activities associated with the proposed Project.

Existing conditions along the foreshore of the Fraser River will likely be altered by work occurring outside of the scope of the proposed Project but located within the Wildlife and Wildlife Habitat LAA and the proposed Project Footprint.

Prior to the commencement of construction of the proposed Project, vegetation within the existing facility site will be removed by construction activities associated with the existing Tilbury facility and the T1B project. Maintenance of existing landscaping and vegetation along existing fence lines are part of the existing facility and not part of the scope of the proposed Project. There is an existing dock that extends out into the Fraser River and this dock will be reutilized as part of the TMJ project. This dock was assessed during the May 2021 wildlife surveys conducted by FortisBC, and a cliff swallow nest colony was observed underneath the dock; however, nest activity was not detected. Cliff swallows are not federally or provincially protected. A follow-up assessment was conducted by FortisBC in May 2022 to confirm potential damage of the nest colony after major flooding events in fall 2021. The assessment confirmed that the nest colony was still intact; however, nest activity was not detected. This existing dock's reutilization or removal is within the scope of the TMJ project. Additional details are included in the Terrestrial Biophysical TDR (Appendix D of the Application).

There was a vacant warehouse within the existing Tilbury facility that has been removed in preparation for the construction of the T1B expansion project. Barn owl surveys were completed by FortisBC in the vacant warehouse in November 2021 (nonbreeding season) and May 2022 (breeding season) for nesting and

roosting habitat suitability and for presence. No barn owls or nests were observed within the warehouse during either survey. Evidence of owl usage within the building was observed (that is, owl pellets and whitewash and old nest debris from an unknown bird species), but recent use could not be confirmed. Full methods and results of the barn owl surveys are outlined in the Terrestrial Biophysical TDR (Appendix D of the Application).

These features and activities (existing dock, warehouse, existing vegetation on the facility site) were not considered in the existing conditions as a potential effect pathway for the Wildlife and Wildlife Habitat VC.

Potential effects of the proposed Project on the Wildlife and Wildlife Habitat VC based on existing conditions are described in subsection 7.8.4.[1]

7.8.3.1 Methods

The Application has been prepared in accordance with the AIR in which potential effects were identified from waterborne delivery associated with the proposed Project and construction of the MOF. Potential effects to wildlife and wildlife habitat from construction of the MOF and barge delivery vessels are described in this subsection.

The assessment team conducted desktop review and field studies to establish the existing conditions for the Wildlife and Wildlife Habitat VC in the LAA and RAA, where potential effects of the proposed Project could occur. The studies were based on a combination of a review of Indigenous Knowledge and Traditional Use Knowledge information, existing literature and publicly available sources, engagement, field studies, and expert opinion.

Indigenous Knowledge and Traditional Use Knowledge were reviewed and incorporated into this Application when Indigenous nations provided information to FortisBC or granted permission for FortisBC to use existing information sources. Indigenous Knowledge and Traditional Use Knowledge provide context of historical conditions of the Wildlife and Wildlife Habitat VC on Tilbury Island and surrounding area before, at, and after the time of European contact, and they help to inform the assessment of cumulative effects to date from the proposed Project.

The following sources of Indigenous Knowledge and Traditional Use Knowledge information have been incorporated into the Wildlife and Wildlife Habitat VC assessment of potential effects from the proposed Project:

- STL'ULNUP – A Cowichan Nation Use and Occupancy Study for Tilbury Island (Charlie 2019)
- Contemporary & Desired Use of Traditional Resources in a Coast Salish Community: Implications for Food Security and Aboriginal Rights in British Columbia (Fediuk and Thom 2003)
- Culturally Significant Vegetation of Tilbury Island (Turner 2020)
- Joint Federal/Provincial Consultation and Accommodation Report for the Trans Mountain Expansion Project Appendix D.1 Cowichan Tribes (B.C. EAO 2017a)

[1] The Application has been prepared in accordance with the AIR in which potential effects were identified from waterborne delivery associated with the proposed Project and construction of the MOF. However, as described in subsection 1.5.5, as a result of concerns received during the Application Development phase engagement activities that occurred after the development of the AIR, the proposed Project will no longer utilize any waterborne delivery of modular components and bulk construction materials to the proposed Project Site during construction. As a result, no MOF is required to be constructed or utilized for the proposed Project to accommodate waterborne deliveries. Avoidance of waterborne deliveries are included in the assessment as an avoidance mitigation measure (refer to subsection 7.8.4.1). Implementation of this avoidance mitigation measure has been incorporated into the determination of potential residual effects to Wildlife and Wildlife Habitat from the proposed Project in subsection 7.8.4.2.

- Trans Mountain Pipeline Expansion Project – Reconsideration Hearing: Written Evidence of Lyackson First Nation (Lyackson First Nation 2018)
- Shxunutun's Tu Suleluxwtst – Interim Strategic Land Plan for the Hul'qumi'num Core Traditional Territory (Hul'qumi'num Treaty Group 2005)
- A Comprehensive Sustainable Community Development Plan (Musqueam Indian Band 2011, 2018)

Additional data sources reviewed to inform the field program and the effects assessment for the Wildlife and Wildlife Habitat VC included publicly available online databases, past field studies conducted during previous site visits within the proposed Project Footprint and surrounding area, field studies completed by other disciplines for the proposed Project Application (that is, aquatics, surface water, vegetation, and wetlands), and field studies completed for other nearby projects to inform EAC applications (such as for the T1B project and the TMJ project).

Existing field data included the results of habitat assessments completed during previous site visits to the Tilbury LNG facility and surrounding area, including along the banks of Tilbury Slough and inside the current Tilbury facility fence line. A high-level biophysical field survey was conducted by FortisBC in October 2019 to support the Environmental Overview Assessment (EOA) for the proposed Project (Jacobs 2020), which was completed for the T1B CPCN application (Project 1599170) filed on December 29, 2020, (BCUC 2022). The EOA describes the existing conditions at the entire Tilbury LNG facility and the potential adverse effects to the biophysical environment from the proposed Project. Information collected during this assessment was included in this description of existing conditions, when applicable.

The following publicly available online data sources were reviewed to obtain information on the existing conditions related to the Wildlife and Wildlife Habitat VC:

- Critical Habitat for Federally listed species at risk (Government of Canada n.d.d)
- Species and Ecosystems at Risk – Publicly Available Occurrences – CDC data set (Ecosystems n.d.)
- BC Species and Ecosystems Explorer (Government of B.C. n.d.e)
- BC Parks, Ecological Reserves, and Protected Areas data set (BC Parks n.d.)
- Provincially identified wildlife areas (for example, UWRs, WMAs, and WHAs) (B.C. MFLNRORD n.d.a, n.d.b, n.d.c, n.d.d, n.d.e)
- Species at risk public registry (Government of Canada n.d.g) and relevant species Recovery Strategies
- COSEWIC status reports (COSEWIC n.d.)
- MBS's across Canada (Government of Canada n.d.e)
- NWAs (Government of Canada n.d.f)
- Important Bird Areas Canada (Bird Studies Canada and Nature Canada n.d.)
- Bird Surveys (Government of Canada n.d.a)
- Bird Conservation Regions and Strategies (Government of Canada n.d.b)
- Atlas of the Breeding Birds of British Columbia (Bird Studies Canada n.d.)
- Western Hemisphere Shorebird Reserves (WHSRN n.d.b)
- Biosphere reserves in Europe & North America (UNESCO n.d.)

- Other nearby project data, including the following:
  - FortisBC TLSE project EOA, prepared for the CPCN application (Jacobs 2020)
  - FortisBC Tilbury LNG Facility Stage 1 PSI (Jacobs 2021)
  - FortisBC TLSE project, Stage 2 PSI (Jacobs 2022a)
  - TJLP's TMJ project EAC application (Part B, subsection 4.8) (WesPac 2019) and Wildlife Baseline Report (Golder 2019)
  - Draft Assessment Report for TMJ project (B.C. EAO 2022)
  - South Fraser Perimeter Road (SFPR) EAC application (Hemmera 2006) and Vegetation and Wildlife Impact Assessment (Robertson 2006)

Wildlife field studies were conducted by FortisBC to supplement existing information previously collected in the field, fill data gaps, as needed, and support information requirements for this Application. Field studies were conducted by QPs on May 14 and November 8, 2021. The studies were designed to assess the existing conditions of available wildlife habitat and to identify the potential for wildlife species at risk and culturally important wildlife species to occur within the Wildlife and Wildlife Habitat LAA and RAA. Wildlife occurrence was documented to inform current species assemblage, diversity, and habitat usage of the Wildlife and Wildlife Habitat LAA and RAA to inform the effects assessment. Field studies included a wildlife habitat assessment, breeding bird point count survey, and pond-dwelling amphibian survey within Tilbury Slough. Detailed documentation of data collection and analysis methods, along with applicable standards and guidance, are outlined in Section 2 of the Terrestrial Biophysical TDR (Appendix D of the Application).

FortisBC initiated early engagement with Indigenous nations on the proposed Project in July 2019. Section 11 of the Application provides a summary of engagement activities and interests and issues raised by Indigenous nations to date. As part of FortisBC's engagement process, participating Indigenous nations were invited to participate in biophysical studies. The wildlife studies were as follows:

- May 13-14, 2021:
- May 11-12, 2022: supplementary studies

Nations that participated in the studies (or requested follow-up) were provided with summary reports of each program.

7.8.3.2 Historical Context

This subsection summarizes the historical context within the Wildlife and Wildlife Habitat LAA and RAA, including pre-industrial context, as well as past and present modern developments and activities within the LAA and RAA that influence the existing state of the Wildlife and Wildlife Habitat VC. A description of Indigenous nation use and occupancy of the RAA is provided in subsection 7.11 (Land and Resource Use) and Section 11 (Indigenous Nations Effects Assessment). Land use over the past century at the Tilbury LNG facility was reviewed to provide a brief overview of history and characterization of surrounding areas, as outlined in the FortisBC TLSE project EOA, prepared for the T1B CPCN application (Jacobs 2020). Further details on past and present land and resource use are outlined in subsection 7.11.

The Fraser River is traditionally used by Indigenous nations for transportation, harvesting activities (hunting, trapping, fishing, and gathering), trade, and other cultural activities (B.C. EAO 2022). Prior to, during, and after European contact in the early 1790s, Tilbury Island was traditionally used for hunting, gathering, and harvesting activities. Harvesting of traditional foods is a central, material part of Indigenous relationships to the land and a culturally integral practice from time immemorial (Fediuk and Thom 2003;

Charlie 2019; Hul'qumi'num Treaty Group 2005). Since these early times, Indigenous nations thrived on the abundant resources of the territory and developed a rich and complex culture built upon fishing and gathering of freshwater and marine foods, as well as hunting of land and marine mammals and birds (Hul'qumi'num Treaty Group 2005; Musqueam Indian Band 2011, 2018). The Fraser River has traditionally been used by local Indigenous nations for harvesting from time immemorial. For instance, the Musqueam People fished for salmon, oolichan (eulachon), and other fish and harvested shellfish (Musqueam Indian Band 2011, 2018). Use of birds as a traditional food source and hunting of fur-bearing species is of cultural importance to o local Nations (Kennedy 2019, Morin 2015). Land and river environments were used extensively for harvesting a wide range of animals and plants (Tsleil-Waututh Nation 2015). Plant resources and habitats on Tilbury Island that have been traditionally used for food, materials, medicines, and spiritual and cultural purposes in the past, or with potential use into the future, are discussed in subsection 7.7 (Vegetation).

Waterfowl, such as geese and ducks, were regularly harvested by Indigenous nations along the south arm of the Fraser River prior to, during, and after European contact (Tsleil-Waututh Nation 2005; Charlie 2019; Fediuk and Thom 2003). The south arm of the Fraser River and the estuary was known as an important area for waterfowl habitat. Caleb Kennerly of the Northwest Boundary Survey in 1857 remarked in his journal when canoeing up the lower Fraser River, "Ducks, geese, gulls and other water birds were everywhere to be seen in myriads upon the water and in the air and occasionally as they arose from the water their flight was accompanied by making noise like thunder" (Kennerly 1857; Charlie 2019).

The estuarine habitat along the Fraser River has traditionally been used by Indigenous nations. In fact, the name Musqueam means "People of the River Grass" and relates to the grass that grows in the Fraser River estuary in the tidal flats and marsh lands (Musqueam Indian Band 2011, 2018). Grasslands on the banks of the lower Fraser River would also have provided suitable habitat for birds (Charlie 2019). Some species, such as Canada goose, northern shoveler, green-winged teal, and mallard would have been available to the Quw'utsun Nation People year round on the lower Fraser River (Charlie 2019; Fediuk and Thom 2003). In the fall, canvasback and lesser scaup arrived and were available for harvest. Mergansers frequented these areas during the winter, as did snow geese (Charlie 2019). Ducks and grebes would also have been traditionally harvested by the Tsleil-Waututh Nation in the Lower Mainland (Tsleil-Waututh Nation 2015).

Ruffed grouse would also have been available on Tilbury Island (Charlie 2019) given the proximity to crab apple trees. Ruffed grouse were known to sleep in and feed on crab apples trees (Charlie 2019; Turner 2020). Ruffed grouse and blue grouse were traditionally hunted by Indigenous nations (Fediuk and Thom 2003). The Quw'utsun Nation territory includes southern Vancouver Island and the lower Fraser River, including the Gulf Islands in between (Hul'qumi'num Treaty Group 2005). Grouse and their eggs would also have been traditionally harvested by the Tsleil-Waututh Nation in the Lower Mainland (Tsleil-Waututh Nation 2015). One method the Quw'utsun Nation People would use to catch waterfowl was with nets and poles (Charlie 2019). Poles would be placed in the intertidal zone at low tide, nets would be stretched across, and clam shells would be laid down under the net. When the tide would rise, the nets would float up and as diving ducks came in to dive for the clams, they would get caught in the nets (Charlie 2019).

In 2001, a study by the Hul'qumi'num Treaty Group (representing Quw'utsun Nation, Stz'unimus First Nation, Penelakut Tribe, Lyackson First Nation, Halalt First Nation, and Lake Cowichan First Nation) on Vancouver Island and the Gulf Islands identified 31 culturally relevant bird species that have been traditionally harvested (Fediuk and Thom 2003; Hul'qumi'num Treaty Group 2005). The most commonly harvested and consumed bird species included black scoter, white scoter, murre, bald eagle, ruffed grouse, blue grouse, mallard, trumpeter swan, western grebe, and golden eagle (Fediuk and Thom 2003). Lyackson First Nation continues to hunt a variety of animals, including ducks, waterbirds, seals, porpoises,

and sea lions (Lyackson First Nation 2018). The cultural importance of marine mammals is incorporated into subsection 7.9 (Fish and Fish Habitat).

Certain land mammal species are also of cultural importance and were traditionally hunted and used for food and hides (Charlie 2019). While resident in the lower Fraser River, the Quw'utsun Nation People hunted game, such as mule deer, bear, and in some areas, elk and mountain goat (Charlie 2019; Hul'qumi'num Treaty Group 2005). Any dry, level grassland on Lulu Island (which encompasses Richmond, B.C., and is located directly across the Fraser River from the proposed Project Footprint) would have been ideal habitat for game (Charlie 2019). The willow, crab apple, and hardhack thickets that made up the vegetation community provided habitat for several animals, including deer and elk, which would have been utilized by the Quw'utsun Nation People for food and hides (Charlie 2019). Willow branches were known to be eaten by deer (Turner 2020).

The Hul'qumi'num Treaty Group identified 16 species of land and sea mammals that have been traditionally hunted on Vancouver Island and the Gulf Islands; the most commonly hunted land mammal species included white-tailed deer, elk, mule deer, moose, black bear, and mountain goat (Fediuk and Thom 2003). Tsleil-Waututh Nation noted deer, bear, elk, rabbit, squirrel, and seal to be of cultural importance (Tsleil-Waututh Nation 2015). Beavers were plentiful on Lulu Island and around the Fraser River delta, and the Quw'utsun People caught them mainly along slough systems and the banks of the south arm of the Fraser River (Charlie 2019). The Quw'utsun ate beaver meat and beaver tails, and they used pelts for blankets and teeth for dice games as entertainment (Charlie 2019). The Quw'utsun traded beaver extensively with the Hudson's Bay Company (Charlie 2019).

In the 1800s, settlers arrived in the Lower Mainland and began to change the landscape through activities including clearing for agriculture and timber harvest (Turner 2020; Boyle et al. 1997). The original vegetation of the entire area of the lower Fraser River soon changed, first with agricultural development and logging, and then with industrial development. Vegetation was removed; shorelines were diked; areas were ditched and drained; and large portions of the land were paved over for roads, parking areas, and buildings (North et al. 1979; referenced in Turner 2020).

Dikes began to be constructed along the Fraser River in the 1860s, to convert land for agricultural use (Boyle et al. 1997). The construction of dikes and industrial development led to a 70-percent loss of wetland ecosystems within the Fraser River estuary (FRESSC 1978; B.C. MOE 2006). The lower Fraser River became an essential transportation route for shipping and for transporting and storing logs. The FRESSC found that one third of the shorelines within the Fraser River estuary have been developed for port and industrial use (FRESSC 1978). It is likely that this proportion has shifted since 1978. A 1949 photograph in the Delta Archives Collection shows a large portion of Tilbury Island being used for agriculture, having been diked and cleared of native vegetation (Delta Heritage Society n.d.). Since 1949, farmland on Tilbury Island has been replaced with industrial developments.

The proposed Project Footprint is located on a private property owned by FortisBC for their existing Tilbury LNG facility in the Tilbury Industrial Park on Tilbury Island, in the lower south arm of the Fraser River, in Delta, B.C. This is a long-standing brownfield site zoned as I7, High Impact Industrial, for uses including natural gas and petroleum products. The proposed Project Footprint also includes areas outside the private property, including the riparian area around the MOF, which extends into the Fraser River. The Tilbury LNG facility was previously used for agricultural purposes in the early part of the 20th century. In the 1970s, the agricultural fields were converted to a sawmill on the western half of the Tilbury LNG facility, and the eastern half was converted for use as natural gas processing and storage. Currently, the existing Tilbury LNG facility and proposed Project Footprint are covered by concrete surfaces, gravelled and paved areas, existing infrastructure (including a double walled LNG tank), and equipment laydown

areas, with very little to no habitat value for wildlife. As outlined in subsection 7.8.3, existing infrastructure and facilities associated with the Base Plant will be demolished in advance of the proposed Project.

The following industrial operations are currently located within the Wildlife and Wildlife Habitat LAA:

- East across Hopcott Road: Heidelberg Materials Canada Limited Cement Plant; Seaspan at 7700 Hopcott Road, Delta, B.C.; and a multitenant industrial building at 7510 Hopcott Road, Delta, B.C. (Cloverleaf Seafood Inc., SCI Logistics, Fountain Tire Distribution Centre, and Canadian Alliance Terminals).
- South across Tilbury Road: Delta Community Animal Shelter at 7505 Hopcott Road, Delta, B.C. An asphalt patch and backfill was noted south of Tilbury Road, which corresponds with the former rail spur visible south of Tilbury Road in the 1949 aerial photograph (Delta Heritage Society n.d.).
- West: Varsteel/Dominion Pipe and Piling Works at 6845 Tilbury Road, Delta, B.C.
- North: Fraser River. A pile of old rail lines and ties was located offsite, northwest of the Tilbury LNG facility on the Fraser River dike (Crown land). A strong creosote-like odour was noted in the vicinity of this pile.

The mainland area to the south of Tilbury Island is primarily a combination of agricultural and industrial lands within Delta, B.C. (Corporation of Delta 1985). The nearest parcel within the ALR is approximately 267 m from the proposed Project Footprint.

To the north of the proposed Project Footprint, the Fraser River is an important transportation route and is used by numerous industrial facilities and cargo terminals that handle logs, steel, machinery, and general industrial cargo. The Fraser River is also used for Indigenous, commercial, and recreational purposes, including boating, fishing, tourism, and marine transportation. The lower Fraser River is highly influenced by the erosion of natural sources of metals, agricultural runoff throughout the catchment, and remobilization of sediments during freshet. The Fraser River has historically elevated background concentrations of metals within the sediment, such as arsenic (B.C. ENV 2021d). Particularly during spring freshet, exceedances are expected due to sediment discharge and sediment remobilization (subsection 7.4, Surface Water). There are existing contaminants in the Fraser River, as detected during field studies to inform the TMJ project EAC application (WesPac 2019); studies conducted by FortisBC to inform this Application, including the 2021 Stage 1 and 2 PSI studies (Jacobs 2021, 2022a); and the 2021 surface water sampling program (refer to the Aquatic Biophysical TDR [Appendix E of the Application]).

Tilbury Slough also contains existing contaminants. Water samples from the slough detected low oxygen and low pH levels, with elevated concentrations of some metals and total phosphorous that exceed B.C. WQGs (B.C. MOE 2013a) and Canadian WQGs (CCME 2021a, 2021b). Water quality in Tilbury Slough is influenced by surface runoff from adjacent properties and roadways, as Delta's municipal stormwater system drains into the slough.

There are existing COCs at the proposed Project Footprint, as identified in the 2021 Stage 1 and 2 PSI studies (Jacobs 2021, 2022a). These contaminants will be removed prior to construction of the proposed Project. The groundwater at the proposed Project Site is not considered to be contaminated (Jacobs 2022a). Refer to subsections 7.4 (Surface Water), 7.5 (Groundwater), and 7.6 (Soil) for further details on the present condition of the proposed Project Footprint and these COC. The potential effects pathways of soil and sediment contaminants on the Wildlife and Wildlife Habitat VC during construction of the proposed Project and proposed mitigation measures are discussed in subsection 7.8.4.

Current Loss of Wildlife Habitat and Biodiversity

The Wildlife and Wildlife Habitat RAA is located within the Fraser River estuary, which is one of the largest estuaries along the west coast of North America and a globally important ecosystem (B.C. MOE 2006). Within the B.C., the Fraser lowlands have the greatest diversity of birds, amphibians, and reptiles (Stevens 1995). However, as previously noted, the shoreline along both sides of the Fraser River within the Wildlife and Wildlife Habitat RAA has been heavily developed by industry, and the river is an important transportation route for shipping. Delta, B.C., has undergone considerable industrial development, and Tilbury Island is one of the fastest-growing industrial areas in Greater Vancouver, B.C. (Corporation of Delta 1985), and is zoned as Industrial in the Future Land Use Plans (OCP Map 2 – Future Land Use Plan) (Corporation of Delta 1985). Currently, less than 30 percent of the Fraser River estuary's habitat is intact (Geological Survey of Canada 2004).

Approximately 200 years of development within the Wildlife and Wildlife Habitat RAA has influenced wildlife and plant communities, species abundance, and biodiversity. Residential, industrial, and agricultural developments in the Lower Mainland have limited and fragmented suitable habitat and have altered much of the original native biodiversity. Development effects to streams, estuaries, shorelines, and intertidal habitat have resulted in the decrease, loss, or contamination of native species, degradation of water and sediment quality, and spread of invasive species (Tsleil-Waututh Nation 2015). The lower Fraser River used to contain an abundance of fish, waterbirds, upland game birds, and large mammals such as elk and moose (Musqueam Indian Band 2011, 2018; Charlie 2019; Turner 2020); however, bears, wolves, grouse (ruffed and blue), elk, and moose are no longer found within the Wildlife and Wildlife Habitat RAA, and bird numbers are in decline (Tsleil-Waututh Nation 2015).

Current wildlife populations within the Wildlife and Wildlife Habitat RAA predominately consist of mesopredators (such as raccoons and skunks) and species at lower trophic levels (such as mice, rats, and rabbits), with apex predators composed largely of birds of prey. Bird and amphibian populations within the Wildlife and Wildlife Habitat LAA have a high abundance of invasive species (such as green frog, European starlings, and house sparrows). Reductions in predators and increases in invasive species can have cascading effects on ecosystems and food webs. The declines of large native carnivores, such as lynx, foxes, wolverines, wolves, and bears, in southern Canada have affected abundance and diversity of prey species and small predators (Canadian Councils of Resource Ministers et al. 2010).

