Information Request Package 9 from the Review Panel for the Roberts Bank Terminal 2 Project Environmental Assessment: Responses

List of Responses

IR9-01 Coastal Birds – Road Mortality Mitigation

Information Source(s)

EIS Volume 3: Section 15.7.2.1, Section 15.7.2.6, Section 15.8.4, Table 15-12

TDR TW-4 Barn Owl Habitat Suitability, Habitat Use, Site Occupancy and Collision Study (CEAR Doc#388)

CEAR Doc#581

Recovery Plan for the Barn Owl (*Tyto alba*) in British Columbia, B.C. Ministry of Environment, 2014 (CEAR Doc#1117)

Context

In Section 15.7.2.6 of the EIS, the Proponent stated that Barn Owls have been documented to be active close to the Project footprint and are susceptible to collisions with vehicles and that without mitigation, negative effects to Barn Owl productive potential are likely. The Proponent concluded that no residual effect to Barn Owls was anticipated because it intended to work collaboratively with appropriate transportation authorities and the Canadian Wildlife Service to develop and implement measures to mitigate effects to Barn Owls from vehicle collisions. Examples of such mitigation measures included planting hedgerows or using reflective fences (to force birds up and over traffic), or the establishment and maintenance of Barn Owl nest boxes. No additional details were provided on the proposed mitigation measures for anticipated road mortality of Barn Owls.

In Section 15.7.2.1 of the EIS, the Proponent reported that 38% of annual bird mortality was from vehicle collisions and that the increase in traffic volume could result in an additional 115 vehicle-related bird mortalities. Despite acknowledging that avian species other than Barn Owls - such as shorebirds, waterfowl and passerines – were susceptible to road mortality, no mitigation measures were proposed for other avian groups.

In its submission to the Review Panel (CEAR Doc#581), Environment and Climate Change Canada stated that road mortality was identified in the Recovery Plan for the Barn Owl in British Columbia (2014) as one of the main threats for this species. Further, under the Recovery Objectives section, the plan provided mitigation of current threats (including road mortality) as one of the objectives towards meeting the population and distribution goal. Environment and Climate Change Canada also noted that mitigation measures were not proposed by the Proponent to avoid Project-related vehicle collisions for waterfowl and for other species. In light of the anticipated increase in road traffic as a result of the Project, Environment and Climate Change Canada requested that the Proponent incorporate measures including but not limited to the following:

- Install appropriate types of physical features that force birds to fly over roads especially in areas where Barn Owls have been observed in the Project study area (from east end of the Roberts Bank causeway to the 72nd Street crossing; Figure 5 of the RBT2 Barn Owl Technical Data Report) to deter owls from flying low across major roads. Environment and Climate Change Canada noted that, given the high abundance of Barn Swallows detected in the Project area, any mitigation measures proposed for Barn Owls should be planned and implemented to also reduce effects on the survival of Barn Swallows and suggested that non-vegetative rather than vegetative barriers such as hedgerows may be a more effective mitigation measure for both Barn Owls and other avian species;

- install signs to reduce speed limits in areas where Barn Owls and other vulnerable species are susceptible to vehicle collision (i.e. highway associated grassland);
- avoid Barn Owl nest box installation in high risk areas (within 1 kilometre and preferably within 3 kilometres of major roads);
- increase the awareness of vehicle operators regarding mitigation practices to reduce Barn Owl road kills;
- install signs to alert vehicle operators about the presence of owls;
- develop aural, visual, or perch deterrents that would reduce the attractiveness of roadsides and medians;
- continue to monitor collision rates for Barn Owls and other potentially affected species within the regional assessment area throughout the duration of the Project to evaluate the effectiveness of mitigation measures implemented; and
- consult with Environment and Climate Change Canada and appropriate transportation authorities to develop and implement mitigation measures.

Additional information regarding potential mitigation measures to avoid or reduce the road mortality of avian species is required.

Information Request

Provide further information including concrete examples of measures to mitigate the increased risk of Project vehicle collisions with Barn Owls.

Describe how these measures are expected to be effective to avoid or reduce effects on Barn Owls and other avian species or bird groups predisposed to a heightened risk of mortality from vehicle collision.

Describe technical and economic feasibility of the mitigation measures proposed by Environment and Climate Change Canada and whether the Proponent intends to implement them.

VFPA Response

As outlined in EIS Section 15.8, the VFPA has committed to mitigating effects of Project vehicle collisions on barn owls. This response provides an evaluation of measures that the VFPA has considered, which include measures recommended by Environment and Climate Change Canada (ECCC) (CEAR Document #581[1]). The VFPA investigated several options within the six general themes identified by ECCC. Measures within the themes were evaluated for their effectiveness and technical and economic feasibility for implementation within the coastal bird

[1] CEAR Document #581 From Environment and Climate Change Canada to the Review Panel re: Comments on the information relating to the environmental assessment of the Roberts Bank Terminal 2 Project.

local assessment area (LAA) (see EIS Figure 15-1). A summary of measures evaluated to mitigate the risk of owl-vehicle collisions isare presented below.

In summary, many of the measures evaluated are deemed to be effective to mitigate the incrementally small increase in barn owl collisions associated with the Project. In particular, the use of barn owl boxes to increase productivity is deemed to be the most effective mitigation measure.

Physical Barriers

Vegetated and non-vegetated barriers have been used effectively to mitigate bird vehicle collisions by forcing individuals to fly over barriers (and consequently vehicles) thereby clearing vehicular traffic (Bard et al. 2002, Shwiff et al. 2003, Jacobson 2005, Kociolek et al. 2015, Zuberogoitia et al. 2015, Barrientos and Borda-de-Água 2017, Carvalho et al. 2017). Vegetated barriers (i.e., cedar hedgerows) have been used locally on Highway 17 (South Fraser Perimeter Road (SFPR)) in areas of known barn owl nesting and usage. ECCC suggest that non-vegetative rather than vegetative barriers such as hedgerows may be a more effective mitigation measure for both barn owls and other avian species. The VFPA is of similar opinion to ECCC that only non-vegetated barriers should be considered, as vegetated barriers can increase bird usage of areas adjacent to roads, increasing the likelihood of vehicle strikes. Therefore, the VFPA only examined non-vegetated barriers (i.e., concrete walls, fencing, and vertical poles spaced ~1 m apart) as mitigation that could help reduce road mortalities associated with the RBT2 Project.

Effectiveness

The effectiveness of mitigation measures was first examined in relation to baseline traffic conditions, barn owl ecology, and existing collision mortality research. Existing research demonstrates the size and volume of roads bisecting barn owl territories has a large effect on collision rates and persistence of barn owls in an area (Ramsden 2003). A 15-year study of barn owls in Great Britain found that ‘major roads’ have large, lasting negative affects on barn owls (Ramsden 2003). Within this study, major roads were classified as high-volume modern roads built for fast traffic with verges and embankments providing wildlife habitat. Roads within the LAA and regional assessment area (RAA) fitting this description include Highway 99, Highway 17, and Deltaport Way, where speed limits range between 60 to 100 km/hour and traffic volumes are high. For example, under existing conditions, the 2012/2013 annual average daily traffic volume estimated for Highway 99 (at the south end of the Deas Slough Bridge) was 78,837 vehicles/day, for Highway 17 (0.8 km north of Deltaport Way) was 38,751 vehicles/day, and for Deltaport Way was 3,824 vehicles/day (B.C. MOTI 2014, EIS Appendix 4-D). Due to the high potential for vehicle collisions under such conditions, Ramsden (2003) estimates the complete absence of breeding barn owls within 0.5 km either side of major roads, severe depletion of populations within 0.5-2.5 km of the road, and some depletion within 2.5-8 km. These results align with results showing highway traffic exposure and the length of highways as strongest predictors of collisions in a Lower Mainland study (Hindmarch et al. 2012). Results from Ramsden’s (2003) study indicate that for barn owls frequenting habitats bisected by roads with high traffic volume, it is more of a question of when an owl will be struck by a vehicle than if they will be struck.

Based on the above research, it is likely that barn owls within the LAA and RAA are highly affected by road mortalities under existing conditions. Traffic volumes are currently high within the LAA and RAA and, after completion of the Project, will continue to be high. Long-term studies of road-related barn owl mortalities suggest that under such conditions increases in traffic along major roads is unlikely to have a meaningful influence on the number of barn owls killed annually (Illner 1992, Ramsden 2003). Therefore, given current traffic volumes, increases in collision mortalities associated with the Project are likely to be minor over existing conditions.

Based on the conditions described above, the installation of non-vegetative barriers within the area providing suitable barn owl foraging habitat in the LAA (i.e., terrestrial habitat encompassing ~550 m of upland northwest of the east end of the causeway and the first ~250 m of marsh habitat bordering the terrestrial environment along Roberts Bank Way) would likely reduce or prevent road mortalities within the Project's LAA. However, non-vegetative barriers would not be effective in mitigating the minor decrease in productivity associated with the Project as the same owls that would avoid vehicle collisions in the LAA are highly likely to suffer road mortalities along non-barriered habitat adjacent to the Project LAA. Therefore, installation of barriers within this small section of the existing transportation network is likely to be ineffective in reducing barn owl road mortalities (as well as mortalities of other species) unless widely implemented throughout the region.

Technical / Economic Feasibility and Implementation

Three types of non-vegetative barriers (i.e., solid wall, vertical poles, fencing) have been evaluated for their technical and economic feasibility. The implementation of solid walls, vertical poles, or fencing is technically feasible and could be implemented within the existing Project footprint. The economic cost of modifying the Project design and constructing non-vegetative barriers were assessed to be disproportionately large, with the associated benefits being small to negligible based on the likely ineffectiveness of mitigating owl-vehicle collisions in a very small portion (i.e., the LAA) of the region in which the same owls are affected. Therefore, the VFPA does not intend to implement non-vegetative barriers as part of the RBT2 Project.

Reduced Vehicle Speeds

Avian road mortalities often increase with increasing speeds. Collision mortalities are lower at speeds <60 km/hr compared to >60km/hr (DeVault et al. 2014), and rare at speeds <40 km/hr (Erritzoe et al. 2003). A study in the United Kingdom found that the number of owls (primarily barn owls) killed on roads with vehicle traffic >80 km/hr was approximately 21 times greater than on roads with slower traffic (Illner 1992). The current speed limit on Roberts Bank Way (i.e., the Roberts Bank causeway) is 60 km/hr and increases to 80 km/hr along Deltaport Way in the terrestrial portion of the LAA. Reducing and enforcing speed limits in these areas has potential to reduce barn owl road mortalities.

Effectiveness

Existing research indicates reducing the speed of vehicular traffic is an effective method of reducing the incidence of road mortalities for a number of avian species, including barn owl.

Technical / Economic Feasibility and Implementation

Reducing vehicular speeds is technically and economically feasible; however, aspects of this mitigation measure are outside the VFPA's control and jurisdiction, and rely on the cooperation and involvement of municipal, provincial, and/or federal agencies to potentially modify speed limits within the LAA, post appropriate signage, and ensure compliance. The VFPA commits to working with local authorities to explore speed management along the causeway within the LAA to decrease the potential for bird-vehicle collisions for multiple avian species.

Installation of Barn Owl Nest Boxes to Increase Productivity

Suitable nesting habitat is one of the main limiting factors for barn owl populations in Canada (COSEWIC 2010, B.C. MOE 2014, Environment Canada 2016). The reduction of available nest sites, resulting from the demolition and/or conversion of old, open wooden farm buildings to modern, closed metal structures, are threatening populations across Canada (COSEWIC 2010, Environment Canada 2016). Locally, barn owl nest productivity has been monitored in 2007/2008 (Hindmarch 2010), from 2009-2012 and 2014-2016 as part of the SFPR mitigation monitoring program (Hemmera 2017), and historically in the 1990s (Andrusiak 1994). Although the barn owl population within B.C. has decreased over the last 50 years (COSEWIC 2010, B.C. MOE 2014), these studies indicate that the use of nest sites in southwest Delta has remained relatively consistent, with approximately 30 (±6 SD) sites occupied annually (Hemmera 2017). In contrast, the more recent SFPR monitoring data supports the assertion that sites are annually being lost to barn owls. For example, during the seven years of monitoring, 10 active nest sites were lost, with nine nest sites lost after nest structures were demolished and one after it was made inaccessible by the landowner (Hemmera 2009, 2010, 2011, 2012, 2013, 2015, 2017). Three of the 10 sites were within 2.5 km of the RBT2 Project.