With the arrival of European settlers in the 1800s, nonnative species arrived, some of which were invasive. The historical and current presence of invasive species can alter native ecosystem community composition. Invasive species are one of the leading direct causes of biodiversity loss within ecosystems and have indirect habitat modification effects (Didham et al. 2005). Invasive wildlife and plant species are now prevalent in the Wildlife and Wildlife Habitat LAA and RAA. During the 2021 field surveys conducted by FortisBC, European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), rock pigeon (*Columba livia*), brown rat (*Rattus norvegicus*), and green frog (*Rana clamitans*) were recorded within the Wildlife and Wildlife Habitat LAA (Terrestrial Biophysical TDR [Appendix D of the Application]). These species are all invasive to B.C. and are known to aggressively outcompete native species for food and habitat. Invasive and, specifically, Noxious plant species (listed on Schedule A of the B.C. *Weed Control Act*) were also observed during the 2021 field surveys conducted by FortisBC within the proposed Project Footprint and the surrounding LAA. These species included Himalayan blackberry (*Rubus armeniacus*), bull thistle (*Cirsium vulagare*), common tansy (*Tanacetum vulgare*), Scotch broom (*Cytisus soparius*), common St. John's wort (*Hypericum perforatum* ssp. *perforatum*), Japanese knotweed (*Reynoutria japonica*), Canada thistle (*Cirsium arvense*), common sow-thistle (*Sonchus oleraceus*), purple loosestrife (*Lythrum salicaria*), and yellow flag iris (*Iris pseudacorus*). Federal law does not protect species that were anthropogenically introduced to North America and are not native to this continent.

7.8.3.3 Overview

This subsection summarizes the existing conditions within the Wildlife and Wildlife Habitat LAA and RAA. Refer to the Terrestrial Biophysical TDR (Appendix D of the Application) for additional details on the existing conditions of the Wildlife and Wildlife Habitat VC, including results of wildlife field studies completed in May and November 2021 by FortisBC. Information on how linked VCs (such as Vegetation), and Indigenous interests may have been potentially affected by the existing conditions of the Wildlife and Wildlife Habitat VC (including past and present projects and activities) can be found in applicable assessment sections.

Currently, land in the Wildlife and Wildlife Habitat RAA is primarily zoned for industrial, commercial, and agricultural operations. Natural habitat within the Wildlife and Wildlife Habitat RAA is limited to small, fragmented patches of mature deciduous trees and shrub understory along the shorelines of Fraser River and bordering Tilbury Slough. Existing operations associated with gas processing, cement manufacturing, residential and commercial developments, and transportation (for example, ferries, railways, airports, seaports, highways, and roads) in the Wildlife and Wildlife Habitat RAA are sources of anthropogenic light (subsection 7.11, Land and Resource Use, and the Visual Quality Assessment Report in Appendix F of the Application) and noise (subsection 7.3, Acoustic).

The main potential threats to birds, mammals, amphibians, and reptiles within the Wildlife and Wildlife Habitat RAA are currently loss and alteration of habitat from urban development, combined with the potential effects from climate change (Trans Mountain 2017; Boundary Bay Conservation Committee 2016; Calbick et al. 2004; Geological Survey of Canada 2004). The Fraser River estuary is already experiencing effects from climate change, including higher than average temperatures; greater frequency of extreme weather events, such as flood and drought; rising water temperatures and sea levels; coastal flooding; and insect infestations (BC RAC n.d.; Fraser Basin Council n.d.a, n.d.b; B.C. MFLNRO 2012; Vancouver 2018; Diamond Head Consulting Ltd. 2016). However, it is unknown how climate change could potentially affect wildlife species' range and abundance in B.C. over the next 10 to 20 years. Climate change has been considered as part of future conditions in the CEA (subsection 7.8.5).

As described in subsection 7.8.3.2, there is little suitable wildlife habitat within the proposed Project Footprint, as it is located within the existing Tilbury LNG facility, which is a long-standing brownfield site zoned as I7, High Impact Industrial, for uses including natural gas and petroleum products. The area has been previously cleared and consists of gravelled (60 percent) and paved (40 percent) areas, existing infrastructure, and equipment laydown areas. There is one constructed drainage ditch within the centre of the existing Tilbury LNG facility, which flows into the Delta municipal stormwater system that will removed/modified by the T1B project prior to construction. The majority of wildlife habitat within the Wildlife and Wildlife Habitat LAA has been altered by development, as it is situated within the Tilbury Industrial Park, an industrialized portion of the Fraser River, and upland habitat is predominately covered by hard, anthropogenic surfaces (that is, paved and gravelled areas currently used for industrial purposes). Wildlife use within the Wildlife and Wildlife Habitat LAA is primarily limited to small, fragmented riparian areas on the banks of Tilbury Slough and the foreshore of the Fraser River, which provide habitat for a variety of wildlife species adapted to urban environments (such as coyotes, raccoons, skunks, rabbits, waterfowl, and songbirds).

To the north of the proposed Project Footprint, the aquatic portion of the LAA extends into the mud flats and intertidal area of the south arm of the Fraser River, which is influenced by shipping and other regular vessel traffic from the Seaspan terminal to the northeast of the proposed Project Footprint. To the south of the proposed Project Footprint, the LAA encompasses an approximately 670-m-long section of Tilbury Slough, a slow-moving side channel of the Fraser River, with beaver dam impoundments (that is, ponded habitat). The majority of the slough within the Wildlife and Wildlife Habitat LAA is freshwater, separated from the downstream brackish water of the Fraser River by flood gates. Surface water samples

demonstrated that the slough is a low-oxygen and low-pH environment with elevated concentrations of some metals and total phosphorous that exceed B.C. WQGs (B.C. MOE 2013a) and Canadian WQGs (CCME 2021a, 2021b) (Aquatic Biophysical TDR [Appendix E of the Application]). The slough receives runoff from the adjacent roadways and industrial properties and is not regularly flushed; therefore, contaminants can persist within the slough.

There is no habitat connectivity within the Wildlife and Wildlife Habitat LAA between the Fraser River and Tilbury Slough, as they are separated by the existing Tilbury LNG facility and existing paved roadways with regular traffic from industrial trucks and workers accessing sites on Tilbury Island. River Road is located directly south of the Wildlife and Wildlife Habitat LAA, within the Wildlife and Wildlife Habitat RAA, and is a designated truck route with a high level of regular traffic and noise. As such, there is regular existing sensory disturbance to wildlife using the Wildlife and Wildlife Habitat LAA and RAA, and wildlife individuals utilizing these areas would likely be habituated to anthropogenic noises and disturbance.

The proposed Project Footprint is surrounded by the Boundary Bay–Roberts Bank–Sturgeon Bank (Fraser River estuary) Important Bird Area (IBA), a large complex of interconnected marine, estuarine, freshwater, and agricultural habitats that form one of the richest and most important ecosystems for resident, migratory, and overwintering waterbirds in Canada (Bird Studies Canada and Nature Canada n.d.). This IBA excludes the developed and industrial portions of Tilbury Island, where there is no suitable habitat for migratory birds; thus, the proposed Project Footprint only overlaps with approximately 1.5 ha of the IBA where the proposed Project MOF footprint extends into the Fraser River. Portions of the Wildlife and Wildlife Habitat LAA overlap with approximately 46 ha of the IBA where the LAA extends into the Fraser River and Tilbury Slough.

The Wildlife and Wildlife Habitat RAA does not overlap with any B.C. CDC element occurrence records of terrestrial wildlife species at risk (Ecosystems n.d.), Provincial WHAs, WMAs, or UWRs (B.C. MFLNRORD n.d.a, n.d.b, n.d.c, n.d.d, n.d.e, 2016); parks or protected areas (BC Parks n.d.); MBS's (Government of Canada n.d.e); NWAs (Government of Canada n.d.f); Western Hemisphere Shorebird Reserves (WHSRN n.d.b); world biosphere reserves (UNESCO n.d.); Indigenous Protected and Conserved Areas (Government of Canada n.d.c); offshore Marine Protected Areas (DFO n.d.); or Ramsar wetlands (Ramsar Convention Secretariat n.d.).

The Wildlife and Wildlife Habitat RAA, LAA, and proposed Project Footprint overlap with Critical Habitat for barn owl (*Tyto alba*), which is Threatened under Schedule 1 of *SARA* and Red-listed in B.C.) (ECCC 2022).

The approximate area of habitat types available within the Wildlife and Wildlife Habitat LAA was calculated based on desktop review of satellite imagery, terrestrial ecosystem mapping, and sensitive ecosystem inventory layers, in addition to field data collections of vegetative communities (as described in the Terrestrial Biophysical TDR [Appendix D of the Application]). Habitat area and percentage of total proposed Project Footprint and Wildlife and Wildlife Habitat LAA are presented in Table 7.8-3. Seasonal use of these habitat types for each Wildlife VC subcomponent (birds, mammals, amphibians, and reptiles) is described in more detail in Appendix C of the Terrestrial Biophysical TDR (Appendix D of the Application). The total area of potentially suitable wildlife habitat within the proposed Project Footprint is 1.46 ha, which contributes to 10.95 percent of the proposed Project Footprint (the majority of which includes open water in the Fraser River).

Table 7.8-3. Habitat Type, Area, and Percent Cover within the Proposed Project Footprint and Wildlife and Wildlife Habitat Local Assessment Area

Habitat Type	Proposed Project Footprint		Wildlife and Wildlife Habitat LAA	
	Area (ha)	% of Proposed Project Footprint	Area (ha)	% of LAA
Anthropogenic areas[a]	98.56	89.05	51.01	53.3
Young forest	0.08	0.60	3.21	3.35
Shrub	0.14	1.05	2.22	2.31
Marsh[b]	0.07	0.53	2.72	2.84
Swamp[b]	0	0	0.04	0.04
Shallow open water wetland[b]	0	0	1.25	1.31
Mud flat[c]	0.21	1.57	3.09	3.23
Fraser River open water[d]	0.96	7.2	32.16	33.6

[a] Anthropogenic areas include infrastructure, gravelled and paved surfaces, ditches, rail lines, and agricultural fields.

[b] Wetland ecological community types are located adjacent to the Fraser River and Tilbury Slough. Wetlands are presented in subsection 7.7. There are no swamp or shallow open water habitats in the proposed Project Footprint.

[c] Mud flat habitats are located within the proposed Project Footprint where the proposed Project MOF extends into the Fraser River intertidal area.

[d] Open water includes portions of the proposed Project Footprint where the proposed Project MOF extends past the intertidal mud flats into deeper water of the Fraser River.

Notes:

Proposed Project Footprint = 13.33 ha
Wildlife and Wildlife Habitat LAA = 95.70 ha

Table 7.8-4 provides a list of wildlife species at risk that have the potential to interact with proposed Project activities (that is, they have low, moderate, or high potential to occur, or confirmed presence within the Wildlife and Wildlife Habitat LAA). The table includes wildlife species designated federally under the Schedule 1 of *SARA* (Government of Canada n.d.g) or listed provincially (that is, Red or Blue status by B.C. CDC or Threatened or Endangered status under the B.C. *Wildlife Act*) (Government of B.C. n.d.c, n.d.e). This list was determined based on desktop review, field assessments, and professional judgment considering known species ranges and habitat requirements. The results of studies conducted for nearby projects (that is, the TMJ project and SFPR project) were reviewed and used to confirm and refine the list of potential species at risk (Golder 2019; Robertson 2006).

A full list of wildlife species at risk that have the potential to occur within the larger spatial boundary of the Wildlife and Wildlife Habitat RAA, as well as their different habitat preferences, seasonal ranges, migration, and movement, is provided in Appendix C of the Terrestrial Biophysical TDR (Appendix D of the Application).

Table 7.8-4. Terrestrial Wildlife Species at Risk with Potential to Interact with the Proposed Project

Subcomponent	Common Name	Scientific Name	Provincial List	Federal *SARA* Designation	Potential to Occur in the LAA
Birds (wading birds and shorebirds)	American bittern	*Botaurus lentiginosus*	Blue[a]	—	Moderate potential; may forage in the Fraser River and Tilbury Slough in the LAA during the breeding season.
	Great blue heron, *fannini* subspecies	*Ardea herodias fannini*	Blue[a]	Special Concern[b]	Confirmed; observed foraging in the LAA during the 2021 wildlife surveys. Resident species; may use LAA year round.
	Green heron	*Butorides virescens*	Blue[a]	—	Moderate potential; may forage in the Fraser River and Tilbury Slough in the LAA year round.
Birds (waterbirds)	Brandt's cormorant	*Urile penicillatus*	Red[a]	—	High potential; may forage in the Fraser River within the LAA year round.
	Brant	*Branta bernicla*	Blue[a]	—	High potential; may forage in the Fraser River within the LAA during the nonbreeding season.
	California gull	*Larus californicus*	Red[a]	—	Moderate potential; may forage over the LAA and in the Fraser River within the LAA year round.
	Double-crested cormorant	*Nannopteruma uritus*	Blue[a]	—	Confirmed; observed foraging in the Fraser River in the LAA during the 2021 wildlife surveys. Resident species; may use LAA year round.
	Horned grebe	*Podiceps auritus*	—	Special Concern[b]	Moderate potential; may forage in the Fraser River in the LAA year round.
	Western grebe	*Aechmophorus occidentalis*	Red[a]	Special Concern[b]	Moderate potential; may forage in the Fraser River in the LAA year round.

Table 7.8-4. Terrestrial Wildlife Species at Risk with Potential to Interact with the Proposed Project

Subcomponent	Common Name	Scientific Name	Provincial List	Federal *SARA* Designation	Potential to Occur in the LAA
Birds (species adapted to human infrastructure)	Barn owl	*Tyto alba*	Blue[a]	Threatened[b]	Low potential; low availability of foraging, nesting, or roosting habitat in the LAA.
	Barn swallow	*Hirundo rustica*	—	Threatened[b]	Moderate potential; may forage over the Fraser River and Tilbury Slough in the LAA during the breeding season.
	Peregrine falcon, *anatum* ssp.	*Falco peregrinus anatum*	Red[a]	Not At Risk	Moderate potential; may occasionally forage within the LAA.
Mammals	Little brown myotis	*Myotis lucifugus*	Blue[a]	Endangered[b]	Moderate potential; may forage over open water areas in the LAA.
	Pacific water shrew	*Sorex bendirii*	Red[a]	Endangered[b]	Low potential; may utilize Tilbury Slough within the LAA.
	Townsend's big-eared bat	*Corynorhinus townsendii*	Blue[a]	—	Moderate potential; may forage over open water areas in the LAA.
Amphibians and reptiles	Red-legged frog	*Rana aurora*	Blue[a]	Special Concern[b]	Low potential; may utilize Tilbury Slough and ditches in the LAA as breeding habitat.
	Western painted turtle, Pacific Coast population	*Chrysemys picta bellii*	Red[a]		Low potential; may utilize Tilbury Slough and ditches in the LAA.
	Western toad	*Anaxyrus boreas*	—	Special Concern[b]	Low potential; may utilize Tilbury Slough and ditches in the LAA as breeding habitat.

[a] B.C. Provincial designation includes species listed as Endangered or Threatened under the B.C. *Wildlife Act* and species with provincial Red and Blue designations (Government of B.C. n.d.c, n.d.e).

[b] Species listed as Endangered, Threatened, or Special Concern under Schedule 1 of *SARA* (Government of Canada n.d.g)

Note:

— = status designations that are not applicable (such as designations of species that have not been assessed or that are not considered to have special conservation status)

Birds

As outlined in Table 7.8-1, the effects assessment on the bird subcomponent will evaluate potential proposed Project interactions and potential effects on resident and migratory forest birds, waterbirds and shorebirds, and species adapted to human infrastructure to account for the different guilds of species, different habitat preferences, seasonal ranges, and migration and movements, and to represent the broad habitat types available in the Wildlife and Wildlife Habitat LAA. The bird subcomponent includes species at risk and culturally important species. In considering potential effects on migratory birds, this Application has taken an ecosystem-based approach where proposed Project potential effects have been assessed on a landscape-level, capturing issues, such as fragmentation and connectivity of habitats, or natural biodiversity (Hanson et al. 2009).

Forest birds include resident and migratory upland birds that could use the shrub and young forest habitat present within the Wildlife and Wildlife Habitat LAA, including passerines and raptors. Waterbirds include resident and migratory waterfowl (such as geese, dabbling and diving ducks, aquatic diving birds [such as grebes] and seabirds [such as cormorants and gulls]) that could use the mud flat and intertidal habitats within the Fraser River in the Wildlife and Wildlife Habitat LAA. Wading birds and shorebirds include resident and migratory wading birds (such as herons and bitterns) and shorebirds (such as sandpipes and plovers) that could use the marsh and mud flat habitats within Tilbury Slough and the Fraser River in the Wildlife and Wildlife Habitat LAA. Bird species adapted to human infrastructure, such as crows, pigeons, sparrows, swallows, and barn owl, commonly utilize anthropogenic structures for roosting and nesting.

Bird species at risk with potential to interact with the proposed Project have been identified by habitat-associated bird groups (Table 7.8-4). The species listed in Table 7.8-4 were compiled from habitat use, species life history, and species range information collected form literature review, field studies, and professional experience.

Due to the existing industrial developments on Tilbury Island, the Wildlife and Wildlife Habitat LAA lacks high-quality foraging and nesting habitat for migratory and resident bird species known to inhabit the surrounding IBA. The small patches of shrub and young forest along the shorelines of the Fraser River and Tilbury Slough within the Wildlife and Wildlife Habitat LAA are fragmented and adjacent to existing industrial activities with a high level of potential disturbance. There is a riparian band of mature deciduous trees, shrub understory, and grasses and reeds associated with the Fraser River shoreline, which ranges from 2 m to 30 m wide, has been previously disturbed by industrial activities, and is bordered to the south by an engineered flood dike and associated riprap (as required by and built to the standard defined by Delta). The riparian habitat associated with Tilbury Slough has been affected by adjacent roads, the surrounding industrial facilities, and the abundant presence of nonnative and invasive plant species. Property ditches feature vegetation, including black cottonwood saplings and extensive patches of invasive plant species, including Himalayan blackberry and reed canarygrass. These ditches will be modified/removed by the T1B project prior to construction of the proposed Project.

The tidal mud flats along the Fraser River within the Wildlife and Wildlife Habitat LAA could provide foraging for waterfowl, wading birds, and shorebirds, as well as staging and resting habitat for overwintering and migratory birds; however, this area is also subject to regular disturbance from shipping activity associated with the adjacent Seaspan terminal. Seabirds, such as cormorants, may roost on pilons present in the Fraser River within the Wildlife and Wildlife Habitat LAA.

Projects and human activities may affect migratory birds in a variety of ways, from changing abundance, demography, and behaviours to habitat loss and alteration (Hanson et al. 2009). The proposed Project Footprint is located within migratory bird Nesting Zone A1, where the general nesting period for expected species is from March 26 to August 16, although some bird species may start nesting earlier (ECCC n.d.a).

As outlined in subsection 7.8.1, the Federal *MBCA* provides legal protection for migratory birds in Canada. The *MBCA* prohibits "the killing, capturing, injuring, taking or disturbing of migratory birds or the damaging, destroying, removing or disturbing of nests" (Government of Canada 1994). Some bird species are not protected by the *MBCA* (for example, grouse, quail, pheasants, ptarmigans, eagles, hawks, owls, cormorants, pelicans, crows, jays, kingfishers, and some species of blackbirds). In B.C., these species, as well as other wildlife, are protected under the B.C. *Wildlife Act*.

The proposed Project Footprint and the Wildlife and Wildlife Habitat LAA overlap with Critical Habitat for barn owl (ECCC 2022); however, the biophysical attributes required for suitable foraging, nesting and roosting habitat are only partially present. Availability of native small mammal prey is expected to be limited, as naturalized areas present within the Wildlife and Wildlife Habitat LAA that could provide forage and cover habitat for small mammals is limited to small pockets of fragmented riparian and foreshore habitat and small grassy ditches and the proposed Project Footprint is predominantly paved (ECCC 2022; Shawyer 1998). There is one small area (approximately 0.59 ha) of an agricultural field overlapping the Wildlife and Wildlife Habitat LAA to the south of River Road that could potentially support small mammal prey, and thus owl foraging; however, the field is cultivated and regularly maintained. There is no suitable nesting or roosting habitat for barn owls within the proposed Project Footprint. Barn owls require natural or anthropogenic structures that have an elevated cavity or partially enclosed space that is accessible through an entry hole at least 15 cm in diameter (ECCC 2022). As discussed in subsection 7.8.3, there was one vacant warehouse within the existing Tilbury facility, but the warehouse has been removed prior to construction of the T1B expansion project and is not considered in the existing conditions for the proposed Project. There is potential that mature trees within the Wildlife and Wildlife Habitat LAA may have cavities to support nesting barn owls; however, no cavities and no evidence of nesting owls was recorded in trees within the Wildlife and Wildlife Habitat LAA during the 2021 wildlife surveys.

As noted in subsection 7.8.3.2, many waterfowl species used to frequent Tilbury Island and were traditionally harvested and consumed by Indigenous nations. Culturally important bird species observed within the Wildlife and Wildlife Habitat LAA during the wildlife field surveys include green-winged teal, lesser scaup, Canada goose, mallard, and bald eagle (Fediuk and Thom 2003; Charlie 2019). Green-winged teal and lesser scaup were observed foraging along the shorelines of the Fraser River. Mallards prefer freshwater environments for foraging, and several were observed within Tilbury Slough during the breeding bird surveys conducted by FortisBC to inform this Application. Canada goose was the most commonly observed species during the wildlife surveys, observed foraging along the shorelines of the Fraser River and flying by overhead. Bald eagles were observed during the breeding bird surveys and incidentally flying overhead. One active bald eagle nest was also observed in a mature cottonwood tree on the north bank of Tilbury Slough, outside of the proposed Project Footprint but within the Wildlife and Wildlife Habitat LAA.

Snow geese, canvasback, and merganser were also traditionally harvested during the fall in the lower Fraser River and consumed by the Quw'utsun Nation People (Charlie 2019), whereas northern shoveler were harvested year round. Even though the Boundary Bay – Roberts Bank – Sturgeon (Fraser River estuary) IBA is known to support snow geese (eBird n.d.), snow geese are not expected to occur in the Wildlife and Wildlife Habitat RAA due to lack of suitable habitat and presence of higher quality foraging habitat in the agricultural fields adjacent to the RAA. Although canvasback and mergansers were not observed during the field surveys, as the surveys were conducted during the spring and outside of the fall migration and overwintering period, these species have potential to forage in the foreshore of the Fraser River within the RAA. Northern shoveler was also not observed during field surveys but could utilize the Fraser River foreshore and Tilbury Slough within the Wildlife and Wildlife Habitat RAA for foraging.

Grouse were known to frequent Tilbury Island and were closely associated with crab apple trees (Charlie 2019; Turner 2020). Pacific crab apple (*Malus fusca*) was observed during the field studies within the Vegetation LAA outside of the proposed Project Footprint; however, given the current level of disturbance and development, there is no longer suitable habitat for grouse within the Wildlife and Wildlife Habitat RAA.

Main findings from the May 2021 wildlife studies conducted by FortisBC to inform the Application (refer to Terrestrial Biophysical TDR [Appendix D of the Application]) related to the bird subcomponent include the following:

- Natural habitat for birds in the Wildlife and Wildlife Habitat LAA is highly disturbed and fragmented. Birds that occur in the LAA are common to urban environments and are adapted to or tolerant of human activity and noise or utilize anthropogenic features for nesting.
- During the breeding bird survey, a total of 120 individual birds were observed (auditory or visual) and 24 species were identified. Water-associated birds (25 percent) and passerines (70 percent) comprised the majority (95 percent) of species observed; 10 of these species were migratory. The only species outside of these categories (that is, not water associated and not a passerine) was the rock pigeon, accounting for 5 percent of the species observed. Canada goose was the most observed species (number = 24), followed by European starling (number = 15), and violet-green swallow (number = 11).
- Species richness ranged from 5 to 10; species diversity, as calculated using the Shannon-Weiner Index (Shannon and Wiener 1949), ranged from 1.5 to 2.1; and species density ranged from 3.4 birds per ha to 14.1 birds per ha. The point count location with the highest species richness, diversity, and density was located on the shoreline of the Fraser River, looking out into the mud flats and tidal areas, outside of the proposed Project Footprint.
- Two bird species at risk were identified incidentally between breeding bird surveys within the Wildlife and Wildlife Habitat LAA: (1) great blue heron *fannini* subspecies (Special Concern under Schedule 1 of *SARA* and Blue-listed in B.C.) and (2) double-crested cormorant (Blue-listed in B.C.).
- No barn swallows (Threatened under Schedule 1 of *SARA* and Blue-listed in B.C.) or evidence of barn swallow nesting or roosting sites were identified during the 2021 wildlife surveys or supplemental wildlife surveys in May 2022.
- One active bald eagle nest was recorded on the north shore of Tilbury Slough within the Wildlife and Wildlife Habitat LAA, approximately 60 m southeast of the proposed Project Footprint and 30 m south of Tilbury Road. As this nest is adjacent to existing roads with high levels of traffic noise and in an urban-industrial setting, the eagles have developed a higher tolerance to human activities and disturbance compared to those in an undeveloped forest setting.