Effectiveness

The use of nest boxes and other artificial nesting structures to provide supplementary breeding habitat and increase productivity for barn owls and other avifauna, such as barn swallows, is a proven management technique (Scott et al. 1977, Marti et al. 1979, Campbell et al. 1997, Brown and Brown 1999, Roulin et al. 2001, Klein et al. 2007, Meyrom et al. 2009, B.C. MOE 2014). Within B.C., barn owls (and barn swallows) nest almost exclusively on artificial structures (Brown and Brown 1999, Marti et al. 2005) and appear to readily inhabit newly available sites (B.C. MOE 2014). For example, 57% of 30 nest boxes installed in Delta in 1992 were used by nesting barn owls within one year (Andrusiak 1994). Similarly, 10 of 13 nest boxes erected by Delta Farmland and Wildlife Trust (DFWT)[2] to compensate for the gradual loss of nest/roost sites in Delta supported nesting barn owls a year following

[2] Delta Farmland and Wildlife Trust is a non-profit organisation that promotes the preservation of farmland and wildlife habitat in the Lower Mainland, B.C. (DFWT 2018)

installation (B.C. MOE 2014). Artificial nest boxes have been shown to have a positive effect on barn owl productivity (Marti et al. 1979, Meyrom et al. 2009), and are likely an effective measure in mitigating the minor loss of productivity associated with the Project.

The effectiveness of mitigation will at least partially depend on where nest boxes are erected. To improve the likelihood of successfully increasing barn owl productivity, nest box installation should be focused on areas where old barns or other suitable nesting habitats are limited and where suitable foraging habitat is available in close proximity. As stated above, research indicates the importance of locating nesting structures at least 2.5 km away from major roads, as the high probability of owl-vehicle collision mortalities can eliminate breeding barn owls within 0.5 km of major roads and severely deplete populations within 0.5-2.5 km. Areas where nest box installation would be most beneficial to barn owls include areas on Westham Island and Boundary Bay in Delta, and southern and northeastern Richmond.

Technical / Economic Feasibility and Implementation

The VFPA has evaluated the estimated cost and technical feasibility of implementing a nest box program to increase barn owl productivity and concluded the implementation and maintenance of such a program is technically and economically feasibly. Long-term nest monitoring data exists from the SFPR Barn Owl Mitigation Monitoring Program (MMP; Hemmera 2009, 2010, 2011, 2012, 2013, 2015, 2017) that has assessed owl habitat suitability within Delta, B.C. and documented nest success and fecundity over multiple years. This information, and information owned by provincial and federal agencies (e.g., B.C. MOE, Canadian Wildlife Service), and environmental non-governmental organisations (e.g., DFWT) make it technically feasible to identify locations of suitable habitat currently underutilised by nesting barn owls. The successful implementation of a nest box program could be managed by the VFPA or achieved by financially supporting work conducted by other organisation(s) with expertise implementing such programs (e.g., DFWT).

The VFPA intends to enhance barn owl productivity through implementing the mitigation measure described above. The proven effectiveness of nest boxes to enhance barn owl productivity is expected to mitigate the minor loss in productivity associated with the Project. However, as locations where nesting structures, such as nest boxes, can be erected will likely be on non-VFPA lands, the successful implementation of a program to increase barn owl fecundity will depend on engagement with landowners willing to support barn owl conservation, permit owl nesting structure(s) on their property, and provide periodic access to personnel to maintain nesting structures.

Education and Awareness

Alerting vehicle operators within the LAA about the presence of barn owls through education (e.g., sign installation, training, news and other media outlets) is a mitigation option that, in conjunction with lower vehicle speeds, can contribute to reduced road mortalities (Belthoff et al. 2015). Increasing motorist awareness about the potential hazards of driving in areas with abundant wildlife is a key component to modifying human behaviour (Hedlund et al. 2003, Knapp et al. 2004, Huijser et al. 2008, O'Keefe and Rea 2012). Awareness and education can be achieved in various ways, including environmental training plans as part of construction and operation environmental management plans (EMPs), news stories, and awareness campaigns during times of year when collisions are anticipated to be highest (Hedlund et al. 2003). Involvement of local organisations (e.g., Delta Naturalists) (Knapp et al. 2004), and brochures, posters, and bumper stickers may also be helpful (Huijser et al. 2008).

Effectiveness

Education has been shown to be partially effective in increasing driver awareness with some potential to contribute to a reduction in avian mortalities. Campaigns that target specific areas for specific species at specific times of year are likely the most effective (Hedlund et al. 2003). The risk of worker and staff habituation and eventual disregard of education materials (e.g., roadside signage) is high. Therefore, this measure is unlikely to be effective without the implementation of additional measures (Huijser et al. 2008, Sielecki 2010, O'Keefe and Rea 2012), such as barn owl boxes and vehicle speed management.

Technical / Economic Feasibility and Implementation

The VFPA has evaluated the estimated cost and technical feasibility of implementing a program to increase construction and operational worker and staff awareness regarding the risk of vehicle collisions with barn owls and has determined the measure is technically and economically feasible. Areas of focus could include environmental training plans associated with construction and operation EMPs, daily tailboard meetings, roadside owl awareness signage, and new employee orientation training materials. However, aspects of this mitigation measure are likely outside the VFPA's control and jurisdiction, and rely on the cooperation of municipal, provincial, and/or federal agencies (e.g., erecting roadside owl awareness signage).

The VFPA commits to working with external partners to raise motorist's awareness and change driver behaviour to reduce the likelihood of barn owl-vehicle collisions.

Aural, Visual, or Perch Deterrents

Barn owls are particularly vulnerable to vehicle collisions as they often hunt from perches such as fence posts, and fly low (1-4 m) over suitable habitat adjacent to roads while hunting (Andrusiak 1994, Taylor 1994, Ramsden 2003, Preston and Powers 2006, COSEWIC 2010). Roadside verge habitats are known to be used by barn owls for foraging significantly more than other habitat types (Hindmarch et al. 2017), possibly due to the presence of voles and other small mammals that make up their primary prey (Bellamy et al. 2000, McGregor et al. 2008). This behaviour, of preferring to hunt along roadsides, places barn owls at higher risk of road mortality.

Deterrents are measures that attempt to reduce or eliminate feeding or discourage animals from entering or using an area. Deterrents can take multiple forms including auditory (e.g., air horns and cannons), visual (e.g., scarecrows, flags, reflectors), and physical (e.g., spikes on posts to prevent perching) (Martin 1986, Bomford and O'Brien 1990, Transport Canada 1998, Blackwell et al. 2002, Bishop et al. 2003, Seamans et al. 2003).

Effectiveness

The use of auditory and visual deterrent methods have been shown to have limited effectiveness, as birds often become habituated to deterrents resulting in deterrents having to be continually changed, rotated, or modified (Martin 1986, Bomford and O'Brien 1990, Transport Canada 1998, Bishop et al. 2003, Seamans et al. 2003). The continual maintenance of, and the tendency for birds to habituate to, such measures limits their usefulness, especially over extended periods of time such as during the multiple years of construction or during the operation phase. Additionally, auditory deterrents can be considered harassment to birds and are preferentially avoided and are therefore not considered a viable deterrent measure by VFPA.

Measures such as perch deterrents can be effective in reducing bird use of areas (Transport Canada 1998, Bishop et al. 2003). Installing perch deterrents in the Project area where barn owls are known or suspected to hunt may reduce the likelihood of road mortalities by making the habitat less suitable. However, unless similar measures are implemented on a regional basis, in areas outside the Project scope, it is likely owls will suffer road mortalities where mitigation measures are lacking and therefore the measures may not have any meaningful impact on mitigating potential incremental changes to barn owl productivity associated with the Project.

Technical / Economic Feasibility and Implementation

The use of aural, visual, and perch deterrents to reduce or eliminate barn owl usage of the LAA adjacent to roads is likely economically feasible; however, as the deployment of deterrents would at least partially occur on non-VFPA owned lands aspects of their technical feasibility are unknown at this time.

Due to the questionable effectiveness of the measures to contribute to mitigating owl-vehicle collisions, the VFPA does not plan to implement these mitigation measures.

Decreasing Habitat Suitability

Roadside vegetation can be used by a number of avian species (including barn owls) depending on the type of habitat, its condition, and suitability. Barn owls forage for small mammals, particularly Townsend's vole (*Microtus townsendii*), over open fields, grasslands, and agricultural areas (BC CDC 2014). As previously mentioned, within the Lower Mainland, barn owls are known to use roadside grass verges for foraging significantly more than other habitat types likely because they offers easier access to voles (Hindmarch et al. 2017).

The use of habitats adjacent to roads likely increases the probability of road mortalities. Therefore, measures to reduce the suitability of foraging habitat along roadways and railways to decrease avian usage, and thereby minimise the potential occurrence of birds close to vehicles and trains, has been a common recommendation (Ramsden 2003, Varga et al. 2005, Belthoff et al. 2015, Kociolek et al. 2015, Barrientos and Borda-de-Água 2017). An example of this is ECCC's recommendation to avoid the use of vegetative barriers (e.g., hedge rows) adjacent to roads and railways associated with the Project (CEAR Document #581). Techniques to reduce habitat suitability to foraging birds include regular mowing to prevent vegetative cover and food sources from establishing, and thereby also reducing its usage by small mammals hunted by raptors. Complete removal of all vegetative habitat followed by paving or gravelling verges is another option to reduce habitat suitability and bird occurrence adjacent to roads.

Effectiveness

Decreasing habitat suitability is an effective method of reducing avian usage adjacent to roadways and railway, which likely reduce the potential for road mortalities (Ramsden 2003). However, this measure alone is not expected to eliminate avian (including barn owl) road mortalities, especially if foraging habitat (e.g., agricultural, old field, or marsh habitat) is present on either side of roadways or railways, as is the case within the LAA, facilitating birds/owls to transit across roads/rails, and exposing themselves to collisions with vehicles.

Technical / Economic Feasibility and Implementation

Managing vegetation to decrease the habitat suitability of verges within the Project footprint adjacent to terrestrial upland and marsh habitat potentially used by foraging barn owls is technically and economically feasible. The VFPA commits to manage the habitat in the Project footprint to reduce or eliminate its suitability to foraging barn owls to the extent possible. The Project footprint abuts large areas of the existing gravelled railway corridor. It is likely that similar gravelling can be implemented on verges as part of the Project design.

Conclusion

In summary, existing research indicates the effects to barn owl productivity from increased traffic volume associated with the Project are likely minor. Barn owl nest boxes are the most effective mitigation measure to increase productivity and offset collision mortalities that may occur within the LAA. The VFPA is committed to implement or work with an appropriate third party organisation (e.g., DFWT) to increase barn owl productivity through installing and maintaining artificial nest structures as feasible.

In addition, the VFPA commits to the following measures:

- Connect and collaborate with local authorities to explore speed management within the LAA, as feasible, to decrease the potential for bird-vehicle collisions for multiple avian species, including barn owl;
- Manage vegetation within verges associated with the Project's footprint adjacent to terrestrial upland and marsh habitat potentially used by foraging barn owls to decrease its habitat suitability to foraging owls; and
- Implement measures to increase education and awareness of owl-vehicle collisions along roads to influence driving habits.

Correction of Information Presented in the Context Section

In the context to this information request above, Section 15.0 of the EIS was referenced and the statement was made that "the increase in traffic volume could result in an additional

115 vehicle-related bird mortalities". The VFPA wishes to clarify that the EIS reports an estimate of an additional 155 vehicle-related bird mortalities, not 115.

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IR9-02 Coastal Birds or Marine Birds – Artificial Light

Information Source(s)

EIS Volume 3: Section 15.7.2.1, Section 15.8.3

Marine Shipping Addendum: Section 8.3.6.2, Section 8.3.7

CEAR Doc#581

Incidental Take of Migratory Birds in Canada 2014 (CEAR Doc#1120)

Context

In Section 15.7.2.1 of the EIS, the Proponent stated that artificial light is generally considered a source of stress to birds and can cause adverse effects such as attracting birds to hazards and disrupting their ability to navigate. The Proponent also noted that there is no known report of this effect occurring at the existing Roberts Bank terminals. To minimise potential adverse effects from artificial lighting during Project construction and operation, the Proponent proposed to implement mitigation measures, where feasible, such as orienting lights downwards, using shielding, controlling and limiting light use, and using fixtures that emit light at wavelengths shown to minimise disorienting effects to birds.