Mammals

The effects assessment on the mammal subcomponent evaluates potential proposed Project interactions and potential effects on terrestrial mammals, including species at risk and culturally important species. Terrestrial mammal species with potential to interact with the proposed Project primarily include species associated with or tolerant of urban environments, such as coyotes, raccoons, beavers, mice, voles, shrews, rats, and bats. Small terrestrial mammals observed during the wildlife field surveys include American mink, eastern cottontail, and brown rat, and there was evidence of American beaver and raccoon (refer to the Terrestrial Biophysical TDR [Appendix D of the Application] for additional information).

Federally designated Critical Habitat has been partially designated for little brown myotis hibernacula; this Critical Habitat does not occur in the Lower Mainland or in proximity to the proposed Project Footprint.

Maternity roosts are not identified as Critical Habitat in the Recovery Strategy (ECCC 2018). Suitable tree-cavity roosting habitat for bats was not identified within the LAA during the 2021 wildlife surveys; no bats, evidence of bat usage, or potential hibernacula or maternity roost sites were identified. There is potential that bats could use old infrastructure within the Wildlife and Wildlife Habitat LAA and RAA for roosting in the summer; however existing infrastructure and facilities within the proposed Project Footprint will be removed in advance of construction (as outlined in subsection 7.8.1). The nearest known little brown myotis and yuma myotis roost is on Deas Island, approximately 1.6 km to the southeast of the proposed Project Footprint. Bats may utilize open habitat over shallow water within Tilbury Slough and the shoreline of the Fraser River, where insect productivity is high, for foraging.

There is federally designated Critical Habitat for Pacific water shrew (*Sorex bendirii*; Endangered under *SARA* and Red-listed in B.C.) along Fraser Perimeter Road, approximately 1.2 km southeast of the proposed Project Footprint and outside of the Wildlife and Wildlife Habitat RAA (Government of Canada n.d.d; Environment Canada 2014). Pacific water shrew is a habitat specialist, adapted to a semi-aquatic existence and typically found in low-elevation riparian and wetland habitats with slow-moving streams or marshes and extensive canopy cover, generally in mature and old-growth forests (COSEWIC 2006; B.C. MELP 1995; Nagorsen 2002; Welstead and Vennesland 2006). Forested habitats are important for Pacific water shrew; however, the species has also been found in nonforested grassy habitats bordering ditches and sloughs in B.C. (COSEWIC 2006). Although some references suggest that Pacific water shrew prefers freshwater habitats (Craig et al. 2010; Environment Canada 2014), the species is difficult to study and generally not well understood. There is potential for salt tolerance in Pacific water shrew, considering several unverified detections in tidally influenced ditches and just above the tideline in spring-fed pools (that is, close to salt water) (Morgan, pers. comm. 2021).

Although some of the biophysical attributes required to support Pacific water shrew are present in the Wildlife and Wildlife Habitat LAA at Tilbury Slough (such as open water at least 1.5 km in length and woody debris for nesting and foraging), the existing habitat present is not optimal due to the lack of intact riparian forest on either side and proximity of industrial development and potential disturbance (Environment Canada 2014). The quality of water within the slough has been affected by road and stormwater runoff and high levels of suspended solids. As such, it was concluded that there is low potential for Pacific water shrew to utilize Tilbury Slough.

The Tilbury LNG facility site and perimeter ditches within the proposed Project Footprint do not contain the biophysical attributes required to support Pacific water shrew. These ditches are ephemeral and lack any natural riparian vegetation buffers or shading from overhanging vegetation. The vegetation along the ditches predominantly consists of invasive species and is regularly mowed as part of ongoing activities associated with the operational industrial site. Pacific water shrew requires a moist microenvironment with suitable vegetation and woody debris to provide cover, which are habitat characteristics not present within any of the ditches within or surrounding the Tilbury LNG facility. Additionally, these ditches collect surface and road runoff, which has affected the substrate and water quality. There is no connectivity along these ditches between Tilbury Slough and the Fraser River riparian area. It is unlikely that Pacific water shrew would utilize these ditches for any life stages and existing ditches will be removed/modified in preparation for the T1B project.

The Fraser River foreshore within the proposed Project Footprint and Wildlife and Wildlife Habitat LAA has patches of remnant riparian vegetation and marsh habitat, with woody debris and tall grasses; however, existing development along the Fraser River within the LAA has fragmented and limited the length of intact foreshore to the extent that there is no potential that Pacific water shrew could use the foreshore for movement or dispersal. The existing Seaspan ferry terminal to the northeast restricts movement of Pacific water shrew upstream of the proposed Project. Downstream, the Fraser River foreshore is fragmented by industrial activity associated with Varsteel/Dominion Pipe and Piling Works. Within the Wildlife and

Wildlife Habitat LAA, there is no habitat connectivity of the Fraser River foreshore with property or perimeter ditches or with Tilbury Slough due to the existing Tilbury LNG facility and roads. As such, Pacific water shrew are unlikely to utilize the habitat along the foreshore of the Fraser River within the LAA for any life stage.

As noted in subsection 7.8.3.2, land mammals (including white-tailed deer, elk, mule deer, moose, and black bear) and beaver were traditionally hunted and harvested on and around Tilbury Island (Lyackson First Nation 2018; Charlie 2019). Although moose, elk, and bears no longer have ranges on Tilbury Island or within the Wildlife and Wildlife Habitat RAA due to residential, industrial, and agricultural developments, deer and beavers are still present in the area and could be present within the Wildlife and Wildlife Habitat LAA.

No deer or evidence of deer use was observed within the Wildlife and Wildlife Habitat LAA during the wildlife field surveys conducted by FortisBC in May or November 2021, nor during any past field studies conducted during previous site visits (as described in subsection 7.8.3.1). However, willow branches, which are known to be a food source for deer (Turner 2020), and Sitka willow (*Salix sitchensis*) were observed within the proposed Project Footprint.

Beaver activity was recorded in Tilbury Slough within the Wildlife and Wildlife Habitat LAA. Three beaver dams were identified in Tilbury Slough within the Wildlife and Wildlife Habitat LAA, ranging from 120 m to 215 m southwest of the proposed Project Footprint, and evidence of beaver browsing was also observed on trees on the north bank of Tilbury Slough. Refer to Figure 3-2 in the Terrestrial Biophysical TDR, (Appendix D of the Application) for the locations of beaver activity and photographs.

Amphibians and Reptiles

The effects assessment on the amphibians and reptiles subcomponent evaluates potential proposed Project interactions and effects on amphibian and reptile species with potential to interact with the proposed Project, including species at risk and culturally important species. Amphibians and reptiles were combined into one subcomponent to capture the potential proposed Project interactions and effects that might be unique to them. As outlined in subsection 7.8.3.2, the majority of the Wildlife and Wildlife Habitat LAA has been anthropogenically influenced, especially within the proposed Project Footprint, as it is located within the existing Tilbury LNG facility. There are no natural watercourses or drainages present within the proposed Project Footprint.

There are two anthropogenic drainage ditches present within the Wildlife and Wildlife Habitat LAA. One roadside ditch follows the east and southeast perimeters of the existing facility, outside of the proposed Project Footprint and adjacent to Hopcott Road and Tilbury Road, before entering a culvert at the south end of the Tilbury LNG facility and flowing into the municipal stormwater system and Tilbury Slough. Although standing water is seasonally present in this ditch, it does not provide suitable habitat for breeding amphibians or reptiles, as it has minimal vegetation cover except for low shrubs and invasive plant species and is regularly mowed.

The other anthropogenic drainage is in the centre of the existing Tilbury LNG facility site, within the proposed Project Footprint, and has low potential to support breeding amphibians or reptiles. Water is ephemeral (seasonally present depending on time of year and annual variation in precipitation), and infrequent vegetation management has allowed the vegetation in the ditch to naturalize with emergent species (such as reed canarygrass and common horsetail), as well as Himalayan blackberry bushes to the north end. As such, this ditch provides low habitat quality for amphibians. No amphibian or reptile species were recorded in this ditch during the May or November 2021 wildlife field surveys, nor during any past field studies conducted during previous site visits (as described in subsection 7.8.3.1). This drainage will be

removed/modified prior to construction of the T1B project and is not included as part of existing conditions for the proposed Project.

The Fraser River within the LAA does not provide suitable habitat for amphibians or reptiles, as it is a large, fast-flowing, tidally influenced river with salty and brackish waters. Amphibians are extremely sensitive to salinity due to their inability to osmoregulate, and they are particularly vulnerable to saline conditions at embryo stages, as eggs often experience high mortality rates when in salt environments (Gomez-Mestre et al. 2004; Beebee 1985; Hua and Pierce 2013; Hopkins and Brodie 2015). In general, turtles inhabit slow-moving, permanent water bodies with soft bottom substrate, ample aquatic vegetation, and adjacent areas of exposed sand or gravel for nesting (SCCP n.d.), which are habitat characteristics that are not present within the portion of the Fraser River within the Wildlife and Wildlife Habitat LAA.

To the south of the proposed Project Footprint, the Wildlife and Wildlife Habitat LAA encompasses sections of the Tilbury Slough, a slow-moving side channel of the Fraser River. The majority of the slough within the Wildlife and Wildlife Habitat RAA is freshwater, separated from the downstream brackish waters of the Fraser River by flood gates located approximately 250 m to the southwest of the proposed Project Footprint, near MacDonald Road (refer the Aquatic Biophysical TDR [Appendix E of the Application] for more information on the surface water sampling program in Tilbury Slough). Other than minor salt influences at the flood gates, the slough is assumed to be freshwater. However, water quality within the slough is poor. Surface water samples demonstrated that the slough is a low-oxygen and low-pH environment with elevated concentrations of some metals and total phosphorous that exceed B.C. WQGs (B.C. MOE 2013a) and Canadian WQGs (CCME 2021a, 2021b) (Aquatic Biophysical TDR [Appendix E of the Application]). The metals that exceed applicable guidelines in Tilbury Slough include aluminum, arsenic, copper, cadmium, iron, lead, manganese, nickel, selenium, thallium, and zinc.

Low-pH conditions are known to inhibit the development of amphibian embryos or prevent hatching, cause swelling of the thoracic region, cause extrusion of the yolk plug, and cause nonlethal effects of delayed growth (Pierce and Wooten 1992). Conditions of low dissolved oxygen stress pond-dwelling amphibians, causing them to swim to the surface to breathe, increasing the risk of predation (Beasley 2020). Low dissolved oxygen diminishes the availability of prey species, manifesting in prolonged periods of metamorphosis, reduced body size, fewer breeding attempts, and smaller egg clutch sizes (Pierce and Wooten 1992). Heavy metals, such as aluminum, lead, zinc, cadmium, copper, arsenic, and manganese, can directly kill amphibians and induce sublethal effects in embryos, larvae, and adults (Blaustein et al. 2003). During the pond-dwelling amphibian survey at Tilbury Slough, conducted in May 2021, the only amphibian species recorded was green frog, which is an invasive species in B.C. No reptiles or native amphibians were recorded in the slough.

Terrestrial reptiles adapted to urban environments (such as garter snake) may forage and find cover in the small patches of riparian habitat and grasses within the Wildlife and Wildlife Habitat LAA. No snakes were observed during the May or November 2021 field surveys, nor during any past field studies conducted during previous site visits (as described in subsection 7.8.3.1).

Although the Wildlife and Wildlife Habitat LAA is within the habitat range of western painted turtle (Pacific Coast population) (*Chrysemys picta bellii*; Threatened under *SARA* and Red-listed in B.C.), the nearest final ECCC-designated Critical Habitat is over 7.6 km to the southwest of the Wildlife and Wildlife Habitat RAA, in the Alaksen Wildlife Refuge (Government of Canada n.d.d; ECCC 2021). Western painted turtle (Pacific Coast population) was recently downlisted from Endangered to Threatened on Schedule 1 of *SARA* (Government of Canada 2021). Western painted turtle requires both aquatic habitat (for breeding, foraging, basking, overwintering, and movement) and surrounding terrestrial habitat (for nesting, basking, and movement) to complete life history functions. Together, these aquatic and terrestrial habitats form the Critical Habitat that is essential for the persistence of the local breeding populations. Tilbury Slough

could provide suitable aquatic habitat for the turtle species as the slough consists of slow-moving, stagnant waters with abundant emergent vegetation, soft silty and muddy bottom substrate, submerged and emergent large woody debris, and warm shallow water margins. However, there is limited suitable terrestrial habitat along the shorelines of Tilbury Slough. Western painted turtle requires open areas with exposed soil (sand, gravel, or silt substrate with low organic content) and little to no vegetation cover (such as beaches or rocky bluffs) or warm south-facing aspects with light exposure (COSEWIC 2016), habitat characteristics which are not present along the densely vegetated shallow margins of the slough. The absence of contiguous freshwater aquatic areas between the Critical Habitat and Tilbury Slough, as well as poor-quality habitat within the slough, suggest that there is low potential for the occurrence of western painted turtle within the Wildlife and Wildlife Habitat LAA (COSEWIC 2016). No evidence of turtles was recorded during the wildlife studies conducted in May 2021 or by any other disciplines conducting fieldwork within Tilbury Slough (that is, aquatics, surface water, or vegetation and wetlands) in May, August, and November 2021 (refer to the Terrestrial Biophysical TDR and Aquatic Biophysical TDR [Appendices D and E of the Application, respectively]).

7.8.4 Potential Effects, Effects Management, and Characterization of Residual Effects

The activities associated with construction, operation, and decommissioning of the proposed Project have the potential to interact directly and indirectly with the Wildlife and Wildlife Habitat VC. The potential effects consider each subcomponent of the Wildlife and Wildlife Habitat VC, including species at risk and culturally important species, based on existing conditions (as described in subsection 7.8.3).[2]

7.8.4.1 Identification of Potential Effects, Effects Management, and Potential Residual Effects

The identification of the potential effects of the proposed Project on the Wildlife and Wildlife Habitat VC is based on engagement with the TAC, Indigenous nations, regulators, and the public during B.C. EA environmental assessment phases (that is, Early Engagement, Process Planning, and Application Development), as well as the results of the desktop review and field surveys conducted for the proposed Project (refer to the Terrestrial Biophysical TDR [Appendix D of the Application]).

Potential negative effects include changes in wildlife habitat from direct and indirect effect pathways, changes in wildlife movement, and changes in wildlife health and mortality risk. Potential negative effects associated with water and air quality, including dust dispersion, deposition, and vegetation uptake of contaminants is considered in the assessment of indirect effects on wildlife and wildlife habitat. There have been no positive effects on the Wildlife and Wildlife Habitat VC identified as a result of the proposed Project.

Table 7.8-5 identifies the potential effect pathways of the proposed Project on the Wildlife and Wildlife Habitat VC, including species at risk, culturally important species, and related habitat.

[2] As described in subsection 1.5.5, as a result of concerns received during the Application Development phase engagement activities that occurred after the development of the AIR, the proposed Project will no longer utilize any waterborne delivery of modular components and bulk construction materials to the proposed Project Site during construction. As a result, no MOF is required to be constructed or utilized for the proposed Project to accommodate waterborne deliveries. Avoidance of waterborne deliveries are included in the assessment as an avoidance mitigation measure (refer to subsection 7.8.4.1). Implementation of this avoidance mitigation measure has been incorporated into the determination of potential residual effects to Wildlife and Wildlife Habitat from the proposed Project in subsection 7.8.4.2.

Table 7.8-5. Wildlife and Wildlife Habitat – Proposed Project Activities, Potential Effect Pathways, and Indicators

Effect Indicator	Proposed Project Activities and Interaction	Measurable Parameter	Potential Effect	Nature of Interaction and Effect Type	
				Negative or Positive	Direct or Indirect
Wildlife Habitat Quality and Quantity	Vegetation removal and ground disturbance along the foreshore of the Fraser River during construction or vegetation maintenance during operation may reduce the availability or effectiveness of wildlife habitat.	▪ Habitat disturbance (that is, area and suitability of habitat) ▪ Reduced habitat quality or effectiveness within a ZOI ▪ Important wildlife habitat features identified in the proposed Project Footprint or within recommended buffer distances	Loss or alteration of wildlife habitat	Negative	Direct
	Sensory disturbance caused by noise, vibration, light, and activity during construction, operation, and decommissioning may reduce adjacent habitat effectiveness.			Negative	Indirect
	Introduction or spread of invasive species during construction may alter habitat suitability and result in a reduction of natural wildlife biodiversity.			Negative	Indirect
Wildlife Movement	Instream construction activities for the installation of the MOF may create barriers to wildlife movement along the shoreline and tidal mud flats of the Fraser River.	Duration and extent of barriers to wildlife movement	Change in wildlife movement	Negative	Direct
Wildlife Health and Mortality	Human-wildlife conflict, such as wildlife attraction to work sites during construction, operation, and decommissioning, may result in the need for removal or destruction of the animal.	▪ Sources of risk to health and mortality and intensity of effect (qualitative) ▪ Overlap of construction activities with sensitive periods for wildlife (such as migratory bird nesting period and amphibian breeding period) ▪ Important wildlife habitat features that may be occupied during construction and that are identified in the proposed Project Footprint or within recommended buffer distances	Increased wildlife health and mortality risk	Negative	Direct
	Wildlife mortalities may result from vehicle strikes associated with proposed Project traffic during construction, operation, and decommissioning; strikes or collisions with facility structures (such as migratory birds colliding with buildings or flare stack) during operation; or interaction of birds with flared gas during operation.			Negative	Direct
	Vegetation removal and ground disturbance activities during construction scheduled during sensitive periods for wildlife may cause wildlife mortality through disturbance of occupied habitats.			Negative	Direct

Table 7.8-5. Wildlife and Wildlife Habitat – Proposed Project Activities, Potential Effect Pathways, and Indicators

Effect Indicator	Proposed Project Activities and Interaction	Measurable Parameter	Potential Effect	Nature of Interaction and Effect Type	
				Negative or Positive	Direct or Indirect
Wildlife Health and Mortality (continued)	Sensory disturbance caused by noise, vibration, light, and activity during construction, operation, and decommissioning within the migratory bird nesting period may disrupt bird nesting and breeding behaviour to an extent that causes nest failure or abandonment of the breeding area.	▪ Reduced water quality in the Fraser River and Tilbury Slough from sedimentation or contaminants ▪ Altered air, surface water, and soil quality from air contaminants, odours, acidification, or eutrophication ▪ Pest control method	Increased wildlife health and mortality risk	Negative	Indirect
	Introduction or disruption of existing deleterious substances (such as contaminated soils or sediments) from instream works during construction (such as pile driving), or surface water runoff from proposed Project Site or accidents or malfunctions potentially affecting water quality in the Fraser River or Tilbury Slough during construction, operation, and decommissioning, may increase health and mortality risks for wildlife within aquatic habitats.			Negative	Indirect
	Proposed Project-generated air emissions or dust during operation and decommissioning may affect terrestrial and aquatic ecosystem health and increase health risks for wildlife.			Negative	Indirect
	Secondary poisoning of raptor species that feed on rodent prey may occur as a result of pest control using anticoagulant rodenticides.			Negative	Indirect

Loss or Alteration of Wildlife Habitat

Construction, operation, and decommissioning of the proposed Project may potentially affect wildlife habitat and has the potential to affect site-specific habitat features. Habitat loss and alteration can cause displacement of wildlife and potentially result in the use of less suitable habitat, reduced foraging ability (Bird et al. 2004), increased energy expenditure (Jalkotzy et al. 1997), and lower reproductive success (Habib et al. 2007).

Reduced Habitat Availability

Reduced habitat availability is measured by the size (area) of habitat disturbed or where suitability is altered. As described in subsection 7.8.3.3, there is currently little suitable wildlife habitat within the proposed Project Footprint. The surrounding habitat within the Wildlife and Wildlife Habitat LAA has been previously disturbed and fragmented, and it is subject to regular sensory disturbance from existing, ongoing industrial activity.

Construction of the proposed Project will disturb small portions of the fragmented remnant forest patch along the foreshore of the Fraser River, the riparian and wetland vegetation within the marsh and intertidal habitat of the Fraser River. Within the proposed Project Footprint, habitat that has potential to support wildlife is limited to approximately 1.46 ha, which accounts for 10.95 percent of the proposed Project Footprint (the majority of which includes open water in the Fraser River). The potentially suitable habitat within the proposed Project Footprint comprises 0.08 ha of young forest habitat, 0.14 ha of shrub habitat, 0.07 ha of marsh habitat, 0.21 ha of mud flat habitat, and 0.96 open water in the Fraser River (refer to Table 7.8-3). Disturbance of riparian, marsh, and intertidal vegetation will reduce the availability of habitat for birds and small mammals utilizing this area. However, as outlined in subsection 7.8.3.3, the small remnant forest patch and the riparian and intertidal areas within the proposed Project Footprint do not provide high-quality habitat for resident or migratory passerines or for water-associated birds due to the previously disturbed nature of the habitat and regular sensory disturbance from nearby industrial activity and shipping traffic. During the May 2021 field surveys, habitat associated with the highest species richness, diversity, and density of birds included the mud flats and intertidal open water of the Fraser River outside of the proposed Project Footprint, which are not being affected by the proposed Project activities (refer to subsection 7.8.3.3). The available habitat within the proposed Project Footprint may provide cover and forage for small mammals associated with urban environments, such as rats, raccoons, rabbits, minks, and bats.

There are no suitable nesting trees for raptors within the proposed Project Footprint; the 0.08 ha of young forest habitat within the proposed Project Footprint does not contain trees of adequate size to support nesting raptors. As such, there is no anticipated direct habitat loss for raptor species with potential to occur in the area. The one active bald eagle nest (a culturally important species) that was recorded during the May 2021 wildlife field surveys was located within the small, fragmented forest patches on the shore of Tilbury Slough, within the Wildlife and Wildlife Habitat RAA but outside the proposed Project Footprint (refer to Terrestrial Biophysical TDR [Appendix D of the Application]). The proposed Project is not anticipated to directly affect the nest. Potential for reduced habitat effectiveness from noise, light, and activity for raptors within nearby habitats is discussed in the following subsection.

As described in subsection 7.8.3.3, there is no high-quality foraging, nesting, or roosting habitat for barn owl within the Wildlife or Wildlife Habitat LAA; therefore, there are no anticipated potential effects from the proposed Project to barn owls.

The existing wildlife biodiversity within the Wildlife and Wildlife Habitat LAA and RAA has been altered by the high level of industrial development and disturbance, as well as invasive plants and wildlife species, as described in subsections 7.8.3.2 and 7.8.3.3. Construction of the proposed Project has potential to introduce or increase the extent of invasive plants, which can alter habitat suitability. If the habitat alteration is substantial or extensive, wildlife biodiversity can be affected. However, as the proposed Project Footprint is primarily limited to the existing Tilbury LNG facility and with the implementation of standard invasive species BMPs, as outlined in Table 7.8-6, the potential for changes in wildlife biodiversity resulting from the proposed Project is unlikely. As such, potential residual effects to changes in wildlife biodiversity are not carried forward through the assessment.