In Section 8.3.6.2 of the Marine Shipping Addendum, the Proponent described that nocturnal feeding marine birds can be attracted to artificial light sources, such as ship lighting, and that mortality is known to occur. For the local assessment area, the Proponent noted that no collisions with vessels have been recorded which indicates that collisions with vessels are most likely infrequent and, if they do occur, do so on a small scale (in terms of the number of birds). However, in Table 8.3-5, of the Marine Shipping Addendum, the Proponent judged that there would be a very low (such as for Red Knot) to moderate (such as for Marble Murrelet) risk of collision with transiting Project-associated vessels. No mitigation measures were proposed to reduce the risk of vessel strikes and disturbance to marine birds from marine shipping associated with the Project.

Environment and Climate Change Canada noted that bird collisions with lit/floodlit structures and navigational lighting from vessels can cause detrimental effects to avian species. Attraction to lights can cause birds to collide with such structures and vessels, resulting in injury or death. In other instances, birds can become disoriented while circling a light source, and may deplete their energy reserves and either die of exhaustion or drop to the ground where they are at risk of predation. Moreover, migratory birds, the nests of migratory birds and/or their eggs can be inadvertently harmed or disturbed as a result of marine shipping-related activities, including collision with vessels and attraction to vessel lights.

In relation to avoiding and minimizing marine bird collision and disturbance risk, Environment and Climate Change Canada recommended that the Proponent consider Environment and Climate Change Canada's Incidental Take of Migratory Birds in Canada 2014, including the Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada.

Environment and Climate Change Canada also recommended that the Proponent should consider the following measures that could contribute to avoiding harm to migratory birds and species at risk in the context of collision with lit and floodlit structures and navigational lighting from vessels:

- minimize the number of light installations;
- avoid the use of solid burning or slow pulsing warning lights;
- use down-shielded lighting fixtures to further reduce light pollution;
- avoid or restrict the time of operation of exterior decorative lights such as spotlights and floodlights that function to highlight the exterior features of buildings, especially on humid, foggy, or rainy nights, when illumination glow can draw birds from distance; and
- in relation to any navigational lighting requirements, use the minimum amount of obstruction avoidance lighting on tall structures. The use of only strobe lights at night, at the minimum intensity and minimum number of flashes per minute (longest duration between flashes) allowable by Transport Canada, was recommended. The use of solid-burning or slow pulsing warning lights at night should be avoided.

In support of mitigation development and management, Environment and Climate Change Canada suggested the Proponent consider undertaking the following:

- identify potential high-risk periods. Environment and Climate Change Canada related that studies have shown that marine/aquatic birds are more susceptible to collision with light structures when visibility is poor (e.g. dark, heavy fog), and/or during high volume of bird movement (e.g. migration period);
- identify specific structures, activities or locations that have the potential to contribute to bird collisions;
- in the context of results from the above 2 bullets, monitor the effectiveness of mitigation measures in avoiding collisions including, but not limited to, carcass searches and, monitoring of bird movement and behavior using tools such as marine radar;
- describe how night lighting would be avoided or minimized to the extent possible; and
- document the monitoring results and demonstrate whether the mitigation measures were proven to be effective and if additional measures were required.

According to Environment and Climate Change Canada the monitoring should identify corrections for searcher efficiency, carcass persistence (i.e. scavenging), and searchable area (i.e. that takes into account areas that are not able to be searched due to substrate, health and safety concerns, etc.), in consideration of the use of marine radar independently or in combination with any carcass searches.

Additional information is required to understand the potential effects of artificial light from the Project and marine shipping associated with the Project on birds and proposed mitigation measures.

Information Request

Provide further information on measures proposed in the EIS to mitigate the predicted effects of the Project on migratory and non-migratory birds and avian species at risk that could be caused by lit and floodlit structures, container loading crane lights and navigational lighting from vessels.

Describe the technical and economic feasibility of the mitigation measures proposed by Environment and Climate Change Canada and how they could be implemented for the proposed Project

Explain whether and how the Environment and Climate Change Canada guidance Incidental Take of Migratory Birds in Canada 2014, including the Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada could be implemented for the Project.

VFPA Response

Introduction

The VFPA is committed to implementing measures to mitigate the potential adverse effects of light on coastal birds. These measures were initially outlined in the EIS (EIS Section 15.0) and have been updated below (Part 1) to include further detail on implementation of the measures where such information is currently available. If additional information is not yet available, details on when this information will be available have been provided. Recommendations from Environmental and Climate Change Canada (ECCC) with respect to lighting mitigation provided in the context to this information request have been evaluated and additional commitments made by the VFPA are listed below (Part 2).

The terminal lighting will be optimised such that lighting requirements to protect human health and safety are met and any unnecessary lighting (including decorative lighting) is eliminated from the design. In accordance with this, the terminal has been designed to be semi-automated, reducing lighting requirements compared to conventional ports. Areas that are not being used by humans are anticipated to remain unilluminated or minimally lit. Therefore, the amount of light emitted from RTB2 is anticipated to be less than the existing Roberts Bank terminals. These light avoidance measures will be achieved while meeting the VFPA's directive to "promote safety, security and productivity on port sites, reduce unwanted light spill and other impacts on adjacent properties and communities, and conserve electrical energy and reduce unnecessary use of electrical power" (VFPA 2015). The terminal lighting will be designed to conform to applicable legislation and regulations, including the Canada Occupational Health and Safety Regulations (SOR/86-304) and the National Building Code of Canada (National Research Council Canada 1953), as well as nationally recognised standards, including the Illuminating Engineering Society of North America (IESNA) Handbook (Rea 2000) and Transport Canada Standard 621, Obstruction Marking and Lighting (Transport Canada 2011). The terminal lighting design will meet the guidelines outlined in the VFPA's Project and Environmental Review (PER) Guidelines for Lighting document (VFPA 2015).

The marine shipping area is within Transport Canada's jurisdiction. The VFPA has reviewed the measures related to marine shipping put forward by ECCC and has addressed how the proposed Project complies with ECCC's guidance on Incidental Take of Migratory Birds in Canada (ECCC 2014), including the Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada (Part 3).

Part 1 – Provide further information on measures proposed in the EIS to mitigate the predicted effects of the Project on migratory and non-migratory birds and avian species at risk that could be caused by lit and floodlit structures, container loading crane lights and navigational lighting from vessels.

Effects to coastal birds from artificial light were assessed within EIS Section 15.0 and IR-7.31.15-25 of CEAR Document #314[1]. Effects from artificial light on coastal birds were assessed to be negligible with the implementation of mitigation. Information on measures proposed in the EIS to mitigate potential effects is provided below (measures A through E). Measures will be further detailed in the Project's Light Management Plan within the construction and operation environmental management plans.

A. **Orient lights downward and away from residential and marine areas:** The VFPA will orient lighting downward and only install lighting in areas needed to be accessed by humans, thus limiting light trespass into the marine environment used by birds and minimising skyglow. No decorative lighting (e.g., to illuminate gantry cranes) will be used, further reducing potential for trespass light to illuminate areas used by birds.

B. **Use shielding to minimise light trespass:** The EIS describes the application of the use of high pressure sodium (HPS) lights at the proposed terminal; however, industry trends indicate the increasing use of light emitting diode (LED) lighting for reduced maintenance and energy consumption. Since completion of the EIS, the VFPA has determined that the proposed terminal will likely be lit using dimmable LEDs (or equivalent technology), which have internal reflectors that focus light and limit light trespass, performing a function similar to traditional shielding. The existing Deltaport Terminal is undergoing retrofitting to replace HPS with LED lighting on various terminal infrastructure, including its high masts and cranes. The retrofit of the Deltaport Terminal and use of LED as part of the Project is expected to benefit the overall light environment and potentially reduce effects to birds through limiting light trespass and skyglow.

C. **Control light levels and limit light use to areas where activities are occurring, where possible:** The terminal will be semi-automated and controlled through a centralised lighting control system that will allow lighting to be turned off when and where it is not required. Therefore, areas that are not actively being used by humans are anticipated to remain unilluminated or minimally lit. Since the terminal is semi-automated, human access will not be required in as many areas of the terminal during regular operation. As a result, it is expected that terminal areas other than the intermodal yard, terminal gates, berth face, and offices where regular human presence is expected, are anticipated to be kept dim during operation unless humans require access to an area. Further details on lighting controls will be provided in the Operation Light Management Plan based on final design and detailed operation practices of the Project.

[1] CEAR Document #314 From Port Metro Vancouver to the Canadian Environmental Assessment Agency re: Completeness Review - Responses to Additional Information Requirements (See reference document # 271) for the Environmental Impact Statement.

D. **Ensure dredge lighting system shields light from spilling outside the basic working footprint of the dredge:** Details on how the lighting system will be implemented during dredging to minimise light trespass into the marine environment will be provided in the Construction Light Management Plan. The VFPA is committed to orienting light downward and away from the marine environment and avoiding excess illumination. Lighting will be focused on where it is needed and limited to the work area.

E. **Where possible, use fixtures that emit light at specific wavelengths:** Light modelling presented in the EIS (EIS Sections 9.4 and 25.0) was based on the use of HPS lighting at the proposed Project and at the Deltaport Terminal. However, given industry trends related to increasing use of LED lighting for reduced maintenance and energy requirement, external lighting fixtures at the terminal will likely use white LEDs (or equivalent technology). The final decision on the light fixtures that will be used at the proposed terminal will occur during the detailed design stage. Use of fixtures that emit light at specific wavelengths or colour temperatures will be considered at that time if appropriate lighting products are commercially available and economically feasible.

All lighting mitigation will be detailed in the Construction and Operation Light Management Plans. As per the PER Guideline for Lighting (VFPA 2015), the Light Management Plans will be prepared by a qualified lighting professional and will include a site plan and key which will indicate the following:

- Locations of all proposed exterior lighting fixtures as well as locations of proposed power sources;
- Type of illuminating devices, fixtures, lamps, supports, reflectors, and other devices, including cut-off characteristics;
- Lamp source types, lumen output, and wattage;
- Mounting height and orientation of each fixture;
- Types of timing devices used to control the hours set for illumination, as well as the proposed hours when each fixture will be operated; and
- Cumulative lighting data for the overall lighting installation, including design power consumption, average illumination, and uniformity levels.

Part 2 – Describe the technical and economic feasibility of the mitigation measures proposed by Environment and Climate Change Canada and how they could be implemented for the proposed Project

The VFPA commits to implementing the five measures recommended by ECCC in the context to this information request, as is feasible while adhering to regulations administered by Transport Canada and other applicable authorities:

1. Minimise the number of light installations;
2. Avoid the use of solid burning or slow pulsing warning lights;
3. Use down-shielded lighting fixtures (or equivalent technology) to further reduce light pollution;

4. Avoid or restrict the time of operation of exterior decorative lights such as spotlights and floodlights that function to highlight the exterior features of buildings, especially on humid, foggy, or rainy nights, when illumination glow can draw birds from distance; and
5. In relation to any navigational lighting requirements, use the minimum amount of obstruction avoidance lighting on tall structures. The use of only strobe lights at night, at the minimum intensity and minimum number of flashes per minute (longest duration between flashes) allowable by Transport Canada, was recommended. The use of solid-burning or slow pulsing warning lights at night should be avoided.

Measures 1, 3, and 4 are already part of the Project mitigation measures, as described in Part 1. These measures are technical and economically feasible, and preferred from a cost perspective. With respect to measures 2 and 5, the VFPA will adhere to Transport Canada's requirements for warning lights and navigational lighting (Transport Canada 2011). As recommended by ECCC, the VFPA will use "only strobe lights at night, at the minimum intensity and minimum number of flashes per minute (longest duration between flashes) allowable by Transport Canada". The VFPA will endeavor to use uniformly flashing (white) lights at a flash rate of 27 to 33 flashes per minute across the Project, as research has shown this to be the optimal flash rate to minimise potential effects to birds while providing the necessary conspicuity for pilots (Gehring 2010, Patterson 2012). The VFPA will avoid the use of steady-burning (i.e., non-flashing) red lights, which are associated with higher avian mortality rates (Gehring et al. 2009, Gehring 2010) as allowable by Transport Canada.