Reduced Habitat Effectiveness

Reduced habitat effectiveness occurs when suitable habitat is available but the quality of the habitat is changed such that wildlife avoids the habitat or reduces their use of it. Reduced habitat effectiveness can occur as a result of fragmentation, the creation of edges, or sensory disturbance from noise, vibration, artificial light, proximity to facilities and infrastructure, human activity, and traffic. Many wildlife species are sensitive to human disturbance and exhibit reduced use or avoidance of habitat in proximity to certain disturbance types (that is, within a ZOI). Habitat effectiveness within a ZOI may be affected by noise, vibration, light, and activity associated with the proposed Project construction, operation, and decommissioning activities. Responses to sensory disturbance are expected to vary for different species and even individual animals. Various factors affect an animal's response to sensory disturbances, such as noise level, frequency distribution, duration, number of events, rate of onset, level of existing ambient noise, time of year or day, animal activity and location, animal age, and gender.

Noisy construction, operation, and decommissioning activities have the potential to temporarily discourage wildlife use of the surrounding habitat, thereby reducing habitat effectiveness. Similarly, artificial light can also influence nearby habitat effectiveness for wildlife, particularly nocturnal species such as bats or migrating birds (Lewanzik and Voigt 2014; Van Doren et al. 2017). Noise and vibrations will be generated through various activities during the construction phase and are anticipated to temporarily increase during construction compared to existing conditions (subsection 7.3, Acoustic). Increased noise and vibration levels during construction will not be continuous and will depend on activities and equipment used. Noise levels during operation of the proposed Project are anticipated to increase relative to existing conditions due to the addition of equipment, such as compressor buildings, but the increase is expected to be low in magnitude (subsection 7.3, Acoustic). There are no expected potential sources of vibration present during operation (subsection 7.3, Acoustic). Decommissioning effects are considered the same as construction; that is, they will also result in a temporary (not continuous) increase in noise and vibration levels, depending on the activities and equipment needed.

There will be a temporary increase in lighting during the construction phase compared to existing conditions due to night shifts and for safety and security reasons (Appendix F, Visual Quality Assessment TDR). Additional nighttime lighting requirements during the 3- to 6-year construction period will be continuous. Similar lighting requirements are anticipated during decommissioning. For operation of the proposed Project, there will be an increase in lighting compared to the existing conditions. However, this increase is considered minimal compared to the existing conditions, as the proposed Project is located within an existing active LNG facility with light fixtures and neighbouring lit industrial infrastructure. Additional lighting associated with the proposed tank and associated infrastructure is anticipated to blend with the existing lighting and will not alter sky glow locally or regionally (Appendix F, Visual Quality Assessment TDR).

Sensory disturbance from noise, vibration, and artificial lighting have potential to temporarily displace migratory birds using habitat in the Wildlife and Wildlife Habitat LAA within the Fraser River and associated shoreline during the nesting, migration, and overwintering periods. Long-distance migrants are particularly sensitive to alterations in stopover and staging habitats, as they rely on these sites to rest and refuel (Baker et al. 2004; Warnock 2010). The proposed Project is located within a heavily developed portion of Tilbury Island, and there are no critical or major stopover, staging, or overwintering sites for migratory birds identified within the Wildlife and Wildlife Habitat LAA. However, some species may temporarily forage or rest during migration in the habitat available in the Wildlife and Wildlife Habitat LAA, in addition to use of the habitat by migratory and resident birds for foraging and breeding during the nesting season.

Vibrations through the ground can affect wildlife species through predator-prey interactions, mate choice, intrasexual competition, and maternal or brood social interactions (Hill 2001); however, some species are resilient to these disturbances. There is evidence that increases in intensity and frequency of vibrations can negatively affect bird species during the breeding and nesting periods (Wiacek et al. 2015). Alternatively, other studies found that some wildlife species, such as insectivorous passerines, ignore or adapt to increased vibration disturbances and may even prefer noisier areas if there is increased resource availability (Mundahl et al. 2013). Refer to subsection 7.3 (Acoustic) for a detailed assessment of vibration anticipated as a result of the proposed Project.

Artificial light near water bodies can disturb migratory and resident waterbirds that forage nocturnally. For instance, great blue herons visually locate their prey (Vennesland and Butler 2011), so increased nighttime lighting may change heron foraging behaviour and habitat use. In contrast, artificial lighting can attract species that visually forage, as the additional illumination assists in prey location and can increase overall prey intake (Santos et al. 2009). Artificial lighting, particularly red and yellow light, can also affect a bird's circadian clock and disorient individuals (Gill 1995; Golder et al. 2010). Birds' circadian clocks, which respond to daily light and dark cycles, direct an individual's behaviour, such as foraging, sleeping, metabolic activity, and body temperature regulation.

Bird species richness, diversity, and densities have been demonstrated to be substantially lower in proximity to noisy facilities and roadways compared to less noisy habitat (Bayne et al. 2008; Kaseloo 2004; Rheindt 2003), though these represent sources of chronic anthropogenic noise. High levels of ambient noise can affect mate attractions, pair bonding, and territory defence by impairing communication between birds (Brumm 2004; Swaddle and Page 2007). Birds in noisier territories sing more loudly than birds at less noisy locations, presumably to mitigate impairment of communication between individuals (Brumm 2004). In another study, the abundance of passerines was found to be up to 1.5 times greater near noiseless energy facilities than areas near noise-producing facilities (Bayne et al. 2008).

Reduced habitat effectiveness within the Wildlife and Wildlife Habitat LAA as a result of the proposed Project construction and operation activities has potential to affect some culturally important species. As outlined in subsection 7.8.3.2, duck, geese, and bald eagle were traditionally harvested for cultural, economic, and ceremonial purposes. Dabbling ducks (such as northern shovelers, green-winged teal, and mallards) may be vulnerable to artificial night lighting within Tilbury Slough, as dabbling ducks are known to be active at night (McNeil et al. 1992). Diving ducks (such as canvasback, lesser scaup, and mergansers) may utilize the Fraser River foreshore for foraging but are unlikely to be affected by artificial lighting, as they are generally diurnal foragers that spend nights offshore (Guillemette et al. 1992; Lewis et al. 2005). Canada geese are not expected to be affected by sensory disturbances, as they are adaptable to anthropogenic environments. Nearby nesting bald eagles are not anticipated to be affected by sensory disturbances associated with the proposed Project. Bald eagles are known to have moderate to high tolerance of human activity (B.C. MOE 2013b), and their known nest is currently located in proximity to

busy roadways and industrial activity. Because they selected this site, it is assumed that the individual birds would be habituated to the existing anthropogenic noise and disturbance.

Sensory disturbance during construction, operation, and decommissioning of the proposed Project may also adversely affect habitat effectiveness for bat species within a ZOI. Bat species differ in their responses to sensory disturbances, including visual disturbances (Duchamp and Swihart 2008). Bats may be negatively affected by noise-generating activities, which can obscure the sound created by the small movements of their insect prey (Arlettaz et al. 2001; Schaub et al. 2008) or impede their foraging success and ability to navigate cluttered environments (Barber et al. 2009). Artificial nighttime lighting was also shown to seriously disrupt foraging onset and activity levels in species of insectivorous bats (Stone et al. 2009, 2012). However, some insectivorous bats appeared to show no negative responses to artificial nighttime lighting and may have even benefited due to some insects' inherent attraction to artificial lighting (Longcore and Rich 2004; Walters et al. 2007). Artificial light produces localized point-sources of light in an otherwise darkly lit environment, which may be attractive to local night-flying insect populations that confuse its intensity and polarization navigational cues with those of the moon (Horvath et al. 2009). This localized concentration of prey insects can make foraging both easier and more efficient for bats (Walters et al. 2007).

Change in Wildlife Movement

The proposed Project has limited potential to alter wildlife movement, including species at risk and culturally important species, during any phase. The entire Tilbury LNG facility is gated, which restricts wildlife movement and presence within the facility by creating a barrier.

FortisBC conducted a comparison of several MOF designs that considered factors such as constructability, access, and potential environmental effects. FortisBC selected a preliminary design that avoids the need for dredging and eliminates potential adverse effects to the riverbed. The selected design also minimizes the number of piles and reach across the channel.

During construction, excavations and material storage (excluding those required for construction of the proposed Project MOF) will occur within the fence line of the existing Tilbury LNG facility, minimizing the effect to wildlife movement. Construction of the proposed Project MOF will require installation of four to six piles into the Fraser River and riprap on the shoreline. The size of the area being disturbed within the Fraser River during construction is anticipated to be small (subsections 7.7, Vegetation, and 7.9, Fish and Fish Habitat) and short in duration (up to a maximum of 2 months), thus unlikely to cause measurable changes in wildlife movement. The proposed Project MOF will be required for the duration of construction. The final proposed Project MOF footprint during operation is a relatively small change compared to the existing dock that it will replace, and it will not alter wildlife movement along the Fraser River foreshore compared to existing conditions.

There are no anticipated interactions with wildlife movement from the proposed Project during construction, operation, or decommissioning phases. As such, no mitigation is proposed for this effect pathway; the effect is considered negligible and has not been carried through to the residual effect assessment. Changes in movement due to sensory disturbance within a ZOI, such as displacement from habitat, are evaluated as part of the assessment of effects on habitat effectiveness.

Increased Wildlife Health and Mortality Risk

The proposed Project has the potential to adversely affect wildlife health or increase wildlife mortality risk during all phases. Wildlife health and mortality effects can occur due to direct sources, such as vehicle-wildlife collisions or direct disturbance of occupied habitat, and indirect sources, such as sensory disturbance causing increased risk of nest abandonment in birds or exposure to legacy contaminants.

Human-Wildlife Conflict

Access roadways within the Wildlife and Wildlife Habitat LAA are existing and were recently upgraded to support trucking traffic in the area and connections to major transportation arteries, including the SFPR (Highway 17). The construction and decommissioning of the proposed Project will require land transportation of construction material, equipment, and workers to the proposed Project Site. During the 3- to 6-year construction period, up to 27,000 truckloads could be required for construction material delivery, with additional light-duty vehicles moving workers onto and within site (refer to the Transportation Desktop Analysis Report [Appendix R of the Application]). Vehicle traffic to the proposed Project Site would vary throughout construction, with periods of high volume related to groundworks and peak workforce. Vehicle traffic and volumes during decommissioning are anticipated to be similar to construction. Compared to existing traffic conditions, this increase in vehicle traffic will be short term and infrequent at peak intensity (refer to subsection 7.11, Land and Resource, for context of existing traffic levels). A temporary increase in vehicle traffic during the construction and decommissioning phases may result in a minor increase in mortality risk to wildlife due to vehicle collisions. Due to their low flying hunting techniques, barn owls are particularly vulnerable to collisions with vehicles, especially as their foraging habitat becomes fragmented and limited by roadways, leading to more foraging along grassy side verges and the need to cross major highways (ECCC 2022). There is no predicted interaction with wildlife mortality risk from vehicle collisions during operation of the proposed Project, as traffic levels are anticipated to be the same as the existing levels, and the contribution of incremental proposed Project traffic is considered negligible to low (refer to the Transportation Desktop Analysis Report [Appendix R of the Application]).

Six to eight project cargo vessels are required to deliver modules to the port, and barges will be used to deliver those modules to the proposed Project Site. The barges will utilize established shipping lanes in the Fraser River and follow the requirements of applicable authorities. The barges will be in place temporarily, only during unloading and loading activities, and will not ground on the riverbed. There are no barges required for the operation of the proposed Project. As previously mentioned in subsection 7.8.3, the Fraser River is currently used as an industrial inland waterway. The number of river barges required for the proposed Project represents an incremental increase to existing river traffic conditions in the Fraser River adjacent to the proposed Project, and tugs used to support barges are currently operating in the Fraser River under existing conditions (refer to the Transportation Desktop Analysis Report [Appendix R of the Application]). As such, increased wildlife mortality risk associated with sensory disturbance from slow-moving river barge traffic for wildlife using the Fraser River habitat within the Wildlife and Wildlife Habitat LAA is expected to be negligible. The risk of collisions of birds with the barges is negligible, given the slow speed of the barges and movement during daylight hours. This effect pathway has not been carried through to the residual effect assessment.

Garbage, food, or industrial waste and debris that create odour may attract wildlife to the proposed Project Site including species common to urban settings, such as coyotes, raccoons, or crows, which can increase the potential for human-wildlife encounters and may increase the mortality risk to these wildlife species.

Disturbance of Occupied Wildlife Habitat

Disturbance of occupied habitat features during construction site preparation activities has the potential to cause accidental mortality to wildlife. Vegetation removal can create risk for wildlife that nest or den in trees and understory vegetation, whereas grubbing, grading, and ground disturbance may affect small mammals and amphibians that inhabit woody debris, litter, and soil. Riparian vegetation disturbance or during construction could potentially increase mortality risk to amphibians present in the water or associated vegetation. Sensitive periods for amphibians vary by species, region, and annual and seasonal conditions. The sensitive timing period for amphibian breeding, egg and juvenile development, and

dispersal can extend from approximately March 1 to October 31 in temperate and low-elevations areas of B.C., with the peak breeding period between April and August (B.C. MELP 1998; B.C. MOE 2014a; B.C. MFLNRO 2016). Overwintering amphibians can be sensitive to ground disturbance activities that occur in occupied habitats between approximately late October and early March. However, the only amphibian species detected during the May 2021 wildlife field studies was the invasive green frog, which remains active during cool conditions but will hibernate when conditions are cold by burrowing into the mud at the bottom of a water body; therefore, sensitive timing windows for amphibians are not applicable for the proposed Project.

Sensory Disturbance

Sensory disturbance can also result in increased mortality risk to nesting migratory and resident birds within a ZOI, including species at risk and culturally important species. However, the potential increase in sensory disturbance from the proposed Project to nearby wildlife is considered minimal compared to the existing conditions due to the proposed Project siting within an area of existing industrial disturbances. Wildlife utilizing the Wildlife and Wildlife Habitat LAA would be adapted to the current levels of noise, vibration, light, and activity from urban and industrial environments.

Increases in noise, vibration, light, and activity during construction, such as barge and vehicle traffic, within the migratory bird nesting period (March 26 to August 16) have potential to disrupt bird nesting and breeding behaviour to an extent that causes nest failure or abandonment of the breeding area (ECCC n.d.a, 2021). Most bird species are sensitive to human disturbance in proximity to nest sites and often have physiological or behavioural responses (Antoniuk and Ainsle 2003) that may result in nest desertion, reduced parental care of young, decreased feeding efficiency, and increased dispersal distances of young (Hill et al. 1997; Jalkotzy et al. 1997; Richardson and Miller 1997). Flushing is a common short-term response to disturbance in which birds temporarily leave the nest or perch site in response to unfamiliar noises, pedestrian approach, or traffic (Antoniuk and Ainsle 2003). Flushing can influence nestling mortality if the adults are displaced from the nest during adverse weather conditions or for lengthy periods, or if young are flushed from their nest before they are developmentally ready to fledge.

Bird population trends are driven by factors that affect reproduction or survival during any point in the annual cycle (Environment Canada 2013). For example, threats that could reduce reproductive success may include reduced quantity and quality of breeding habitat, which can occur as a result of sensory disturbance. Noise, vibration, light, and activity from proposed Project construction, operation, and decommissioning activities could disrupt nesting and breeding behaviours to an extent that causes nest failure or abandonment of the breeding area. The resilience of an individual bird to stress from sensory disturbance can vary by species, life stage, and the environment they are habituated to (Blums et al. 2005). Some species are more sensitive to disturbance than others, and even within species, birds choosing to nest in urban areas show much more tolerance to disturbance than those nesting in more remote areas (B.C. MOE 2013b).

As previously discussed, the construction and decommissioning of the proposed Project will require additional temporary nighttime lighting, and operation will require an increase in permanent light fixtures, which could result in an incremental change in mortality risk to birds due to collisions with infrastructure. However, this increase is considered minimal compared to the existing conditions, as the proposed Project is located within an existing active LNG facility with light fixtures and neighbouring lit industrial infrastructure.

Artificial lighting can attract birds, increasing the likelihood of collisions with infrastructure and increasing their mortality risk. If migrating birds lose their natural navigation due to weather events, such as storms, fog, or strong winds, they can become attracted to the nearest artificial light source, especially at

nighttime (Johnson et al. 2011; Jones and Francis 2003; Ogden 2002; Loss et al. 2020). This can result in immediate mortality or crippling injury if the individual collides with the structure, or individuals may exhaust energy reserves flying in circles above the light source (Erickson et al. 2001, 2005; Van de Laar 2007). Artificial lighting has potential to affect seasonal migrations of certain culturally important birds, such as canvasbacks, Canada geese, green-winged teals, mergansers, lesser scaup, and northern shovelers. Canada geese and green-winged teals are partial migrants, and the resident populations could have more time to adapt to changes in habitat (such as increases in artificial lighting), experiencing less effects than their migrating counterparts (Wittwer et al. 2015). In contrast, resident populations are also likely to experience greater exposure to changes in sensory disturbance, as they can be in the Wildlife and Wildlife Habitat LAA year round, when migrating species may not be present in the area (Botsch et al. 2017). Artificial lighting near water bodies has potential to disturb waterbirds that forage nocturnally, such as herons or culturally important dabbling ducks (such as northern shovelers, green-winged teal, and mallards) (McNeil et al. 1992).

Flaring

Flares are common features of LNG facility operation and act as safety devices designed to relieve pressure and prevent the uncontrolled release of flammable gases. Flares may also be used during maintenance to safely depressurize the facility and prevent the venting of methane. Flaring will be required for the proposed Project during commissioning (one time event) and during annual SS's (approximately five times per year). Flaring may also occur during upset conditions in an emergency scenario.

The proposed Project will use a TEGF. A TEGF can be considered the BAT, with its high combustion and destruction efficiency and its design to safely combust gases with minimal effects on the surrounding environment and wildlife (Solaris 2022). As combustion takes places entirely within a large, refractory-lined combustion chamber, TEGF systems have no smoke, low noise and vibration levels, and no direct heat radiation from the flame outside of the chamber (Solaris 2022; Bourji et al. 2016). Although the flame from a TEGF is not visible from ground level, it could be visible from above, and there is potential for heat to radiate upward above the flame. The heat plume rising above the top of the flame would produce a heat gradient, becoming increasingly hot with decreased proximity to the flare. It is anticipated that birds would be deterred from perching on the TEGF structure by the increasing air temperature, so there is limited potential for direct incineration or inhalation of toxic gases by birds perching on the TEGF. There is potential for bird interactions with heat causing injury or burns.

The TEGF is a shorter structure than an elevated flare stack, which will reduce the potential for bird collisions but not eliminate it. The chamber for the proposed TEGF will be approximately 27.4 m in height and 23.2 m in diameter, so there is some potential for collisions for migratory birds, especially during the night or during low-visibility events (such as fog and storm events). Birds that migrate at night, including culturally important species such as lesser scaup, mergansers, and canvasback, could be at higher risk of collisions with infrastructure that can lead to increased health and mortality risks to birds.

Deleterious Substances

The potential for altered water quality in the Fraser River or Tilbury Slough as a result of sedimentation or contamination has been considered in this Application as a potential health and mortality risk for wildlife. As noted in subsection 7.8.3.2, the lower Fraser River also currently contains levels of total iron, total copper, total aluminum, and total phosphorous that exceed the CCME long-term freshwater guidance/B.C. recreational guidelines for protection of aquatic life, as well as high TSS and suspended solid concentrations (Jacobs 2022a). Suspended sediments from the riverbed may also contain legacy contaminants from previous activities (such as PCBs, PAHs, metals, dioxins, and furans) (WesPac 2019).

Some of these contaminants could accumulate in wildlife, especially piscivorous waterfowl and amphibians, through bioaccumulation and biomagnification. Bioaccumulation is the increase in pollutant concentration within one organism over its lifetime, and biomagnification takes places as chemicals transfer from lower to higher trophic levels, causing increasingly detrimental effects to wildlife higher in the food chain (Popek 2018). The biomagnification of these contaminants within the food chain can reach toxic concentrations in predators at higher trophic levels (Popek 2018). Increased suspended sediments can cause fish die-offs at high concentrations (Wilber and Clarke 2001), which can affect food sources for piscivorous waterfowl.

The construction activities planned in the Fraser River associated with the MOF and include the installation of four to six piles and installation of riprap around the MOF. As there is limited instream activity, the likelihood of construction activities disrupting sediment in the Fraser River or remobilizing legacy contaminants is negligible to low (subsection 7.4, Surface Water).

Under existing conditions within the Fraser River, sediment substrates are consistently remobilized, and sediment is transported downstream to the lower reaches of the Fraser River and further into the Fraser River estuary toward the Strait of Georgia (Bull 2004; Shaw and Tuominen 1999). Due to inherent variability caused by tidal cycles and Fraser River discharge, it is not expected that sediments potentially disrupted during construction of the MOF will be detectable from the existing conditions of sediment movement or surface water quality (TSS) in the Fraser River (subsection 7.4, Surface Water; Jacobs 2022c). Additionally, sediment samples collected within the LAA showed that concentrations of metals, PCBs, VOCs, and phenols were at or below the B.C. sediment quality guidelines and the Fraser River Objectives (subsection 7.4, Surface Water); therefore, if the installation of the piles and riprap for the MOF does disrupt sediments on the bed and banks of the Fraser River, a temporary remobilization of TSS or exposure of legacy contaminants to downstream aquatic habitats is not anticipated to result in a measurable change in water quality (subsection 7.4, Surface Water; Jacobs 2022c). Any sedimentation resulting from construction of the MOF is considered negligible compared to existing river processes and the concentration of any legacy COCs in these sediments are not anticipated to be discernable from those already occurring in the Fraser River (subsection 7.4, Surface Water). There are no anticipated interactions of sedimentation or legacy contaminants as a result of the proposed Project with wildlife health or mortality risk, and this effect pathway has not been carried through to the residual effect assessment. Potential effects during decommissioning of the proposed Project, including the MOF, are assumed to be comparable to those expected during construction.

As described in subsection 7.8.3.2, there is historical soil contamination within the existing Tilbury LNG facility site; however, construction, operation, and decommissioning activities associated with the proposed Project are not expected to disturb these contaminated soils areas (subsection 7.6, Soil). Contaminated soils within the proposed Project Footprint will be contained and removed prior to construction of the proposed Project. The majority of runoff from these ditches and the existing Tilbury LNG facility site enters the municipal stormwater system and is diluted with other water sources (that is, runoff from other industrial and commercial properties and roadways) prior to entering Tilbury Slough (as outlined in subsection 7.8.3.2). Should any soils or sediments be mobilized during proposed Project construction activities and enter Tilbury Slough during a remobilization event, the amount would be considered negligible and would not result in a change to existing water quality conditions in the slough (subsection 7.4, Surface Water). As such, changes in water quality (TSS and contaminants) in Tilbury Slough resulting from construction activities associated with the proposed Project are not considered to be an effects pathway in this assessment. There are no anticipated interactions with health or mortality risk to wildlife in Tilbury Slough, including for culturally important species (such as waterfowl and beavers), from increased sediments or contaminants associated with the construction, operation, or decommissioning of the proposed Project. Regardless, BMPs around sediment and erosion control will be

implemented during construction of the proposed Project (as summarized in Table 7.8-6). This effect pathway has not been carried through to the residual effect assessment.

As outlined in subsection 7.2 (Air Quality), the normal operation of the proposed Project is predicted to have a minimal incremental contribution to existing concentrations of CO or PM. Nearby receiving aquatic and terrestrial environments for both surface water and soil within the Air Quality VC RAA are not susceptible to acidification, nitrogen loading, or eutrophication from the proposed Project emissions (Jacobs 2022b; refer to the Nitrogen and Acid Deposition Receiving Environment Report [Appendix H of the Application]). As such, there are no anticipated interactions with wildlife health risk from emissions generated by the proposed Project, and this effect pathway has not been carried through to the residual effect assessment.

The dispersal of small dust particles during construction may reduce air quality, which could interact with wildlife health risk. Fugitive dust emissions are anticipated to be discernable from existing conditions and to extend just outside the proposed Project Footprint during construction activities but will be managed with mitigation measures (low magnitude) (subsection 7.2, Air Quality).

To align with the recovery objectives of the Barn Owl Federal Recovery Strategy (ECCC 2022), potential effects of pest control on wildlife has been considered. Rats and mice are known to be present within and around the proposed Project Footprint, seeking cover in infrastructure and drainages ditches in the existing Tilbury LNG facility. Pest control using anticoagulant rodenticides (that is, rodent poisons) has the potential to result in secondary poisoning of barn owls and other raptors that feed on rodent prey (Government of B.C. n.d.b; B.C. ENV 2021a, 2021b, 2021c). The consumption of poisoned rodents by raptors has the potential to cause increased health and mortality risks to birds (Thomas et al. 2011; Government of B.C. n.d.d). The use of rodenticides can degrade or destroy foraging habitat for barn owl by reducing the availability of prey species within foraging habitat and surrounding areas (ECCC 2022). Studies in B.C. have shown that barn owl mortality due to secondary rodenticide poisoning is increasing.

To reduce the risk of wildlife poisoning, an 18-month ban on second-generation anticoagulant rodenticides (SGARs) was implemented by the Government of B.C. starting on July 21, 2021 (Government of B.C. n.d.d). SGARs are formulated as poisonous baits; they are highly toxic and can also pose a serious risk to people, pets, and wildlife through direct and secondary poisoning. The risk of secondary poisoning for wildlife by SGARs is higher than first-generation products because the active ingredients remain in animal tissue long after feeding. Current pest control methods at the existing Tilbury LNG facility include mechanical traps used inside buildings and tamper-resistant bait stations deployed around building perimeters.

Mitigation

Table 7.8-6 summarizes the potential effects related to proposed Project construction, operation, and decommissioning activities, along with proposed mitigation measures (effects management) and potential residual effects. Proposed mitigation measures have been identified in a manner consistent with subsection 6.5 of this Application.

As previously stated, FortisBC conducted a comparison of several MOF designs that considered factors such as constructability, access, and potential environmental effects. FortisBC selected a preliminary design that avoids the need for dredging and eliminates potential adverse effects to the riverbed. The selected design also minimizes the number of piles and reach across the channel.

However, as described in subsection 1.5.5, as a result of concerns received from engagement activities during Application Development phase that occurred after the development of the AIR, the proposed Project no longer proposes to construct the MOF and will not utilize any waterborne delivery of modular

components and bulk construction materials to the proposed Project Site during construction. As a result, no MOF is required to be constructed or utilized for the proposed Project to accommodate waterborne deliveries. Avoidance of waterborne deliveries are included in the assessment as an avoidance mitigation measure (refer to subsection 7.8.4.1). Implementation of this avoidance mitigation measure has been incorporated into the determination of potential residual effects to Wildlife and Wildlife Habitat from the proposed Project.

Species-specific mitigation measures will be developed as part of the CEMP and the Tilbury Operations Plan. Sensitive timing windows and setback buffers for applicable wildlife species and habitats will be considered in the development of the proposed Project's CEMP by a QP and in alignment with relevant species recovery strategies, actions plans, or management plans. Proposed mitigation measures focus on avoidance and minimization of potential adverse effects on wildlife and wildlife habitat, including species at risk and culturally important species. Although not listed in Table 7.8-6, mitigation measures proposed for other VCs will also apply to wildlife and wildlife habitat, when applicable, and will be implemented through the CEMP (for example, reducing air emissions, lighting and noise, erosion and sediment control, wetland restoration, and Noxious weed management).

The majority of the proposed mitigation measures are expected to be effective immediately upon implementation. During decommissioning, onsite restoration is not considered practical due to the preconstruction conditions (cleared brownfield site), the constraints of ongoing maintenance and operation over the life of the proposed Project, and the industrial zoning of the majority of the proposed Project Footprint and adjacent lands. The proposed Project Footprint will not be revegetated upon decommissioning.

As described in subsection 1.7, a number of alternatives to the proposed Project were evaluated, but it was concluded that there are no viable alternatives to storing adequate gas volumes to provide energy resilience in the Lower Mainland. Even if a viable alternative was identified, there would be no changes in proposed Project interactions with Critical Habitat as a result, as there are no final designated Critical Habitat for federally listed terrestrial wildlife species at risk within the RAA (Government of Canada n.d.d.).

Table 7.8-6. Wildlife and Wildlife Habitat – Potential Effects, Mitigation Measures, and Potential Residual Effects

Proposed Project Phase	Potential Effect	Spatial Boundary	Mitigation Measures	Mitigation Tier[a]	Mitigation Timeline[b]	Effectiveness[c]	Potential Residual Effect
All project phases	Loss or alteration of wildlife habitat	LAA	▪ Complete wildlife surveys prior to construction to identify habitat features that warrant site-specific mitigation measures to reduce potential project effects to wildlife and wildlife habitat. [M-72]	Avoidance and Minimization	Immediate	High	Loss or alteration of wildlife habitat
			▪ Where practical, plan construction activities within wildlife habitat or buffers of identified wildlife habitat features during the least-risk timing windows for applicable species. For any work within the buffer zone during a sensitive timing window, consult with Indigenous nations and a Wildlife QP and the appropriate regulatory agencies to determine whether additional feature-specific mitigation is required to be incorporated into the CEMP. [M-02]	Avoidance and Minimization	Immediate	High	
			▪ Develop and implement soil-management and soil-handling practices that are effective at managing the introduction and spread of invasive Noxious plant species, as required under Provincial regulations and Municipal bylaws. These measures will be incorporated into the CEMP. [M-60]	Avoidance and Minimization	Immediate	High	
			▪ There will be no waterborne deliveries of modular components or construction materials to the project site, and no MOF will be required. [M-77]	Avoidance and Minimization	Immediate	High	
			▪ Lighting for the project will be designed in a manner that is consistent with the BCER's Light Control Best Practices Guideline. [M-36]	Minimization	Immediate	High	Increased wildlife health and mortality risk
			▪ Complete wildlife surveys prior to construction to identify habitat features that warrant site-specific mitigation measures to reduce potential project effects to wildlife and wildlife habitat. [M-72]	Avoidance and Minimization	Immediate	Moderate	
			▪ Develop mitigation and contingency measures in consultation with Indigenous nations and a QP to reduce the potential for adverse interactions with wildlife and wildlife habitat (such as human-wildlife conflict, vehicle collisions, and sensory disturbance), and incorporate these measures into the CEMP. [M-59]	Avoidance and Minimization	Immediate	Moderate	
			▪ During construction and operation of the project, develop mitigation and contingency measures through engagement with a QP to manage acoustic disturbance to human and wildlife receptors, and incorporate these measures into the CEMP and EMS. [M-57]	Avoidance and Minimization	Immediate	Moderate	
			▪ Establish a refuelling and spill response plan. The measures will be incorporated into the CEMP. [M-50]	Avoidance and Minimization	Immediate	Moderate	
			▪ There will be no waterborne deliveries of modular components or construction materials to the project site, and no MOF will be required. [M-84]	Avoidance and Minimization	Immediate	Moderate	
			▪ Develop dust-control measures to be described in the CEMP to limit particulate matter emission during the construction phase. [M-54]	Avoidance and Minimization	Immediate	Moderate	

Table 7.8-6. Wildlife and Wildlife Habitat – Potential Effects, Mitigation Measures, and Potential Residual Effects

Proposed Project Phase	Potential Effect	Spatial Boundary	Mitigation Measures	Mitigation Tier[a]	Mitigation Timeline[b]	Effectiveness[c]	Potential Residual Effect
All project phases (continued)	Increased wildlife health and mortality risk	LAA	▪ If rodent population control is needed at the project site, employ best practices to manage rodent populations onsite during construction and operation and these measures will be included in the CEMP. [M-45]	Avoidance and Minimization	Immediate	Moderate	Increased wildlife health and mortality risk

[a] Mitigation tiers:

- Avoidance: Measures taken to avoid creating potential effects from the outset, such as considering spatial or temporal factors in proposed Project design. These measures are taken to avoid potential effects on certain VCs.
- Minimization: Measures taken to reduce the duration, intensity, or extent of potential effects that cannot be completely avoided, as far as is practically feasible.
- Restoration (onsite): Measures taken in response to potential residual adverse effects where these effects cannot be completely avoided or reduced.
- Enhancement: A recommendation that aims to promote the likelihood of potential positive environmental or socio-economic residual effects.

[b] Mitigation timeline:

- Immediate: Mitigation measures are expected to be effective immediately in alleviating or reducing potential proposed Project effects on the VC.
- Short term: Mitigation measures may not be effective immediately and require up to 1 year before they function as intended or predicted.
- Medium term: Mitigation measures may not be effective immediately and require up to 10 years before they function as intended or predicted.
- Long term: Mitigation measures may not be effective immediately and require more than 10 years before they function as intended or predicted.

[c] Mitigation effectiveness:

- High effectiveness: The mitigation measure is expected to noticeably reduce or alleviate the effect, or noticeably improve the condition of the VC.
- Moderate effectiveness: The mitigation measure is expected to moderately reduce the effect or moderately improve the condition of the VC.
- Low effectiveness: The mitigation measure may result in little to no change in the effect on a VC, unknown or unproven effects on a VC, or no improvement to the condition of the VC.

Sensitive Timing Windows and Protective Buffers

Potential effects associated with sensory disturbance and increased risk to wildlife mortality can be avoided or reduced by scheduling proposed Project activities within or near occupied wildlife habitats, to the extent practical, outside of the relevant recommended sensitive timing windows for wildlife with potential to occur within the Wildlife and Wildlife Habitat LAA, including species at risk (Table 7.8-4).

The sensitive timing windows will be outlined in the CEMP and will be compiled from various Provincial and Federal guidelines for the applicable bird, mammal, and amphibian species (ECCC n.d.a; B.C. MFLNRO 2014, 2016; B.C. MELP 1998; B.C. MOE 2013b, 2014a, 2014c; B.C. ENV 2022). Recommended sensitive timing windows may vary from year-to-year depending on seasonal weather conditions, Contractor and equipment availability, soil moisture conditions, and other sensitive timing windows associated with fish and fish habitat that may influence construction timing.

The proposed Project is located in the migratory bird Nesting Zone A1, which has a general nesting period from March 26 to August 16 (ECCC 2018), although some migratory and resident bird species may begin nesting in early March (B.C. MFLNRO 2014). Barn owls are not migratory, and although egg-laying can occur at any time of the year that conditions are suitable (for example, during periods of high prey abundance), most egg-laying is recorded from early March to early May, and nestlings are reported from late April to early June (Campbell et al. 1990). Other raptor species with potential to occur in the Wildlife and Wildlife Habitat LAA begin nesting early in the year (for example, bald eagles and great horned owls initiate nesting in January and February) (B.C. MOE 2013b). Great blue herons have potential to begin courtship in mid-January (B.C. MOE 2014c).

The risk of disturbance to nesting birds can vary among nest zones, broad habitat types, and species, but overall, the risk is generally higher for construction activities that involve vegetation clearing; vibration and loud noise; and regular approach by vehicles, machinery, or humans (ECCC n.d.b). When scheduling cannot avoid a sensitive timing window, mitigation measures will be applied to reduce the potential effects of construction activities on sensory disturbance and mortality risk to wildlife, such as preconstruction wildlife habitat searches and the implementation of protective buffers (refer to the proposed mitigation outlined in Table 7.8-6). Species of concern or important wildlife habitat features, such as bird nests and amphibian breeding sites, may be encountered within or adjacent to the proposed Project Footprint during preconstruction wildlife habitat searches. For discoveries made during construction preparation surveys, appropriate mitigation measures will be implemented, as outlined in Table 7.8-6. If the discovery is made incidentally during clearing or construction, contingency measures will be implemented, which will be outlined in the CEMP.

Where appropriate and practical, protective buffers may be applied, depending on factors including the wildlife species and habitat feature, degree of tolerance of the species, life stage of the wildlife species, surrounding conditions and landscape context, timing (such as overlap with peak activity period within a sensitive timing window), and the potential for planned construction activities to cause disturbance. A QP will recommend appropriate mitigation measures in the CEMP considering these factors. The recommended protective buffers are typically area- and situation-specific and can therefore be modified by a QP. The minimum recommended setback distances are 50-m buffers for passerines, 100-m buffers for waterfowl and waterbirds, and 50-m buffers for swallow colonies (B.C. MFLNRO 2014). For raptor species with potential to occur in the Wildlife and Wildlife Habitat LAA, the minimum recommended setback distance is generally 1.5 tree lengths in urban areas, with an additional 100-m “quiet buffer” recommended during the breeding season (B.C. MFLNRO 2014; B.C. MOE 2013b). For great blue heron, the recommended setback distance is 60 m in urban areas, with an additional 200-m “quiet buffer” recommended during the breeding season (B.C. MOE 2014c).

As previously discussed in subsection 7.8.3.3, there is limited suitable habitat for pond-dwelling amphibians within the proposed Project Footprint, with the highest quality habitat being within Tilbury Slough and only invasive green frogs observed during field surveys. No proposed Project activities involving disturbance to riparian or instream habitats with potential to support pond-dwelling amphibians will occur in the existing facility footprint prior to construction of the proposed Project.

7.8.4.2 Characterization of Potential Residual Effects

The characterization of predicted residual effects on the Wildlife and Wildlife Habitat VC follows the methods outlined in subsection 6.6. The resiliency and risk tolerance of species within each subcomponent (that is, species' ability to recover from or adjust easily to change), indicated by conservation status, population trend, and sensitivity to disturbance, provided context that was considered in the determination of magnitude. The magnitude rating also considered relevant conservation, recovery, and land use planning objectives and strategies, as well as previous EAs reviewed and approved under Provincial and Federal environmental regulatory processes, when appropriate. These sources provided useful information on the social values and cultural importance of wildlife species within each subcomponent, which is for the determination of magnitude. A conservative approach was taken for the characterization of potential residual effects, in that each criterion was rated considering the most vulnerable wildlife species within the subcomponents (such as species with low resiliency to change).

Negligible Effects Not Carried Through for Further Assessment

The proposed mitigation measures identified in Table 7.8-6 are expected to reduce or eliminate potential adverse effects of the proposed Project on the Wildlife and Wildlife Habitat VC. As previously stated, the Application has been prepared in accordance with the AIR in which potential effects were identified from waterborne delivery associated with the proposed Project and construction of the MOF. Potential effects to wildlife and wildlife habitat from barge delivery vessels were described previously. However, as described in subsection 1.5.5, as a result of concerns received from engagement activities during the Application Development phase that occurred after the development of the AIR, the proposed Project will no longer utilize any waterborne delivery of modular components and bulk construction materials to the proposed Project Site as an avoidance mitigation measure (subsection 7.8.4.1); therefore, a MOF is not required during construction operation, or decommissioning by the proposed Project.

The following potential effect pathways listed are expected to be avoided through the implementation of proposed mitigation measures, including the proposed mitigation measure to eliminate the use of waterborne deliveries to the proposed Project Site. As a result, the following potential effects do not warrant further detailed assessment:

- Change in wildlife movement
- Loss or alteration of wildlife habitat attributed to the construction operation and decommissioning of the MOF
- Increased mortality risk attributed to the construction operation and decommissioning of the MOF (including use of barges to bring construction modules to site)

Predicted Residual Effects

Given the scope of the proposed Project, the potential residual effects on Wildlife and Wildlife Habitat VC cannot be completely avoided or reduced with the implementation of proposed mitigation measures outlined in Table 7.8-6. Consequently, some residual effects from the proposed Project may remain after the implementation of proposed mitigation measures.

Predicted residual effects on the Wildlife and Wildlife Habitat VC identified in Table 7.8-6 include the following:

- Loss or alteration of wildlife habitat
- Increased wildlife health and mortality risk

Table 7.8-7 provides the characterization of and rationale used to characterize each of the predicted residual effects on the Wildlife and Wildlife Habitat VC during proposed Project construction, operation, and decommissioning activities.

Table 7.8-7. Characterization of Residual Effects on Wildlife and Wildlife Habitat

Predicted Residual Effects	Criteria Rating	Effects Characterization Rationale
Loss or alteration of wildlife habitat	**Context:** There is little to no wildlife habitat within the proposed Project Footprint, as it is located within the existing Tilbury LNG facility, which is a long-standing brownfield site zoned as I7, High Impact Industrial, for uses including natural gas and petroleum products. The available potentially suitable wildlife habitat within the Wildlife and Wildlife Habitat LAA is limited and has been substantially degraded by past and existing disturbances. Disturbance of potentially suitable wildlife habitat within the proposed Project Footprint is limited. The proposed Project Footprint is entirely located within existing anthropogenic disturbances, including infrastructure, gravelled and paved surfaces, and ditches. Wildlife habitat within a ZOI from the proposed Project Footprint may be altered by noise, vibration, light, and activity associated with the proposed Project construction, operation, and decommissioning activities. Sensory disturbance has the potential to temporarily displace resident and migratory birds and other wildlife species using habitat within the Wildlife and Wildlife Habitat LAA.	
	Direction: Adverse	The loss or alteration to wildlife habitat will be a negative residual effect.
	Magnitude: Negligible to Low	The magnitude of the residual adverse effect is expected to be negligible to low given the minor incremental contribution of the proposed Project (entirety of proposed Project Footprint is located within existing anthropogenic disturbances and has limited wildlife habitat value) and with the implementation of mitigation measures. The magnitude is considered negligible for most wildlife species; however, the resilience of species at risk is lower and a precautionary rating of low is therefore used to capture potential residual effects to species at risk (such as barn owl).
	Spatial boundary: Wildlife and Wildlife Habitat LAA	Direct habitat loss or alteration will be limited to a small portion of the proposed Project Footprint. Reduced habitat effectiveness will potentially extend to a ZOI within the Wildlife and Wildlife Habitat LAA.
	Timing: Year round	Effects of habitat alteration are year round; different species will experience residual effects in different ways, depending on the season and life stage.
	Duration: Long term	The residual effects on loss of wildlife habitat within the proposed Project Footprint will be long term until the proposed Project is decommissioned. Sensory disturbance effects on habitat effectiveness are expected to be highest during the construction phase of the proposed Project, but the overall residual effect will be long term over the operation and decommissioning phases.

Table 7.8-7. Characterization of Residual Effects on Wildlife and Wildlife Habitat

Predicted Residual Effects	Criteria Rating	Effects Characterization Rationale
Loss or alteration of wildlife habitat (continued)	**Frequency:** Continuous	The residual effect will be continuous.
	Reversibility: Reversible	The residual effect is reversible at the end of the proposed Project life, after decommissioning and abandonment (including removal of infrastructure).
	Likelihood: High	The residual effect will occur if the proposed Project proceeds.
	Importance: High	Loss or alteration of wildlife habitat has been identified repeatedly as a top interest or priority by Indigenous nations and government agencies during ongoing engagement for the proposed Project.
	Confidence: High	The effect characterization is based on good understanding of cause-effect relationships, the known effectiveness of mitigation measures, and data pertinent to the proposed Project Area.
Increased wildlife health and mortality risk	**Context:** The proposed Project has potential to increase wildlife health and mortality risk during construction, operation, and decommissioning. Implementation of proposed mitigation measures is expected to reduce some health and mortality risk effect pathways or reduce any potential effects to negligible levels. Although implementation of mitigation measures will reduce the remaining residual effects associated with wildlife health and mortality risk, there is no way to predict if or when an interaction may occur given the nature of wildlife. As such, residual effects on wildlife health and mortality risk may be associated with vehicle strikes from proposed Project construction and decommissioning truck traffic, sensory disturbance of occupied habitats, and wildlife collisions with proposed Project infrastructure.	
	Direction: Adverse	The increased wildlife health and mortality risk will be a negative residual effect.
	Magnitude: Negligible to Low	Given the scope of the proposed Project and with the implementation of proposed mitigation measures, the magnitude of the residual effect is expected to be negligible to low. The magnitude is negligible for most wildlife species; however, the resilience of species at risk is lower and a precautionary rating of low is therefore used to capture potential residual effects to species at risk (such as barn owl).
	Spatial boundary: Wildlife and Wildlife Habitat LAA	Increased wildlife health and mortality risk will be limited mainly to the proposed Project Footprint. However, there is potential for wildlife health and mortality risk effects to occur as a result of proposed Project vehicle traffic, which may extend to the existing roads within the Wildlife and Wildlife Habitat LAA.
	Timing: Year round	Effects to wildlife health and mortality risk are year-round but may be higher at certain times of the year (such as during the migratory bird nesting or amphibian breeding season).

Table 7.8-7. Characterization of Residual Effects on Wildlife and Wildlife Habitat

Predicted Residual Effects	Criteria Rating	Effects Characterization Rationale
Increased wildlife health and mortality risk (continued)	**Duration:** Long Term	The residual effect to wildlife mortality risk from sensory disturbance will be highest during construction and decommissioning but will extend throughout all proposed Project phases (long term). Residual effects attributed to potential vehicle strikes will only occur during construction and decommissioning. Residual effects to increased wildlife health and mortality risk attributed to wildlife collisions with proposed Project infrastructure will occur over the life of the proposed Project (long term).
	Frequency: Infrequent	The residual effect will occur infrequently.
	Reversibility: Reversible	The residual effect is reversible at the end of the proposed Project life, after decommissioning and abandonment (including removal of infrastructure). Given the negligible to low magnitude and infrequent nature of the residual effect, the proposed Project is not predicted to alter the viability or sustainability of any local wildlife populations (including species at risk); therefore, there are no permanent effects predicted as a result of wildlife health and mortality risk from the proposed Project.
	Likelihood: Medium	The residual effect may occur.
	Importance: High	Increased wildlife health and mortality risk has been identified repeatedly as a top interest or priority by Indigenous nations and government agencies during ongoing engagement for the proposed Project.
	Confidence: High	The effect characterization is based on good understanding of cause-effect relationships and data pertinent to the proposed Project Area.

Loss or Alteration of Wildlife Habitat

Residual effects of loss or alteration of wildlife habitat are predicted from all phases of the proposed Project. The residual effects are predicted to be negligible to low magnitude, long term, continuous, and reversible.

The proposed Project Footprint is entirely located within existing anthropogenic disturbances that have limited wildlife habitat value. With removal of the MOF and barge deliveries, the proposed Project avoids direct effects to the riparian and intertidal areas of the Fraser River. The quality of habitat being affected is low due to previous disturbances within the proposed Project Footprint and surrounding Wildlife and Wildlife Habitat LAA. Sensory disturbance caused by the construction, operation, and decommissioning of the proposed Project will be a minor incremental change to existing conditions. Species currently using the fragmented, disturbed habitat within the proposed Project Footprint and Wildlife and Wildlife Habitat LAA are expected to be resilient to human disturbances and have some level of habituation given the existing urban and industrial disturbances. With implementation of the proposed mitigation measures outlined in Table 7.8-6, the magnitude of the residual adverse effect of the proposed Project on wildlife habitat is expected to be negligible to low. Although the magnitude of residual effects of habitat loss or alteration are expected to be negligible for the majority of wildlife species occurring in the LAA, the

resiliency of species at risk is lower; therefore, a precautionary magnitude rating of low is used to capture potential residual effects to species at risk.

The residual effects of habitat alteration are year round, as different wildlife species will experience effects in different ways depending on the season and life stage. Migratory and resident birds are particularly sensitive to habitat disturbance during the nesting season. Birds may also experience effects of habitat disturbance during migratory and overwintering periods; however, no important migratory bird stopover or overwintering sites have been identified in the LAA. Although most migratory birds in Nesting Zone A1 are nesting between March 26 to August 16 (ECCC n.d.a), there is variation in nesting windows for birds. Barn owls can nest year round when conditions are suitable (for example, during periods of high prey abundance), and other raptor species begin nesting early in the year (for example, bald eagles and great horned owls initiate nesting in January and February).

Sensory disturbance effects on habitat effectiveness are expected to be highest during the construction and decommissioning phase of the proposed Project (short term), but sensory disturbance will also occur over the operation phase of the proposed Project (long term). Increased noise and vibration levels during construction and decommissioning of the proposed Project will be temporary and infrequent, as they are activity dependent. Increased additional artificial lighting during construction and decommissioning will be continuous. Operation will result in an incremental increase in noise, vibration, and light compared to existing conditions; however, this increase is considered minimal compared to the existing conditions, as the proposed Project is located within an existing active LNG facility and adjacent industrial area within the LAA. Wildlife utilizing the Wildlife and Wildlife Habitat LAA would be adapted to noise, vibration, and light from urban and industrial environments; as such, the predicted change in sensory disturbance during proposed Project construction compared to existing levels is not anticipated to have long-term effects on wildlife.