As suggested by ECCC, the VFPA recognises there are periods and locations within the facility at which the risk of collisions is greater. Based on site-specific data collected at the existing Roberts Bank terminals (Roe and Williams 1984, Burger and Cassidy 1995, Cassidy et al. 1998, Next 2005, Hemmera 2014), migration (i.e., particularly southward migration when numerous inexperienced juveniles are present) and periods of inclement weather (e.g., fog, heavy rain) are recognised as periods of increased risk, with the eastern end of the causeway experiencing higher collision rates compared to the western causeway and terminal pods. The illumination along the causeway is not anticipated to differ substantially from existing conditions (see EIS Section 9.4) and therefore, potential effects to birds should be similar to those under existing conditions in this area. The proposed mitigation (described within this response) to minimise lighting and potential collision risk have taken ECCC's recommendations into account. As discussed above, the semi-automated design of the facility will further minimise the light emitted by the Project and will employ technologies associated with reducing the potential to distract or disorient birds, and therefore, the potential for collision risk. To verify the anticipated change in light trespass and sky glow associated with the Project a follow-up monitoring program will be conducted (see the VFPA'S forthcoming response to IR13-30).

Part 3 – Explain whether and how the Environment and Climate Change Canada guidance Incidental Take of Migratory Birds in Canada 2014, including the Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada could be implemented for the Project.

ECCC's guidance on Incidental Take of Migratory Birds in Canada, including the Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada (ECCC 2014) was consulted when writing the EIS and Marine Shipping Addendum (MSA). Specific guidelines recommended within the above document are listed in **Table IR9-02-1** along with details on how the proposed Project complies with the guideline.

Table IR9-02-1 Guidelines to Avoid Disturbance to Seabird and Waterbird Colonies in Canada (ECCC 2014) and Compliance by the Proposed Project

	Guideline	Project Compliance
1	*In general, maintain a minimum distance of at least 300 m from all areas of the island or colony occupied by seabirds and waterbirds.*	In the marine shipping area, the closest a transiting vessel will pass in relation to a nesting colony is approximately 700 m within Boundary Passage / Haro Strait (MSA Section 8.3.6). Within the EIS local assessment area (LAA), nesting is limited to black oystercatcher (*Haematopus bachmani*) and Pigeon guillemot (*Cepphus columba*) nesting along the BC Ferries causeway (>3 km from the RBT2 Project), and the cormorant colony (*Phalacrocorax sp*.) located on the Westshore coal jetty. These nest sites have been active for numerous years and bird behaviour indicates they are habituated to the regular activities associated with the ferry, coal, and container terminal operations. The closest RBT2-associated vessels are likely to be to nesting waterbirds (i.e., the cormorant colony on the Westshore coal jetty) is >600 m. It is judged that RBT2 vessel activity is unlikely to affect these birds or colonies.
2	*Always travel at steady speeds when close to seabird and waterbird colonies, moving parallel to the shore, rather than approaching the colony directly.*	Transiting vessels in the LAA and marine shipping area travel at steady speeds and will not directly approach colonies. Ships within the marine shipping area use international shipping lanes, which parallel the shore and minimise the potential interactions of vessels with colonies.
3	*Avoid any sharp or loud noises, do not blow horns or whistles, and maintain constant engine noise levels.*	RBT2-associated vessels will abide by all Transport Canada marine transportation regulations pertaining to the emission of atmospheric noise within Canadian waters.
4	*Do not pursue seabirds or waterbirds swimming on the water surface and avoid concentrations of these birds on the water.*	During operation, vessels in the LAA and marine shipping area are restricted to corridors that limit bird-vessel interactions and allow avifauna to habituate to their movements.

	Guideline	Project Compliance
		Vessels are required to stay on a regular course and will not pursue birds.
5	*Where possible, only use certified tour boats or accredited guides.*	This measure is not applicable to the proposed Project as it relates to tour boats and guides.
6	*Anchor large vessels, such as cruise ships, at least 500 m from the breeding islands and only approach as close as 300 m in smaller vessels. If closer access is required, please contact Environment and Climate Change Canada's Canadian Wildlife Services office in your region.*	Ships berthed at the RBT2 terminal will be >600 m to the closest nesting colony (i.e., the cormorant colony located on the Westshore coal port jetty).
7	*Never dump waste or garbage overboard, because* • *even small amounts of oil can kill birds and other marine life, and habitats may take years to recover; and* • *fishing line, cans, plastic bottles and other plastic waste can injure or kill birds.*	RBT2-associated vessels are mandated by law to abide by international requirements for the prevention of pollution from garbage, contained in Annex V of MARPOL, *Regulations for the Prevention of Pollution by Garbage from Ships* and the *Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals, Division 5* (Transport Canada 2010). Division 5 applies to all ships in Canadian waters and to all Canadian ships everywhere. RBT2-associated ships are also mandated by law to adhere to international requirements for the prevention of oil pollution from ships contained in Annex I of the International Maritime Organizations' Pollution Convention entitled *Regulations for the Prevention of Pollution by Oil,* which have been incorporated into the *Canada Shipping Act* under Part XV of the *Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals*.

Conclusion

The VFPA is committed to optimising the terminal lighting such that lighting requirements to protect human health and safety are met and any unnecessary lighting is eliminated to minimise effects to the environment. Lighting optimisation will occur as part of the detailed design phase. Mitigation measures proposed within the LAA will be implemented by the VFPA and will be detailed in the Light Management Plans. Mitigation measures recommended by ECCC and listed in the context to this information request will be incorporated, as feasible. Measures proposed within the marine shipping area are recommended to be implemented by Transport Canada.

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IR9-03 Marine Birds – Representative Species

Information Source(s)

Marine Shipping Addendum: Section 8.3.1

CEAR Doc#372

Context

In Section 8.3.1 of the Marine Shipping Addendum, the Proponent identified five sub-components and their representative species for the marine bird assessment including the Red Knot to represent shorebirds and the Fork-tailed Storm Petrel to represent pelagic birds.