Overall, the proposed Project is not expected to substantially change availability or effectiveness of habitat for wildlife, including species at risk and culturally important species, with potential to occur in the Wildlife and Wildlife Habitat LAA. Proposed Project design and siting to maximize use of existing disturbances will avoid new clearing and habitat fragmentation. Furthermore, the proposed mitigation measures outlined in Table 7.8-6 include measures to avoid or reduce the potential residual effect of loss or alteration of wildlife habitat.

Increased Wildlife Health and Mortality Risk

Residual effects to wildlife health and mortality risk may result from the construction, operation, and decommissioning of the proposed Project, attributed to vehicle strikes, sensory disturbance, and wildlife collisions with proposed Project infrastructure. To reflect the range of feasible outcomes of wildlife collisions with proposed Project infrastructure or vehicle strikes, as described previously, if this unlikely event were to occur, only minor injuries to an individual could occur or mortality could occur. With consideration of existing risk in an industrial area and with the implementation of proposed mitigation measures outlined in Table 7.8-6, the incremental increase in wildlife health and mortality risk due to the proposed Project is predicted to be negligible to low magnitude, long term, infrequent, and reversible. Although the magnitude of residual effect of habitat loss or alteration is expected to be negligible for the majority of wildlife species occurring in the LAA, the resiliency of species at risk is lower; therefore, a precautionary magnitude rating of low is used to capture potential residual effects to species at risk.

The predicted residual effects of increased wildlife health and mortality risk from sensory disturbance are year round and may occur intermittently, although they may be higher at certain times of the year. Residual effects may occur if proposed Project activities occur during sensitive life stages or near occupied habitats for wildlife. Effects to mortality risk from sensory disturbance of occupied habitats will vary, as

different species will experience sensory disturbance effects in different ways depending on the season and life stage. For example, increased mortality risk to birds from sensory disturbance will be greatest during the nesting period, when birds are most vulnerable. However, the increased mortality risk to nearby wildlife as a result of sensory disturbance is anticipated to be incremental, with short-term and infrequent peaks in intensity, due to the siting of the proposed Project within an area of existing industrial disturbances.

The risk of bird mortality can be reduced by scheduling vegetation disturbance activities outside of the nesting period (ECCC n.d.a, 2021). Although most migratory birds in Nesting Zone A1 are nesting between March 26 and August 16 (ECCC n.d.a), there is variation in nesting windows for birds. Barn owls are not migratory, and although egg-laying can occur at any time of the year when conditions are suitable (for example, during periods of high prey abundance), most egg-laying is recorded from early March to early May, and nestlings are reported from late April to early June (Campbell et al. 1990). Other raptor species begin nesting early in the year (for example, bald eagles and great horned owls initiate nesting in January and February) (B.C. MOE 2013b). The incremental risk of migratory bird collisions with proposed Project infrastructure is low, as there will be no tall structures and no reflective surfaces. The risk will be greatest during peak migration periods, which will vary by species and seasonal conditions (generally spring and fall). Poor weather events may increase risks of bird collisions with infrastructure when visibility is low.

The predicted residual effects to wildlife health and mortality risks from vehicle strikes from proposed Project traffic will be year round, as there is no way to predict if or when the interaction may occur. The risk of vehicle strikes increases when traffic volumes are highest, which is associated with groundworks and peak workforce over the construction and decommissioning phases. Wildlife vehicle strikes are predicted to occur rarely or infrequently. While proposed mitigation measures are expected to reduce the potential for vehicle strikes to rare occurrences, there remains potential for wildlife mortality risk, particularly during seasons or times of the day when wildlife is moving or when visibility is lower (for example, during dawn and dusk, foggy conditions, and migratory periods).

Overall, the proposed Project is not expected to substantially increase wildlife health or mortality risk for wildlife with potential to occur in the Wildlife and Wildlife Habitat LAA, including species at risk and culturally important species. The proposed mitigation measures outlined in Table 7.8-6 includes measures to avoid or reduce potential residual effects to wildlife health and mortality. Implementation of proposed mitigation measures to avoid or reduce potential incremental effects of the proposed Project and the residual effect on wildlife health and mortality risk is unlikely to affect wildlife populations such that stated management or conservation objectives may not be attainable. There are no residual effects that are anticipated to result in potential population-level effects or a potential effect to the overall biodiversity of wildlife within the Wildlife and Wildlife Habitat LAA.

7.8.5 Cumulative Effects

At a regional scale, wildlife and wildlife habitat will potentially be affected by future changes resulted from natural physical processes in the Fraser River and Tilbury Slough, natural hazards (such as flooding), climate change factors, land use, socio-economic factors, and other future projects or activities. These factors may interact and influence each other, resulting in uncertainty for predicting future conditions without the proposed Project in the RAA. However, it is expected that short-term changes (prior to proposed Project construction) in natural physical processes (such as water depth, current, and wave height) that influence the Fraser River and Tilbury Slough are likely to be minor. Long-term effects of climate change are discussed in subsection 7.8.5.3. Socio-economic factors and land use that may influence future conditions regionally are discussed in subsections 7.10 (Employment and Economy), 7.11 (Land and Resource Use), and 7.12 (Infrastructure and Services). Given the uncertainty in predicting changes in natural physical processes, natural hazards, climate change factors, land use, socio-economic

factors, and other projects or activities, future conditions at the time of proposed Project construction scheduled to start in 2025 (that is, future conditions without the proposed Project) are assumed to be the same as existing conditions (refer to subsection 7.8.3). As such, the assessment of predicted cumulative effects on the Wildlife and Wildlife Habitat VC qualitatively considers incremental potential effects of natural hazards, climate change factors, and other projects or activities to the extent of available information.

Past and present developments and activities, including climate change, that have influenced the existing conditions within the Wildlife and Wildlife Habitat RAA are described in subsections 7.8.3.2 and 7.8.3.3. Table 7.8-8 lists the reasonably foreseeable projects and activities whose effects might act cumulatively with the proposed Project residual effects within the Wildlife and Wildlife Habitat RAA.

7.8.5.1 Spatial and Temporal Boundaries

As described in subsection 7.8.2.1, the spatial boundary for the Wildlife and Wildlife Habitat VC CEA is the Wildlife and Wildlife Habitat RAA, which encompasses the proposed Project Footprint and the Wildlife and Wildlife Habitat LAA, where there is potential for the proposed Project residual effects to overlap and interact with other projects and activities to result in cumulative effects.

The temporal boundary for the Wildlife and Wildlife Habitat VC CEA includes the construction, operation, and decommissioning phases of the proposed Project (subsection 7.8.2.2), which is the time frame that effects from reasonably foreseeable projects and activities in Wildlife and Wildlife Habitat RAA have potential to overlap and interact with the proposed Project residual effects to result in cumulative effects.

7.8.5.2 Potential Interactions with Other Projects

The effects of past and present projects and activities within the Wildlife and Wildlife Habitat RAA are captured in the description of existing conditions (subsections 7.8.3.2 and 7.8.3.3). Table 7.8-8 provides a list of reasonably foreseeable projects and activities with potential residual effects that may interact and overlap with residual effects of the proposed Project, resulting in cumulative effects on the Wildlife and Wildlife Habitat VC.

Table 7.8-8. Reasonably Foreseeable Projects and Activities and Potential Adverse Cumulative Interactions with Proposed Project Residual Effects on the Wildlife and Wildlife Habitat Valued Component

Proposed Project Name or Activity	Spatial Proximity	Temporal Overlap	Potential Incremental Effect	VC Interactions	Project Certainty	Assumptions/Uncertainties
Tilbury Phase 1 LNG Expansion project	Footprint overlaps the proposed Project	All phases	▪ Incremental loss or alteration of wildlife habitat ▪ Incremental risk to wildlife health and mortality	All phases of the Tilbury Phase 1 LNG Expansion project are likely to result in effects that overlap and interact with residual effects of the proposed Project and other existing, ongoing, and future disturbances are likely to have a combined effect on the loss or alteration of wildlife habitat, as well as wildlife health and mortality risk within the Wildlife and Wildlife Habitat RAA. The EOA for the Tilbury Phase 1 LNG Expansion project concluded low risks of the project on wildlife, as the potential effects are likely within environmental and regulatory standards, can be managed using industry mitigation measures, and the regulatory process for approvals is predictable (Jacobs 2020).	High	▪ The Tilbury Phase 1 LNG Expansion project is approved and constructed. Phase 1 construction and operation phases will overlap with the proposed Project residual effects to result in a cumulative interaction with the Wildlife and Wildlife Habitat VC. ▪ It is assumed the Tilbury Phase 1 LNG Expansion project will have effects on wildlife associated with sensory disturbance and temporary displacement, loss or alteration of habitat, and risk to wildlife health and mortality. ▪ It is assumed effects from construction and operation phases of the Tilbury Phase 1 LNG Expansion project would overlap with the proposed Project residual effects and have a cumulative interaction causing sensory disturbance. ▪ It is assumed the Tilbury Phase 1 LNG Expansion project will implement standard best practices and mitigation measures to reduce its contribution to cumulative effects.

Table 7.8-8. Reasonably Foreseeable Projects and Activities and Potential Adverse Cumulative Interactions with Proposed Project Residual Effects on the Wildlife and Wildlife Habitat Valued Component

Proposed Project Name or Activity	Spatial Proximity	Temporal Overlap	Potential Incremental Effect	VC Interactions	Project Certainty	Assumptions/Uncertainties
TMJ project	Footprint overlaps the proposed Project	All phases	▪ Incremental loss or alteration of wildlife habitat ▪ Incremental risk to wildlife health and mortality	All phases of the TMJ project are likely to result in effects that interact with the proposed Project residual effects and other existing, ongoing, and future effects to have a combined effect on the loss or alteration of wildlife habitat, and wildlife health and mortality risk within the Wildlife and Wildlife Habitat RAA.	High	▪ The TMJ project has been approved. It is assumed that it will be constructed and that the effects from construction or operation phases, or both, will overlap with the proposed Project residual effects to result in a cumulative interaction with the Wildlife and Wildlife Habitat VC. ▪ It is assumed the TMJ project would have negligible to low residual effects to wildlife associated with sensory disturbance and temporary displacement, loss or alteration of habitat, and risk to wildlife health and mortality. ▪ It is assumed effects from construction and operation phases of the TMJ project would overlap with the proposed Project residual effects and have a cumulative interaction causing sensory disturbance. ▪ It is assumed the TMJ project will implement standard best practices and mitigation to reduce its contribution to cumulative effects.
Natural hazards (such as flooding)	N/A	All phases	▪ Incremental loss or alteration of wildlife habitat ▪ Incremental risk to wildlife health and mortality	All phases of the proposed Project have the potential to interact with natural hazards (such as flooding). Natural hazards have the potential to temporarily displace wildlife, incrementally affect wildlife habitat, and cause risk to wildlife health and mortality.	Low	It is assumed that natural hazards (such as flooding) will interact with the Wildlife and Wildlife Habitat VC for the proposed Project during one or more instances of any phase of the proposed Project.

Table 7.8-8. Reasonably Foreseeable Projects and Activities and Potential Adverse Cumulative Interactions with Proposed Project Residual Effects on the Wildlife and Wildlife Habitat Valued Component

Proposed Project Name or Activity	Spatial Proximity	Temporal Overlap	Potential Incremental Effect	VC Interactions	Project Certainty	Assumptions/Uncertainties
Climate change	N/A	All phases	▪ Incremental loss or alteration of wildlife habitat ▪ Incremental risk to wildlife health and mortality	All phases of the proposed Project residual effects will interact with climate change. Refer to subsection 7.8.5.3 for a summary of the potential interactions with climate change.	High	Although the certainty of the proposed Project residual effects interacting with climate change is high, there is a high level of uncertainty as to how climate change will incrementally affect the Wildlife and Wildlife Habitat VC.

7.8.5.3 Potential Influences of Climate Change on Future Conditions

In addition to the potential cumulative interactions with existing activities and the reasonably foreseeable projects and activities described previously, climate change is another factor that is expected to contribute to cumulative effects on Wildlife and Wildlife Habitat VC. Climate change has the potential to affect the suitability of habitat for wildlife and resiliency of wildlife populations to current and reasonably foreseeable stressors. Potential effects on the future conditions of Wildlife and Wildlife Habitat VC resulting from climate change are considered in the CEA in this Application. The CCRA described in Appendix G of the Application and in Section 8 (Climate Change and Greenhouse Gas Emissions) outlines climate change parameters that are anticipated to act cumulatively with the proposed Project residual effects. This CCRA follows a Public Infrastructure Engineering Vulnerability Committee risk assessment framework and provides local and regional climate projections and rationale for climate model chosen. The extent to which climate change has influenced the existing conditions for the Wildlife and Wildlife Habitat VC and will continue to affect the VC over the next 10 to 20 years is not fully understood. However, it is assumed that existing conditions within the Wildlife and Wildlife Habitat RAA (as described in subsection 7.8.3.3) have been influenced by the effects of climate change and that the predicted future changes in climatic event parameters (Appendix G of the Application) due to climate change will interact with Wildlife and Wildlife Habitat VC.

Key climatic event parameters that are predicted to interact with the Wildlife and Wildlife Habitat VC in the future include greater frequency of extreme weather events, such as flood and drought; higher average temperatures; rising water temperatures and sea levels; coastal flooding; and insect infestations. These factors may lead to decreases in wildlife habitat suitability, increased stresses on wildlife individuals and populations, and potential implications to the resiliency of wildlife to cumulative disturbances.

For example, increased rainfall events or flooding can alter the hydrodynamics of riparian and wetland habitats, which could affect the suitability of the habitats for wildlife and increase mortality risk for wildlife, especially during critical life stages when species are most sensitive to disturbances. Flooding over lowland areas of the Lower Mainland also has potential to reduce the amount of available foraging habitat for some bird species, such as barn owl (B.C. MOE 2014d). Increased precipitation during winter has demonstrated a decrease in vole activity, a main prey food source for owls (Bäumler 1975; Lehmann and Sommersberg 1980). Increased storm events may lead to increased risk of birds colliding with proposed Project infrastructure due to decreased visibility and increased winds (Riding et al. 2021; Van Doren et al. 2017, 2021). Summer droughts may lead to less water availability and potentially a reduction in the amount of available habitat for wildlife in aquatic environments.

Rapid changes in seasonal activity in one species can have consequences on interacting species, within and among trophic levels. Many bird species are advancing their breeding initiation dates in response to a warming climate, which can have both positive and negative reproductive consequences (Dunn et al. 2011; Bourret et al. 2015). Unfortunately, some species may not have sufficiently advanced their breeding initiation dates to stay synchronized with the occurrence of peak food availability. This can lead species, especially long-distance migrants, to become mismatched with their food sources, resulting in decreases in fecundity and subsequently abundance (Møller et al. 2008).

Climate-driven loss of intertidal habitat could cause increased resource pressure within the Wildlife and Wildlife Habitat RAA for displaced birds. The Fraser River estuary is a productive transition zone of freshwater and saltwater and includes large mud and sandflats with abundant prey; thus, it is a critical stopover for shorebird species (Butler et al. 2001; Harrington et al. 2002). Food supply on migration is essential for shorebird survival and reproductive success (Butler et al. 2001). For instance, the size and timing of the Fraser River freshet could be affected by earlier snowmelt caused by higher mean air temperatures decreasing winter snowpack (Shrestha et al. 2012). The influence of climate change on the

spring freshet could have adverse effects on migratory bird food quantity and quality. If the advancement of freshet results in greater water discharge rates within the Fraser River during the migration period, then additional declines in shorebird numbers could occur (Canham et al. 2021).

The warming climate weakens natural controls on insect pest populations while also accelerating their rates of growth and reproduction (Fraser Basin Council n.d.a; Diamond Head Consulting Ltd. 2016). This allows pests to spread much farther and faster and to make their way into new ecosystems and attack new species. Wildlife species' resiliency to withstand these projected shifts is dependent on coevolutionary relationships and the adaptive capacity of each species (Muths et al. 2020). In response to climate change, the breeding range of land birds that breed in southern Canada moved northward by an average of 2.4 km per year from 1964 to 2002; this includes Swainson's thrush, which has extended its range 141 km northward over this period (Hitch and Leberg 2007). The Fraser River estuary, where the Wildlife and Wildlife Habitat RAA is located, is home to many species at the northern edge of their ranges (Raincoast Conservation Foundation 2021). These "edge populations" may be well-equipped for northward range shifts of species caused by warming climates (Hargreaves and Eckert 2019). Edge populations are valued for their colonization potential to help species cope with environmental change, as species are generally thought to spread along environmental gradients (Kehoe et al. 2020). For instance, studies on North American mammals have demonstrated greater resiliency of individuals on the edges of species' historical ranges (Lomolino and Channell 1995, 1998; Channell and Lomolino 2000). Additionally, northern edge populations account for the most genetic diversity across a species' range (Gibson et al. 2009).

7.8.5.4 Characterization of Cumulative Effects

The predicted adverse residual effects of the proposed Project on the Wildlife and Wildlife Habitat VC (subsection 7.8.4.2) will potentially interact with reasonably foreseeable projects and activities, as well as climate change, to have the following cumulative effects within the Wildlife and Wildlife Habitat RAA:

- Cumulative loss or alteration of wildlife habitat
- Cumulative risk to wildlife health and mortality

Table 7.8-9 provides the cumulative effect characterization for each cumulative effect using the criteria defined in subsection 6.7. The proposed Project is predicted to have a limited incremental contribution to cumulative effects on wildlife and wildlife habitat in the Wildlife and Wildlife Habitat RAA, and the cumulative effects will persist at the same level of magnitude with or without the proposed Project.

Table 7.8-9. Predicted Cumulative Effects on Wildlife and Wildlife Habitat

Predicted Cumulative Effects	Criteria Rating	Effects Characterization Rationale
Cumulative loss or alteration of wildlife habitat	**Context:** The Wildlife and Wildlife Habitat RAA is located in a highly industrialized area within a larger urban landscape. Cumulative loss and alteration of wildlife habitat from past and existing projects and activities is extensive and expected to persist with or without the proposed Project. Climate change is likely to have various effects that will contribute to ongoing cumulative effects on wildlife habitat in the Wildlife and Wildlife Habitat RAA.	

Table 7.8-9. Predicted Cumulative Effects on Wildlife and Wildlife Habitat

Predicted Cumulative Effects	Criteria Rating	Effects Characterization Rationale
Cumulative loss or alteration of wildlife habitat (continued)	**Magnitude:** High	The extent of existing habitat disturbance in the RAA indicates a high-magnitude cumulative effect, which is likely to be exacerbated by climate change. Incremental effects from the proposed Project and reasonably foreseeable projects are unlikely to measurably alter the magnitude of the existing cumulative effect. Given the magnitude of the proposed Project's residual effects and the overlap with residual effects from reasonably foreseeable projects, its incremental contribution to the overall cumulative effects on wildlife habitat in the Wildlife and Wildlife Habitat RAA are negligible (for nonlisted species) to low (for species at risk) and will be effectively managed with the proposed mitigation measures.
	Spatial boundary: Wildlife and Wildlife Habitat RAA	Residual effects from the proposed Project will overlap and interact with the effects from reasonably foreseeable projects and activities projects, as well as climate change, within the Wildlife and Wildlife Habitat RAA to have a cumulative effect on wildlife habitat.
	Timing: Year round	Residual effects from the proposed Project, reasonably foreseeable projects and activities, and climate change may interact resulting in cumulative effects throughout the year.
	Duration: Extended term	Cumulative effects are expected to persist, with or without the proposed Project, beyond the decommissioning phase of the proposed Project.
	Frequency: Continuous	Residual effects from the proposed Project and reasonably foreseeable projects and activities may overlap and interact continuously (along with climate change).
	Reversibility: Irreversible	Given the setting of the Wildlife and Wildlife Habitat RAA in a heavily industrialized area within an urban area, cumulative effects are expected to persist for the foreseeable future.
	Likelihood: High	The cumulative effect will continue to persist, with or without the proposed Project.
	Importance: High	Cumulative effects on wildlife habitat have been identified repeatedly as a top interest or priority by Indigenous nations and government agencies during ongoing engagement for the proposed Project.
	Confidence: Low to Moderate	A range in confidence has been presented to account for the uncertainties around future effects of climate change. The interactions of existing, reasonably foreseeable, and proposed Project effects causing cumulative effects on wildlife habitat are based on a good understanding of cause-effect relationships and information relevant to the Wildlife and Wildlife Habitat RAA, which allows for moderate confidence in the cumulative effect characterization. However, a precautionary rating of low is used to capture the limited available knowledge related to cumulative interactions with climate change effects.

Table 7.8-9. Predicted Cumulative Effects on Wildlife and Wildlife Habitat

Predicted Cumulative Effects	Criteria Rating	Effects Characterization Rationale
Cumulative risk to wildlife health and mortality	**Context:** The Wildlife and Wildlife Habitat RAA is located in a highly industrialized area within a larger landscape. Cumulative risks to wildlife health and mortality from past and existing projects and activities is extensive and expected to persist with or without the proposed Project. Climate change is likely to have various effects that will contribute to ongoing cumulative effects on health and mortality risk for wildlife in the Wildlife and Wildlife Habitat RAA. Given the magnitude of the proposed Project's residual effects, its incremental contribution to the overall cumulative effects on health and mortality risk for wildlife in the Wildlife and Wildlife Habitat RAA are minor and will effectively be managed with proposed mitigation measures.	
	Magnitude: High	The existing extensive cumulative risk to wildlife health and mortality in the Wildlife and Wildlife Habitat RAA indicates a high-magnitude cumulative effect, which is likely exacerbated by climate change. Incremental cumulative effects from the proposed Project and reasonably foreseeable projects are considered negligible, as they are unlikely to measurably alter the magnitude of the existing cumulative effect.
	Spatial boundary: Wildlife and Wildlife Habitat RAA	Residual effects from the proposed Project may overlap and interact with effects from other projects and activities within the Wildlife and Wildlife Habitat RAA to have a cumulative effect on risk to wildlife health and mortality.
	Timing: Year round	Residual effects from the proposed Project, reasonably foreseeable projects and activities, and climate change may interact to have cumulative effects throughout the year.
	Duration: Extended term	Cumulative effects are expected to persist, with or without the proposed Project, beyond the decommissioning phase of the proposed Project.
	Frequency: Continuous	Incremental residual effects from the proposed Project on risks to wildlife health and mortality are expected to occur rarely to infrequently; however, cumulative effects are expected to occur continuously due to past, existing, and reasonably foreseeable projects and activities (and climate change).
	Reversibility: Irreversible	Given the setting of the Wildlife and Wildlife Habitat RAA in a heavily industrialized area within an urban area, cumulative effects are expected to persist for the foreseeable future.
	Likelihood: High	The cumulative effect will continue to persist with or without the proposed Project.
	Importance: High	Cumulative effects on risk to wildlife health and mortality risk has been identified repeatedly as a top interest or priority by Indigenous nations and government agencies during ongoing engagement for the proposed Project.

Table 7.8-9. Predicted Cumulative Effects on Wildlife and Wildlife Habitat

Predicted Cumulative Effects	Criteria Rating	Effects Characterization Rationale
Cumulative risk to wildlife health and mortality (continued)	**Confidence:** Low to Moderate	A range in confidence has been presented to account for the uncertainties around future effects of climate change. The overlap and interactions of existing, reasonably foreseeable, and proposed Project residual effects resulting in cumulative effects risk to wildlife health and mortality are based on a good understanding of cause-effect relationships and information relevant to the Wildlife and Wildlife Habitat RAA, which allows for moderate confidence in the cumulative effect characterization. However, a precautionary rating of low is used to capture the limited available knowledge related to cumulative interactions with climate change effects.

7.8.6 Summary

Table 7.8-10 summarizes the predicted adverse residual effects and cumulative effects on Wildlife and Wildlife Habitat from the proposed Project, as well as their characterization criteria.

Table 7.8-10. Summary of Predicted Adverse Residual Effects and Cumulative Effects on Wildlife and Wildlife Habitat

Predicted Residual Effects	Residual Effects Characterization	Cumulative Effects Characterization
Loss or alteration of wildlife habitat	**Magnitude:** Negligible to low **Spatial boundary:** Wildlife and Wildlife Habitat LAA **Timing:** Year round **Duration:** Medium to extended term **Frequency:** Continuous **Reversibility:** Reversible **Likelihood:** High **Importance:** High **Confidence:** High	**Magnitude:** High **Spatial boundary:** Wildlife and Wildlife Habitat RAA **Timing:** Year round **Duration:** Extended term **Frequency:** Continuous **Reversibility:** Irreversible **Likelihood:** High **Importance:** High **Confidence:** Low to moderate
Increased wildlife health and mortality risk	**Magnitude:** Negligible to low **Spatial boundary:** Wildlife and Wildlife Habitat LAA **Timing:** Year round **Duration:** Long term **Frequency:** Infrequent **Reversibility:** Reversible **Likelihood:** Medium **Importance:** High **Confidence:** High	**Magnitude:** High **Spatial boundary:** Wildlife and Wildlife Habitat RAA **Timing:** Year round **Duration:** Extended term **Frequency:** Continuous **Reversibility:** Irreversible **Likelihood:** High **Importance:** High **Confidence:** Low to moderate

7.8.7 Follow-up Strategy

Detailed mitigation and monitoring will be developed by FortisBC in the CEMP prior to construction, through engagement with applicable regulators and Indigenous nations. Monitoring will occur during construction to determine that the mitigation measures (as described in subsection 7.8.4.1) are effective at reducing predicted residual effects. If a mitigation measure is found to be ineffective at reducing potential effects, corrective measures will be taken through adaptive management, as specified in management plans, as applicable, through engagement with applicable regulators and Indigenous nations.

7.8.8 References

Antoniuk, T. and B. Ainsle. 2003. "Appendix I: Cumulative Effects: Sources, Indicators, and Thresholds." *Volume 2, Cumulative Effects Indicators, Thresholds, and Case Studies*. Cumulative Effects Assessment and Management for Northeast British Columbia. Prepared by Salmo Consulting Inc. for the Oil and Gas Science Commission Science and Community Knowledge Fund and Muskwa – Kechika.

Arlettaz, R., G. Jones, and P. A. Racey. 2001. "Effect of Acoustic Clutter on Prey Detection by Bats." *Nature*. Vol. 414, No. 6865. pp. 742–745.

Baker, A. J., P. M. Gonzalez, T. Piersma, L. J. Niles, I. de Lima Serrano do Nascimento, P. Atkinson, N. A. Clark, C. D. T. Minton, M. Peck, and G. Aarts. 2004. "Rapid population decline in red knots: fitness consequences of decreased refuelling rates and late arrival in Delaware Bay." *Proceedings: Biological Sciences*. Vol. 271. pp. 875–882.

Barber, J. R., K. M. Fristrup, C. L. Brown, A. R. Hardy, L. M. Angeloni, and K. R. Crooks. 2009. "Conserving the Wildlife Therein—Protecting Park Fauna from Anthropogenic Noise." *Park Science*. Vol. 26, No. 3. pp. 26–31.

Bäumler, W. 1975. "Activity of Some Small Mammals in the Field." *Acta Theriologica*. Vol. 20. pp. 365–379.

Bayne, E. M., L. Habib, and S. Boutin. 2008. "Impacts of Chronic Anthropogenic Noise from Energy-Sector Activity on Abundance of Songbirds in the Boreal Forest." *Conservation Biology*. Vol. 22, No. 5. pp. 1186–1193.

BC Parks. n.d. *BC Parks, Ecological Reserves, and Protected Areas*. Accessed February 2022. https://catalogue.data.gov.bc.ca/dataset/bc-parks-ecological-reserves-and-protected-areas.

Beasley, V. R. 2020. "Direct and Indirect Effects of Environmental Contaminants on Amphibians." *Reference Module in Earth Systems and Environmental Sciences*.

Beebee, T. J. C. 1985. "Salt tolerances of natterjack toad *(Bufo calamita)* eggs and larvae from coastal and inland populations in Britain." *Herpetological Journal*. Vol. 1. pp. 14–16.

Bird Studies Canada and Nature Canada. n.d. *Important Bird Areas Canada* [map]. Accessed February 2022. https://www.ibacanada.com/mapviewer.jsp?lang=EN.

Bird Studies Canada. n.d. *Atlas of the Breeding Birds of British Columbia*. Accessed February 2022. https://www.birdatlas.bc.ca/.

Bird, B. L., L. C. Branch, and D. L. Miller. 2004. "Effects of Coastal Lighting on Foraging Behaviour of Beach Mice." *Conservation Biology*. Vol. 18, No. 5. pp. 1435–1439.

Blaustein, A., J. Romansic, J. Kiesecker, and A. Hatch. 2003. "Ultraviolet radiation, toxic chemicals and amphibian population declines." *Diversity and Distributions*. Vol. 9. pp. 123–140.

Blums, P., J. D. Nichols, J. E. Hines, M. S. Lindberg, and A. Mednis. 2005. "Individual quality, survival variation and patterns of phenotypic selection on body condition and timing of nesting in birds." *Oecologia*. Vol. 143, No. 3. pp. 365–376.

Botsch, Y., Z. Tablado, and L. Jenni. 2017. "Experimental evidence of human recreational disturbance effects on bird-territory establishment." *Proceedings of the Royal Society B*. Vol. 284, No. 1858. July. p. 20170846.

Boundary Bay Conservation Committee. 2016. *Save the Fraser River Delta from Mega Projects*. April 22. https://www.againstportexpansion.org/uploads/images/file_view/Fraser_River_Estuary_and_Mega_Projects_April_22_2016_A.pdf.

Bourji, A., M. Choroszy, and P. Prather. 2016. "Design and Implement a Totally Enclosed Ground Flare." *Hydrocarbon Processing*. Gulf Publishing Co. March. https://go.gale.com/ps/i.do?p=AONE&u=googlescholar&id=GALE|A448317008&v=2.1&it=r&sid=googleScholar&asid=30be893b.

Bourret, A., M. Bélisle, F. Pelletier, and D. Garant. 2015. "Multidimensional environmental influences on timing of breeding in a tree swallow population facing climate change." *Evolutionary Applications*. Vol. 8, No. 10. pp. 933–944.

Boyle, C. A., L. Lackulich, H. Schreier, and E. Kiss. 1997. "Changes in Land Cover and Subsequent Effects on Lower Fraser Basin Ecosystems from 1827 to 1990." *Environmental Management*. Vol. 21, No. 2. pp. 185–196.

British Columbia Environmental Assessment Office (B.C. EAO). 2017a. "Appendix D.1 – Cowichan Tribes." Decision Materials for the Trans Mountain Pipeline ULC's Application for an Environmental Assessment Certificate for Trans Mountain Expansion Project. https://www.projects.eao.gov.bc.ca/api/public/document/5892318ab637cc02bea16464/download/Appendix%20D.1%20%3F%20Cowichan%20Tribes.pdf.

British Columbia Environmental Assessment Office (B.C. EAO). 2017b. *Information Bulletin #1: Relationship between the Cumulative Effects Framework and Reviewable Project Environmental Assessment*. February. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/bulletin_1_cef-ea_feb_2017.pdf.

British Columbia Environmental Assessment Office (B.C. EAO). 2020. *Effects Assessment Policy*. Version 1.0. April. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/environmental-assessments/guidance-documents/2018-act/effects_assessment_policy_v1_-_april_2020.pdf.

British Columbia Environmental Assessment Office (B.C. EAO). 2022. *DRAFT Assessment Report for Tilbury Marine Jetty Project (TMJ)*. July 13, 2022. https://projects.eao.gov.bc.ca/api/public/document/62cf08ec0d82fb00228f3027/download/TMJ_Summary%20Assessment%20Report_Draft_for_PCP_20220713.pdf.

British Columbia Ministry of Environment & Climate Change Strategy (B.C. ENV). 2021d. British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Quality Guideline Series No. WQG-08. February. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/bc_env_working_water_quality_guidelines.pdf.

British Columbia Ministry of Environment (B.C. MOE). 2006. *Ecosystems in British Columbia at Risk: Estuaries in British Columbia*. March. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/species-ecosystems-at-risk/brochures/estuaries_bc.pdf.

British Columbia Ministry of Environment (B.C. MOE). 2009. *Conservation Framework: Conservation Priorities for Species and Ecosystems Primer*. Ecosystems Branch, Environmental Stewardship Division. November. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/species-ecosystems-at-risk/species-at-risk-documents/cf_primer.pdf.

British Columbia Ministry of Environment (B.C. MOE). 2013a. Approved Water Quality Guidelines. Accessed July 2019. http://www2.gov.bc.ca/gov/topic.page?id=044DD64C7E24415D83D07430964113C9.

British Columbia Ministry of Environment (B.C. MOE). 2013b. *Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia (2013)*. A companion document to *Develop with Care 2012*. February. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/raptor_conservation_guidelines_2013.pdf.

British Columbia Ministry of Environment (B.C. MOE). 2014a. *Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia (2014)*. A companion document to *Develop with Care*. January. https://www.env.gov.bc.ca/wld/documents/bmp/HerptileBMP_complete.pdf.

British Columbia Ministry of Environment (B.C. MOE). 2014b. *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia*. March. https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/best-management-practices/develop-with-care.

British Columbia Ministry of Environment (B.C. MOE). 2014c. "Fact Sheet #11: Great Blue Herons." *Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia*. March. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/develop-with-care/fact-sheet-11-herons.pdf.

British Columbia Ministry of Environment (B.C. MOE). 2014d. *Recovery Plan for the Barn Owl (Tyto alba) in British Columbia*. British Columbia Recovery Strategy Series. March. https://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=9701.

British Columbia Ministry of Environment (B.C. MOE). 2014e. *Policy for Mitigating Impacts on Environmental Values (Environmental Mitigation Policy)*. May 13. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-policy-legislation/environmental-mitigation-policy/em_policy_may13_2014.pdf.

British Columbia Ministry of Environment (B.C. MOE). 2014f. *Procedures for Mitigating Impacts on Environmental Values (Environmental Mitigation Procedures)*. Version 1.0. May 27. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-policy-legislation/environmental-mitigation-policy/em_procedures_may27_2014.pdf.

British Columbia Ministry of Environment and Climate Change Strategy (B.C. ENV). 2021b. *Integrated Pest Management Program for Rodents: Agricultural Operations*. May. https://www2.gov.bc.ca/assets/gov/environment/pesticides-and-pest-management/legislation-consultation-new/bmp_rodent_ipm_for_agri.pdf.

British Columbia Ministry of Environment and Climate Change Strategy (B.C. ENV). 2021c. *Protect your Home from Rats and Mice without Harming Wildlife – Integrated Pest Management Program for Rodents: A Guide for Residents*. https://www2.gov.bc.ca/assets/gov/environment/pesticides-and-pest-management/legislation-consultation-new/bmp_rodent_ipm_for_public.pdf.

British Columbia Ministry of Environment and Climate Change Strategy (B.C. ENV). 2022. *Best Management Practices for Bats*. February. https://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=12460.

British Columbia Ministry of Environment, Land and Parks (B.C. MELP). 1995. *Wildlife in British Columbia at Risk: Pacific Water Shrew*. March. https://www.env.gov.bc.ca/wld/documents/shrew.pdf.

British Columbia Ministry of Environment, Land and Parks (B.C. MELP). 1998. *Inventory Methods for Pond-breeding Amphibians and Painted Turtle*. Standards for Components of British Columbia's Biodiversity No. 27. Version 2.0. March 13. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/pond.pdf.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (B.C. MFLNRO). 2012. *Cost of Adaptation – Sea Dikes & Alternative Strategies*. Final. Submitted by Delcan. October. https://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/cost_of_adaptation-final_report_oct2012.pdf.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (B.C. MFLNRO). 2014. *A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia*. Interim Guidance. https://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=9921.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (B.C. MFLNRO). 2016. *Best Management Practices for Amphibian and Reptile Salvages in British Columba*. Version 1.0. June 2. https://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=10351.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (B.C. MFLNRORD). n.d.a. *TANTALIS – Wildlife Management Areas*. Modified April 2021. Accessed February 2022. https://catalogue.data.gov.bc.ca/dataset/tantalis-wildlife-management-areas.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (B.C. MFLNRORD). n.d.b. *Ungulate Winter Range – Approved*. Modified April 2021. Accessed February 2022. https://catalogue.data.gov.bc.ca/dataset/ungulate-winter-range-approved.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (B.C. MFLNRORD). n.d.c. *Ungulate Winter Range – Proposed*. Modified April 2021. Accessed February 2022. https://catalogue.data.gov.bc.ca/dataset/ungulate-winter-range-proposed.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (B.C. MFLNRORD). n.d.d. *Wildlife Habitat Areas – Approved*. Modified April 2021. Accessed February 2022. https://catalogue.data.gov.bc.ca/dataset/wildlife-habitat-areas-approved.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (B.C. MFLNRORD). n.d.e. *Wildlife Habitat Areas – Proposed*. Victoria, B.C. Data modified April 2021. Accessed Febuary2022. https://catalogue.data.gov.bc.ca/dataset/wildlife-habitat-areas-proposed.

British Columbia Oil and Gas Commission (B.C. OGC). 2021a. *Oil and Gas Activity Application Manual*. Version 1.42. November. https://www.bcogc.ca/industry-zone/documentation/oil-and-gas-activity-application-manual.

British Columbia Oil and Gas Commission (B.C. OGC). 2021b. *Environmental Protection and Management Guideline*. Version 2.9. December. https://www.bcogc.ca/files/operations-documentation/Environmental-Management/Environmental-Protection-and-Management-Guideline.pdf.

British Columbia Regional Adaptation Collaborative (BC RAC). n.d. ReTooling for Climate Change. A partnership program of the Fraser Basin Council and the B.C. Ministry of Environment – Climate Action Secretariat. Accessed February 2022. https://retooling.ca/.

British Columbia Utilities Commission (BCUC). 2022. FortisBC Energy Inc. (gas) Certificate of Public Convenience and Necessity for the Tilbury Liquefied Natural Gas Storage Expansion Project – Adjourned. In progress. Application Filed December 29, 2020. BCUC Project No. 1599170. https://www.bcuc.com/OurWork/ViewProceeding?ApplicationId=843.

Brumm, H. 2004. The impact of environmental noise on song amplitude in a territorial bird. Journal of Animal Ecology. Volume 73, Issue 3. May 2004. Pp 434-440. https://doi.org/10.1111/j.0021-8790.2004.00814.x.

Bull, J. 2004. *Status of Water, Sediment and Fish Quality in the Lower Fraser River (Hope to the Mouth), from 1971 to 2003*. Ministry of Water, Land and Air Protection. March.

Butler, R., N. Davidson, and R. Morrison. 2001. Global-Scale Shorebird Distribution in Relation to Productivity of Near-Shore Ocean Waters. *Waterbirds: The International Journal of Waterbird Biology*. Vol. 24, No. 2. August. pp. 224–232.

Calbick, K., R. McAllister, D. Marshall, S. Litke. 2004. "Fraser River Basin Case Study British Columbia." *Canada*. Vancouver: Fraser Basin Council.

Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. W. Kaiser, and M. C. E. McNall. 1990. *The Birds of British Columbia*. Vancouver: University of British Columbia Press.

Canadian Council of Ministers of the Environment (CCME). 2021a. Canadian Water Quality Guidelines for the Protection of Aquatic Life (Freshwater, Marine).

Canadian Council of Ministers of the Environment (CCME). 2021b. Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (Livestock and Irrigation).

Canadian Councils of Resource Ministers; Federal, Provincial and Territorial Governments of Canada; and Canadian Biodiversity: Ecosystem Status and Trends 2010. 2010. *Canadian Biodiversity: ecosystem status and trends 2010*. p. 16.

Canham, R., S. Flemming, D. Hope, M. Drever. 2021. "Sandpipers go with the flow: Correlations between estuarine conditions and shorebird abundance at an important stopover on the Pacific Flyway." *Ecology and Evolution*. Vol. 11, No. 6. pp. 2828–2841.

Channell, R., and M. Lomolino. 2000. "Dynamic biogeography and conservation of endangered species." *Nature*. Vol. 403. pp. 84–86.

Charlie, Candace. 2019. *STL'ULNUP: A Cowichan Nation Use and Occupancy Study for Tilbury Island*. Prepared for WesPac Midstream-Vancouver LLC for Cowichan Tribes, on behalf of the Cowichan Nation Alliance. September 9.

City of Delta (Delta). 2018. *Delta's Birds & Biodiversity Conservation Strategy*. February. https://www.bcsla.org/sites/default/files/resources/files/climate-change/downloads/Delta%27s%20Bird%20%26%20Biodiversity%20Conservation%20Plan.%202018.pdf.

City of Vancouver (Vancouver). 2018. *Coastal Adaptation Plan: Fraser River Foreshore*. Final. December. https://vancouver.ca/files/cov/coastal-adaptation-plan-final-report.pdf.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). n.d. "COSWEIC status reports." Accessed April 2022. https://www.cosewic.ca/index.php/en-ca/status-reports.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2006. *COSEWIC Assessment and Status Report on the Pacific Water Shrew* Sorex bendirii *in Canada*. https://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_pacific_water_shrew_e.pdf.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2016. *Western painted turtle* (Chrysemys picta bellii)*: COSEWIC assessment and status report 2016*. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/western-painted-turtle-2016.html.

Corporation of Delta. 1985. Official Community Plan Bylaw No. 3950. Accessed May 2023.

Craig, V., R. Vennesland, and K. Welstead. 2010. *Best Management Practices Guidelines for Pacific Water Shrew in Urban and Rural Areas*. Prepared for the Pacific Water Shrew Recovery Team.

Delta Heritage Society. n.d. Archives Search. Accessed April 2022. https://deltaheritagesociety.ca/archives-search/.

Diamond Head Consulting Ltd. 2016. *Urban Forest Climate Adaptation Framework for Metro Vancouver: Tree Species Selection, Planting and Management*. February 23. Updated May 11, 2017. Accessed February 2022. http://www.metrovancouver.org/services/regional-planning/PlanningPublications/UrbanForestClimateAdaptationFrameworkTreeSpeciesSelection.pdf.

Didham, R., J. Tylianakis, M. Hutchison, R. Ewers, and N. Gemmell. 2005. "Are invasive species the drivers of ecological change?" *Trends in Ecology and Evolution*. Vol. 20, No. 9. pp. 470–474.

Duchamp, J. E. and R.K. Swihart. 2008. "Shifts in bat community structure related to evolved traits and features of human-altered landscapes." *Landscape Ecology*. Vol. 23, No. 27. pp. 849–860.

Dunn, P., D. Winkler, L. Whittingham, S. Hannon, and R. Robertson. 2011. "A test of the mismatch hypothesis: How is timing of reproduction related to food abundance in an aerial insectivore?" *Ecology*. Vol. 92, No. 2. pp. 450–461.

eBird. n.d. Bird Observations: Boundary Bay – Roberts Bank – Sturgeon Bank (Fraser River Estuary) Important Bird Area Histogram Data. Accessed February 2022. https://ebird.org/barchart?byr=1900&eyr=2019&bmo=1&emo=12&r=CA-BC_017.

Ecosystems. n.d. *Species and Ecosystems at Risk – Publicly Available Occurrences – CDC*. Accessed April 2021. https://catalogue.data.gov.bc.ca/dataset/species-and-ecosystems-at-risk-publicly-available-occurrences-cdc.

Environment and Climate Change Canada (ECCC). n.d.a. "General nesting periods of migratory birds." Last updated October 30, 2018. Accessed February 2022. https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html.

Environment and Climate Change Canada (ECCC). n.d.b. "Guidelines to reduce risk to migratory birds." Last updated August 4, 2022. Accessed February 2022. https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html.

Environment and Climate Change Canada (ECCC). n.d.c. "Status update on the modernization of the *Migratory Birds Regulations*, 2022." Updated November 25, 2022. Accessed June 2022. https://www.canada.ca/en/environment-climate-change/services/migratory-game-bird-hunting/status-update-modernization-regulations.html.

Environment and Climate Change Canada (ECCC). 2018. *Recovery Strategy for the Little Brown Myotis* (Myotis lucifugus)*, the Northern Myotis* (Myotis septentrionalis)*, and the Tri-coloured Bat* (Perimyotis subflavus) *in Canada*. Final. *Species at Risk Act* Recovery Strategy Series. December 21. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/little-brown-myotis-2018.html.

Environment and Climate Change Canada (ECCC). 2021. *Recovery Strategy for the Western Painted Turtle* (Chrysemys picta bellii) *Pacific Coast population in Canada*. Final. *Species at Risk Act* Recovery Strategy Series. July 8.

Environment and Climate Change Canada (ECCC). 2022. *Recovery Strategy for the Barn Owl* (Tyto alba)*, Western Population, in Canada*. Proposed. *Species at Risk Act* Recovery Strategy Series. canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/barn-owl-2022.html.

Environment Canada. 2013. *Bird Conservation Strategy for Bird Conservation Region 5: Northern Pacific Rainforest*. Canadian Wildlife Service. https://www.canada.ca/content/dam/eccc/migration/main/mbc-com/df49c9a5-e2a7-466f-b06c-2df69b0e0664/bcr-5-pyr-final-feb-2013.pdf.

Environment Canada. 2014. *Recovery Strategy for the Pacific Water Shrew* (Sorex bendirii) *in Canada*. Final. *Species at Risk Act* Recovery Strategy Series. December. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/recovery-strategies/pacific-water-shrew-2014.html.

Erickson, W. P., G. D. Johnson, and D. P. Young Jr. 2005. *A Summary and Comparison of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions*. USDA Forest Service General Technical Report PSW-GTR-191. https://www.fs.usda.gov/research/treesearch/32103.

Erickson, W. P., G. D. Johnson, D. M. Strickland, D. P. Young Jr., K. J. Sernka, and R. E. Good. 2001. *Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States*. National Wind Coordinating Committee Resource Document. August. https://www.osti.gov/servlets/purl/822418.

Fediuk, Karen and Brian Thom. 2003. Contemporary & Desired Use of Traditional Resources in a Coast Salish Community: Implications for Food Security and Aboriginal Rights in British Columbia. Presented at the 26th Annual Meeting of the Society for Ethnobiology, Seattle, Washington. March 27. http://www.web.uvic.ca/~bthom1/Media/pdfs/abrights/Barriers_to_Harvesting3_.pdf.

Fisheries and Oceans Canada (DFO). n.d. "Marine Protected Areas across Canada." Accessed November 2022. https://www.dfo-mpo.gc.ca/oceans/mpa-zpm/index-eng.html.

FortisBC. 2022. Tilbury Phase 2 LNG Expansion Project. Detailed Project Description. January 2022. https://www.projects.eao.gov.bc.ca/api/public/document/61d61dc5733ef50022683d05/download/FortisBC_Tilbury_DPD_Final_Jan2022.pdf.

Fraser Basin Council. n.d.a. "Action on Climate Change." Accessed February 2022. https://www.fraserbasin.bc.ca/services-programs_ccaq.html.

Fraser Basin Council. n.d.b. FloodWise in B.C.'s Lower Mainland. Accessed February 2022. https://floodwise.ca/.

Fraser River Estuary Management Program (FREMP) and Burrard Inlet Environmental Action Program (BIEAP). n.d. *Habitat Atlas – Fraser River Habitat Colour Coding* [map]. Community Mapping Network. Last updated 2016. Accessed February 2022. https://cmnmaps.ca/FREMP/map.php?agree=0.

Fraser River Estuary Management Program (FREMP). 1994. *A Living Working River: An Estuary Management Plan for the Fraser River*. August.

Fraser River Estuary Management Program (FREMP). 2003. *A Living Working River Updated 2003: The Estuary Management Plan for the Fraser River*. https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/281396.pdf.

Fraser River Estuary Study Steering Committee (FRESSC). 1978. Fraser River Estuary Study Summary. Ministry of Agriculture, Fisheries and Food Aquaculture and Commercial Fisheries Branch Library. Victoria, British Columbia.

Geological Survey of Canada. 2004. *Fraser River Delta, British Columbia: Issues of an Urban Estuary*. Geological Survey of Canada Bulletin 567. B. Groulx, D. Mosher, J. Luternauer, and E. Bilderback, eds.

Gibson, S., R. Van de Marel, and B. Starzomski. 2009. "Climate change and conservation of leading-edge peripheral populations." *Conservation Biology*. Vol. 2, No. 6. pp. 1369–1373.

Gill, Frank B. 1995. *Ornithology*. 2nd edition. New York.

Golder Associates Ltd. (Golder), ABR Inc., and Rolf Bergman Consulting. 2010. *Literature review, synthesis and design of monitoring of ambient artificial light intensity on the OCS regarding potential effects on resident marine fauna*. Prepared for U.S. Department of the Interior Minerals management Services.

Golder Associates Ltd. (Golder). 2019. "Appendix 4.8-1: Wildlife Baseline Study." *WesPac Tilbury Marine Jetty Project Wildlife Baseline Study*. March 20. https://extranet.fortisbc.com/projects/TLB/2/Jacobs/Jacobs_Working_Folder/Environmental_Assessment/Resources/Tilbury_Marine_Jetty_Project_EA/Jetty_EA_and_Errata/4.8-1%20Wildlife%20Baseline%20Study.pdf.

Gomez-Mestre, I., Tejedo, M., Ramayo, E., and Estepa, J. 2004. "Developmental Alterations and Osmoregulatory Physiology of a Larval Anuran under Osmotic Stress." *Physiological and Biochemical Zoology*. Vol. 77, No. 2. pp. 267–274.

Government of British Columbia (Government of B.C.). n.d.a. *Conservation Data Centre* [map]. iMap 2.0. Interactive Geographic Data. Accessed April 2022. http://maps.gov.bc.ca/ess/hm/cdc/.

Government of British Columbia (Government of B.C.). n.d.b. "Managing rat and mouse pests." Accessed February 2022. https://www2.gov.bc.ca/gov/content/environment/pesticides-pest-management/managing-pests/animals/rodents.

Government of British Columbia (Government of B.C.). n.d.c. "Red, Blue & Yellow Lists." Accessed April 2022. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/red-blue-yellow-lists.

Government of British Columbia (Government of B.C.). n.d.d. "Second-generation anticoagulant rodenticide (SGAR) Use in British Columbia." Accessed February 2022. https://www2.gov.bc.ca/gov/content/environment/pesticides-pest-management/legislation-consultation/rodenticide-ban.

Government of British Columbia (Government of B.C.). n.d.e. BC Species & Ecosystems Explorer. Online Database. Accessed April 2022. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/species-and-ecosystems-explorer.

Government of British Columbia (Government of B.C.). 2016. *Cumulative Effects Framework: Interim Policy for the Natural Resource Sector*. October. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/cef-interimpolicy-oct_14_-2_2016_signed.pdf.

Government of Canada. n.d.a. "Bird surveys." Last updated May 25, 2017. Accessed February 2022. https://www.canada.ca/en/environment-climate-change/services/bird-surveys.html.

Government of Canada. n.d.b. "Bird Conservation Regions and strategies." Last updated June 6, 2017. Accessed February 2022. https://www.canada.ca/en/environment-climate-change/services/migratory-bird-conservation/regions-strategies.html.

Government of Canada. n.d.c. Canadian Protected and Conserved Areas Database. Accessed November 2022. https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/protected-conserved-areas-database.html.

Government of Canada. n.d.d. *Critical Habitat for Federally-listed species at risk (posted)*. Environment Canada. Last updated April 12, 2019. Accessed February 2022. https://catalogue.data.gov.bc.ca/dataset/critical-habitat-for-federally-listed-species-at-risk-posted-.

Government of Canada. n.d.e. "Migratory bird sanctuaries across Canada." Last updated June 3, 2022. Accessed February 2022. https://www.canada.ca/en/environment-climate-change/services/migratory-bird-sanctuaries/locations.html.

Government of Canada. n.d.f. "National wildlife areas." Last updated June 30, 2021. Accessed February 2022. https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas.html.

Government of Canada. n.d.g. "Species at risk public registry." Last updated May 11, 2022. Accessed February 2022. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html.

Government of Canada. 1994. *Migratory Birds Convention Act*, 1994 (S.C. 1994, c. 22). https://laws.justice.gc.ca/eng/acts/M-7.01/.

Government of Canada. 2021. "Statutory Instruments 2021." *Canada Gazette, Part II*. SOR/2021-195 to 214 and SI/2021-55 to 62. Vol. 155, No. 18. September 1. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/orders/g2-155182.pdf.

Guillemette, M., R. C. Ydenberg, and J. H. Himmelman. 1992. The role of energy intake rate in prey and habitat selection of Common Eiders *Somateria mollissima* in winter: a risk-sensitive interpretation. Journal of Animal Ecology 61:599– 610.

Habib, L., E. M. Bayne, and S. Boutin. 2007. "Chronic Industrial Noise Affects Pairing Success and Age Structure of Ovenbirds *Seiurus aurcapilla*." *Journal of Applied Ecology*. Vol. 44. pp. 176–184.

Hanson, A., I. Goudie, A. Lang, C. Gjerdrum, R. Cotter, and G. Donaldson, G. 2009. *A Framework for the Scientific Assessment of Potential Project Impact on Birds*. Technical Report Series Number 508. Canadian Wildlife Service. December. https://publications.gc.ca/site/eng/367511/publication.html.

Harrington, B., S. Brown, J. Corven, and J. Bart. 2002. "Collaborative Approaches to the Evolution of Migration and the Development of Science-Based Conservation in Shorebirds." *The Auk*. Vol. 119, No. 4. pp. 914–921.

Hemmera Envirochem Inc. (Hemmera). 2006. *South Fraser Perimeter Road Environmental Assessment Application*. Prepared for the Ministry of Transportation.

Hill, D., D. Hokin, D. Price, G. Tuckers, R. Morris, and J. Treweek. 1997. "Bird Disturbance: Improving the Quality and Utility of Disturbance Research." *Journal of Applied Ecology*. Vol. 34. pp. 275–288.

Hill, P. 2001. "Vibration and Animal Communication: A Review." *American Zoologist*, Vol. 41, No. 5. pp. 1135–1142.

Hitch, A. T. and P. L. Leberg. 2007. "Breeding distributions of North American bird species moving north as a result of climate change." *Conservation Biology*. Vol. 21. pp. 534–539.

Hopkins, G. and E. Brodie. 2015. "Occurrence of Amphibians in Saline Habitats: A Review and Evolutionary Perspective." *Herpetological Monographs*. No. 29. pp. 1–27.

Horvath, G., G. Kriska, P. Malik, and B. Robertson. 2009. "Polarized light pollution: A new kind of ecological photopollution." *Frontiers in Ecology and the Environment*. Vol. 7, No. 6. pp. 317–325.

Hua, J. and B.A. Pierce. 2013. "Lethal and sublethal effects of salinity on three common Texas amphibians." *Copeia*. Vol. 3. pp. 562–566.

Hul'qumi'num Treaty Group. 2005. *In the Footsteps of Our Ancestors: Interim Strategic Land Plan for the Hul'q'umi'num Core Traditional Territory, 2005*. Prepared by Bryan Evans, Julia Gardner, Brian Thom, Lea Joe, Cheri Ayers, Joey Caro, Rob Flemming, Jana Kotaska, Eric McLay, Hillary Rudd, Robert Morales, and Herrainco Skipp Herrainco. http://www.hulquminum.bc.ca/pubs/HTG_LUP_FINAL.pdf.

Jacobs Consultancy Canada Inc. (Jacobs). 2020. *FortisBC Tilbury LNG Storage Expansion Project – Environmental Overview Assessment*. Prepared for FortisBC Energy Inc. June. Revision 2.

Jacobs Consultancy Canada Inc. (Jacobs). 2021. *FortisBC Tilbury LNG Storage Expansion Project – Stage 1 Preliminary Site Investigation*. Prepared for FortisBC Energy Inc.

Jacobs Consultancy Canada Inc. (Jacobs). 2022a. *FortisBC Tilbury LNG Storage Expansion Project – Stage 2 Preliminary Site Investigation*. Prepared for FortisBC Energy Inc.

Jacobs Consultancy Canada Inc. (Jacobs). 2022b. *FortisBC Tilbury Phase 2 Expansion Project – Nitrogen and Acid Deposition Receiving Environment Report*. Prepared for FortisBC Energy Inc.

Jacobs Consultancy Canada Inc. (Jacobs). 2022c. *FortisBC Tilbury Phase 2 Expansion Project – Response to Environment and Climate Change Canada: PP-ECCC-051*. Prepared for FortisBC Energy Inc.

Jalkotzy, M. G., P. I. Ross, and M. D. Nasserden. 1997. *The Effects of Linear Developments on Wildlife: A Review of Selected Scientific Literature*. Prepared by Arc Wildlife Services Ltd. for the Canadian Association of Petroleum Producers.

Johnson, O. W., L. Fielding, J. W. Fox, R. S. Gold, R. H. Goodwill, and P. M. Johnson. 2011. "Tracking the migrations of Pacific Golden-Plovers *(Pluvialis fulva)* between Hawaii and Alaska: New insight on flight performance, breeding ground destinations, and nesting from birds carrying light level geolocators." *Wader Study Group Bulletin*. Vol. 118, No. 1. pp. 26–31.

Jones, J. and C. M. Francis. 2003. "The effects of light characteristics on avian mortality at lighthouses." *Journal of Avian Biology*. Vol. 34, No. 4. pp. 328–333.

Kaseloo, P. 2004. Synthesis of Noise Effects on Wildlife Populations. Publication No. FWHA-HEP-06-016. U.S. Department of Transportation. Federal Highway Administration. September 2004. https://www.nrc.gov/docs/ML1219/ML12199A433.pdf.

Katzie First Nation. 2019. *Katzie First Nation Land Use Plan*. Published August 2019. Accessed May 2, 2023. https://katzie.ca/wp-content/uploads/2023/03/KatzieLUP_Final_online_reduced_2019-09-12.pdf.

Kehoe, L., J. Lund, L. Chalifour, Y. Asadian, E. Balke, S. Boyd, D. Carlson, J. Casey, B. Connors, N. Cryer, M. Drever, S. Hinch, C. Levings, M. MacDuffee, H. McGregor, J. Richardson, D. Scott, D. Stewart, R. Vennesland, C. Wilkinson, P. Zevit, J. Baum, and T. Martin. 2020. "Conservation in heavily urbanized biodiverse regions requires urgent management action and attention to governance." *Conservation Science and Practice*. Vol. 3, No. 2.

Kennerly, Caleb Burwell Rowan. 1857. CBR Kennerly-Report to Lt. Parke of an Expedition to Orcas Island Performed in December 1857 (Northwest Boundary Survey).

Lehmann, U. and C. W. Sommersberg. 1980. "Activity patterns of the common vole, *Microtus arvalis* – automatic recording of behaviour in an enclosure." *Oecologica*. Vol. 47 pp. 61–75.

Leq'á:mel First Nation. 2015. *Leq'á:mel First Nation Land Use Plan*. March 23. http://leqamel.ca/wp-content/uploads/2017/03/FINAL-Land-Use-Plan-March-26-2015.pdf.

Lewanzik, D. and C. C. Voigt. 2014. "Artificial light puts ecosystem services of frugivorous bats at risk." *Journal of Applied Ecology*. Vol. 51. pp. 388–394.

Lewis, T., D. Esler, W. S. Boyd, and R. Zydelis. 2005. "Nocturnal foraging behaviour of wintering surf scoters and white-winged scoters." *The Condor*. Vol. 107. pp. 637–647.

Lomolino, M. and R. Channel. 1995. "Splendid isolation: patterns of geographic range collapse in endangered mammals." *Journal of Mammalogy*. Vol. 76 pp. 335–347.

Lomolino, M. and R. Channell. 1998. "Range collapse, reintroductions, and biogeographic guidelines for conservation." *Conservation Biology*. Vol. 12. pp. 481–484.

Longcore, T. and C. Rich. 2004. "Ecological light pollution." *Frontiers in Ecology and the Environment*. Vol. 2, No. 4. pp. 191-198.

Loss, S. R., S. Lao, A. W. Anderson, R. B. Blair, J. W. Eckles, and R. J. Turner. 2020. "Inclement weather and American woodcock building collisions during spring migration." *Wildlife Biology*.

Lyackson First Nation. 2018. Written Evidence of Lyackson First Nation. Trans Mountain Pipeline Expansion Project Reconsideration Hearing. Hearing Order MH-052-2018.

McNeil, R., P. Drapeau, and J. Goss-Custard. 1992. "The occurrence and adaptive significance of nocturnal habits in waterfowl." *Biological Reviews: Cambridge Philosophical Society*. Vol. 67, No. 4. pp. 381–419.

Metro Vancouver. 2018. *Ecological Health Framework*. October 26. http://www.metrovancouver.org/services/regional-planning/PlanningPublications/EcologicalHealthFramework.pdf.

Møller, A., D. Rubolini, and E. Lehikoinen. 2008. "Populations of migratory bird species that did not show a phenological response to climate change are declining." *Proceedings of the National Academy of Sciences of the United States of America*. Vol. 105, No. 42. pp. 16195–16200.

Morgan, Kendra, Section Head, Fish & Aquatic Wildlife Resources, British Columbia Ministry of Water, Land and Resource Stewardship. 2021. Personal communication (email) with Sarah McLaughlin, Jacobs. December 13.

Mundahl, N. D., A. G. Bilyeu, and L. Maas. 2013. "Bald Eagle nesting habitats in the Upper Mississippi River National Wildlife and Fish Refuge." *Journal of Fish and Wildlife Management*. Vol. 4. pp 362–376.

Musqueam Indian Band. 2011. *Musqueam First Nation: A Comprehensive Sustainable Community Development Plan*. July. http://www.musqueam.bc.ca/wp-content/uploads/2018/06/MUSQUEAMccp-112611-HiRes.pdf.

Musqueam Indian Band. 2018. *Musqueam First Nation: A Comprehensive Sustainable Community Development Plan Update*. October. https://www.musqueam.bc.ca/wp-content/uploads/2018/10/Musqueam-CCP-Update_FINAL_Oct2018_lowres.pdf.

Muths, E., B. Hossack, G. Campbell, H. Evan, D. Pilliod, and S. David. 2020. "Effects of snowpack, temperature, and disease on demography in a wild population of amphibians." *Herpetologica*. Vol. 76, No. 2. p. 132.

Nagorsen, D. W. 2002. *An Identification Manual to the Small Mammals of British Columbia*. Government of British Columbia, Ministry of Sustainable Resource Management.

North, M. E. A., M. W. Dunn, and J. M. Teversham. 1979. *Vegetation of the Southwestern Fraser Lowland, 1858-1880* [map]. Fraser Lowland 1979, 92 G/2, 3, 6, 7. Minister of Supply and Services Canada 1979 and Lands Directorate, Environment Canada. http://www.env.gov.bc.ca/esd/distdata/ecosystems/TEI_Scanned_Maps/F03/F03-5462/F03-5462.pdf.

Ogden, E. 2002. *Summary Report on the Bird Friendly Building Program: Effect of Light Reduction on Collision of Migratory Birds*.

Ovaska, K., L. Sopuck, C. Engelstoft, and L. Matthias. 2004. *Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia*. B.C. Ministry of Water, Land, and Air Protection.

Pierce, B. and D. Wooten. 1992. "Genetic Variation in Tolerance of Amphibians." *Journal of Herpetology*. Vol. 26, No. 4. pp. 422–429.

Popek, E. 2018. E*nvironmental Chemical Pollutants. Sampling and Analysis of Environmental Chemical Pollutants*. 2nd Edition.

Raincoast Conservation Foundation. 2021. "Webinar #4: The Fraser Estuary – climate change." Connected Estuary: a webinar series on the Fraser River Estuary. https://www.raincoast.org/estuary-webinar/.

Ramsar Convention Secretariat. n.d. Ramsar Sites Information Service. Accessed February 2022. https://rsis.ramsar.org/.

Rheindt, F. 2003. The impact of roads on birds: Does song frequency play a role in determining susceptibility to noise pollution? Journal of Ornithology. Volume 133, pp. 295 – 306 (2003). https://doi.org/10.1007/BF02465629.

Richardson, C. T. and C. K. Miller. 1997. "Recommendations for Protecting Raptors from Human Disturbance: A Review." *Wildlife Society Bulletin*. Vol. 25, No. 3. pp. 634–638.

Riding, C.S., T. J. O'Connell, and S. R. Loss. 2021. "Multi-scale temporal variation in bird-window collisions in the central United States." *Scientific Reports*. Vol. 11, No. 11062.

Robertson Environmental Services Limited (Robertson). 2006. *South Fraser Perimeter Road. Vegetation and Wildlife Impact Assessment*. Technical Volume 12 of the Environmental Assessment Application. Prepared for the Ministry of Transportation. September.

S'ólh Téméxw Stewardship Alliance. 2018. *S'ólh Téméxw Use Plan Policy*. Public Policy Version 1.1. April 18. https://thestsa.ca/resources-relations/stsa-policies-and-plans/solh-temexw-use-plan-and-policy/.

Santos, C. D., S. Saraiva, J. M. Palmeirim, and J. P. Grandadeiro. 2009. "How do waders perceive buried prey with patchy distributions? The role of prey density and size of patch." *Journal of Experimental Marine Biology and Ecology*. Vol. 372, No. 1–2. pp. 43–48.

Schaub, A., J. Ostwald, and B. M. Siemers. 2008. "Foraging Bats Avoid Noise." Journal of Experimental Biology. Vol. 211, No. 19. pp. 3174-3180.

Shannon, C.E. and W. Wiener. 1949. The mathematical theory of communication. Urbana, IL: University of Illinois Press. p. 127.

Shaw, D. Patrick and Taina Tuominen. Fraser River Action Plan (FRAP). 1999. "Section 3.2: – Water Quality in the Fraser River Basin." Fraser River Action Plan. https://publications.gc.ca/collections/collection_2015/ec/En47-119-1999-5-eng.pdf.

Shawyer, C. 1998. *The Barn Owl*. Essex, United Kingdom: Arlequin Press.

Shrestha, R., M. Schnorbus, A. Werner, and A. Berland. 2012. "Modelling spatial and temporal variability of hydrologic impacts of climate change in the Fraser River basin, British Columbia. Canada." *Hydrological Processes*. Vol. 26, No. 12. pp. 1840–1860.

Solaris Management Consultants Inc. (Solaris). 2022. *Tilbury LNG Phase 2 Expansion BAT Study in Accordance with Strategic Assessment of Climate Change Requirements*. Revision 3. Document No. 04173-001-32-3109-REP-0001.Prepared for FortisBC Energy Inc. May 9.

South Coast Conservation Program (SCCP). n.d. "Western Painted Turtle – Pacific Coast Population." Accessed January 2022. http://www.sccp.ca/species-habitat/western-painted-turtle-pacific-coast-population.

Stevens, V. 1995. *Wildlife diversity in British Columbia: distribution and habitat use of amphibians, reptiles, birds, and mammals in biogeoclimatic zones*. Research Branch of B.C. Ministry of Forests and Wildlife Branch of B.C. Ministry of Environment, Lands and Parks.

Stone, E., G. Jones, and S. Harris. 2009. "Street lighting disturbs commuting bats." *Current Biology*. Vol. 19. pp. 1123–1127.

Stone, E., G. Jones, and S. Harris. 2012. "Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats." *Global Change Biology*. Vol. 18, No. 8. pp. 2458–2465.

Swaddle, J., and L. Page. 2007. High levels of environmental noise erode pair references in zebra finches: implications for noise pollution. ScienceDirect, 74, 363-368. doi:10.1016/j.anbehav.2007.01.004

Thomas, P., P. Mineau, R. Shore, L. Champoux, P. Martin, L. Wilson, G. Fitzgerald, and J. Elliott. 2011. "Second generation anticoagulant rodenticides in predatory birds: Probabilistic characterization of toxic liver concentrations and implications for predatory bird populations in Canada." *Environment International*. Vol. 37, No. 5. pp. 914–920.

Trans Mountain. 2017. Final Argument, Appendix D.7 – Lyackson First Nation.

Tsawwassen First Nation and AECOM. 2009. Tsawwassen First Nation Land Use Plan. Accessed September 22, 2020. http://tsawwassenfirstnation.com/wp-content/uploads/2019/07/TFN_Land_Use_Plan.pdf.

Tsleil-Waututh Nation. n.d. *Land Use Plan: 2018-2118*. https://twnation.ca/wp-content/uploads/2019/07/TWN-Land-Use-Plan-Booklet-Educational.pdf.

Tsleil-Waututh Nation. 2015. *Assessment of the Trans Mountain Pipeline and Tanker Expansion Proposal*. https://twnsacredtrust.ca/wp-content/uploads/TWN_assessment_final_med-res_v2.pdf.

Turner, N. J. 2020. *Culturally Significant Vegetation of Tilbury Island*. Prepared by Woodward and Co. for Cowichan Nation Alliance Traditional Use and Occupation Study for Tilbury Island.

United Nations Educational Scientific and Cultural Organization (UNESCO). n.d. *Biosphere reserves in Europe & North America*. Accessed February 2022. https://en.unesco.org/biosphere/eu-na.

Van de Laar, F. 2007. *green light to birds: Investigation into the effect of bird-friendly lighting*. December.

Van Doren, B. M., D. E. Willard, M. Hennen, K. G. Horton, E. F. Stuber, D. Sheldon, A. H. Sivakumar, J. Wang, A. Farnsworth, and B. M. Winger. 2021. "Drivers of fatal bird collisions in an urban centre." *Proceedings of the National Academy of Sciences*. Vol. 118, No. 24.

Van Doren, B., K. Horton, A. Dokter, H. Klinck, S. Elbin, and A. Farnsworth. 2017. "High-intensity urban light installation dramatically alters nocturnal bird migration." *Proceedings of the National Academy of Sciences*. Vol. 114, No. 42. pp. 11175–11180.

Vennesland, R. G. and R. W. Butler. 2011. "Great Blue Heron *(Ardea herodias)*." *The Birds of North America Online*. Ithaca, New York: Cornell Lab of Ornithology. A. Poole, ed. https://birdsoftheworld.org/bow/species/grbher3/cur/introduction.

Walters, B., C. Ritzi, D. Sparks, and J. Whitaker Jr. 2007. "Foraging behaviour of eastern red bats *(Lasiurus borealis)* at an urban-rural interface." *The American Midland Naturalist*. Vol. 157, No. 2. pp. 365–373.

Warnock, N. 2010. "Stopping vs. staging: The difference between a hop and a jump." *Journal of Avian Biology*. Vol. 41, No. 6. December. pp. 621–626.

Welstead, K. and R. Vennesland. 2006. "Fish Traps Threaten Pacific Water Shrew Recovery." *Streamline Watershed Management Bulletin*. Vol. 9, No. 2. Spring. http://www.sccp.ca/sites/default/files/species-habitat/documents/fish%20trap%20threats%20to%20water%20shrews%20_streamline.pdf.

WesPac Midstream-Vancouver LLC. (WesPac). 2019. *Environmental Assessment Certificate Application – WesPac Tilbury Marine Jetty Project*. https://projects.eao.gov.bc.ca/p/58851208aaecd9001b829b58/project-details;currentPage=1;pageSize=10;sortBy=-dateAdded;ms=1581371449997.

Western Hemisphere Shorebird Reserve Network (WHSRN). n.d.b. *WHSRN Sites* [map]. Accessed February 2022. https://whsrn.org/whsrn-sites/map-of-sites/.

Wiacek, J., M. Polak, M. Filipiuk, M. Kucharczyk, and J. Bohatkiewicz. 2015. "Do birds avoid railroads as has been found for roads?" *Environmental Management*. Vol. 56. pp. 643–652.

Wilber, D. H. and D. G. Clarke. 2001. "Biological effects of suspended sediments: a review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries." *North American journal of fisheries management*. Vol. 21, No. 4. pp. 855–875.

Wittwer, Torben, Robert O'Hara, Paul Caplat, Thomas Hickler, and Henrik Smith. 2015. "Long-term population dynamics of a migrant bird suggests interaction of climate change and competition with resident species." *Oikos*.