In its submission (CEAR Doc#372) to the Review Panel, Environment and Climate Change Canada noted that Red Knot occurs in very small numbers, and that it is distributed sparsely over the marine bird local assessment area, except for the Boundary Bay area, where this species has been more concentrated over the years. For this reason, Environment and Climate Change Canada commented that this species may not be a good indicator of habitat use within the local assessment area for those shorebirds that are more uniformly distributed over the entire marine bird area. For example, Black Oystercatcher is a shorebird commonly found in the marine bird local assessment area that uses a different habitat type (rocky intertidal) than that used by migratory wading bird species such as Red Knot.

In addition, Environment and Climate Change Canada noted that the Marine Shipping Addendum stated that available data indicated that Fork-Tailed Storm-Petrels occur at low (0% to 2% of documented occurrences) frequency throughout the local assessment area during the entire year and occur most frequently (10% to 25% of documented occurrences) at the western edge of the local assessment area at the mouth of Juan de Fuca Strait. Further, Environment and Climate Change Canada commented that this species reflects different behavioral strategies relative to other pelagic species (for example, foraging behavior.)

A rationale to support the choice of representative species for the marine bird assessment is required.

Information Request

Provide a specific rationale for how the marine bird representative species within each subcomponent is an appropriate proxy for each of the species considered within those subcomponents including each species at risk.

Explain how the conclusions of the assessment apply to each of the species represented.

VFPA Response

Context

To accompany this response, a brief summary of the rationale and approach for the selection and assessment of representative bird species for the Marine Shipping Addendum (MSA) is provided. Further information on the representative species approach is provided in *Information Request Package 5 – Response to Information Requests Relating to Represented Species* of CEAR Document #1078[1]. To structure and streamline the assessment, avian species were assembled into five sub-components (sea ducks, pelagic birds, waterfowl, gulls and terns, and shorebirds). These sub-components contain groups of species that are similar in nature/behaviour, occupy comparable habitats, play similar ecological roles, and are likely to be affected by marine shipping associated with the Project in analogous ways (MSA Section 8.3.1, Table 8.3-1; MSA Appendix 8.0-A, Table 8.0-A2). Sub-components were further refined by selecting one to two representative species to represent the diverse assemblage of resident and migrant marine birds within the component (see *Information Request Package 5 – Response to Information Requests Relating to Represented Species* of CEAR Document #1078). Further information is provided below to specifically address the issue raised in the context to this information request concerning the appropriateness of red knot and fork-tailed storm-petrels as representative species.

- *Red Knot*

  Red knot is deemed to be an appropriate representative species for black oystercatcher as they share numerous ecological traits that will cause them to experience potential interactions with Project-associated vessels similarly (see **Appendix IR9-03-A**). For example, both species are restricted to foraging along marine shorelines (i.e., black oystercatcher forage heavily on rocky shores exposed to surf action, and red knot prefer to hunt on falling or rising tides over tidal sand flats and mudflats). The restriction of both species, and other species within the shorebird sub-component, to nearshore habitats is a primary attribute that facilitates the assessment of potential effects collectively. As changes to the shoreline in relation to vessel wake, underwater noise, and visual disturbance are predicted to be unmeasurable (MSA Section 8.6.3.1), potential negligible effect predictions for red knot equally apply to all species within the shorebird sub-component, including black oystercatcher.

  Similarly, in relation to the predicted residual effect associated with collision with Project-associated ships, the restriction of both species to marine shorelines removes them (and other species within the shorebird sub-component) from direct interaction with vessels transiting within shipping lanes, facilitating the assessment of potential effects collectively. Further information is provided in **Appendix IR9-03-A**.

[1] CEAR Document #1078 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Requests IR4-33, IR5-01, IR5-12, IR5-15, IR5-16, IR5-23, IR5-24, IR5-32, IR5-33, IR5-34, IR5-35, IR5-36, IR6-26, IR7-03, and IR7-05 (See Reference Documents #946, #975, #991, and #1000).

- *Fork-tailed Storm-petrel*

  For clarification, two representative species were used to assess potential effects to pelagic birds: fork-tailed storm petrel and marbled murrelet (as detailed in MSA Table 8.3.1). The basis for this was in recognition that fork-tailed storm-petrel possesses different behavioural strategies relative to many other pelagic species. For this reason, marbled murrelet was also chosen as a representative species within the assessment to ensure potential effects to pelagic birds were properly assessed. Further information is provided in **Appendix IR9-03-A**.

The sub-components and representative species listed in MSA Table 8.3-1 therefore represent a suite of marine birds (including species at risk) occupying a similar ecological niche upon which effects from marine shipping associated with the Project can be assessed. The rationale for how the representative species within each sub-component is an appropriate proxy for each of the species considered within each sub-component is provided in MSA Section 8.3.1, Table 8.3-1 and MSA Appendix 8.0-A, Table 8.0-A2. Additional information pertaining to represented species have been previously described in AIR-12.04.15-09 (CEAR Document #388[2]) and in MSA Appendix 8.0-A, Table 8.0-A2.

Five potential interactions with Project-associated vessels were assessed within the marine bird assessment (MSA Section 8.3.6): vessel wake, underwater noise, visual disturbance and atmospheric noise, and loss of productivity from collisions with transiting vessels. Potential effects to representative species assessed to be negligible prior to the implementation of mitigation were vessel wake, underwater noise, and visual disturbance and atmospheric noise (MSA Section 8.3.6.1). The rationale for these determinations applies to all species represented by other species (MSA Section 8.3.6.1). Therefore, these effects are not considered further in this response.

The remaining portion of this response therefore focuses on the interaction 'loss of productivity from collisions with transiting vessels' and the rationale for the selected representative bird species.

Provide a specific rationale for how the marine bird representative species within each subcomponent is an appropriate proxy for each of the species considered within those subcomponents including each species at risk.

Explain how the conclusions of the assessment apply to each of the species represented.

Appendix IR9-03-A provides specific rationale regarding how each representative species is an appropriate proxy for each of the species it represents (including each species at risk) in relation to the potential interaction of loss of productivity from collisions with transiting vessels. The table also presents how the conclusions of the assessment pertaining to effects

[2] CEAR Document #388 From Port Metro Vancouver to the Canadian Environmental Assessment Agency re: Completeness Review - Responses to Additional Information Requirements Follow-Up (See Reference Document # 345) including 22 Technical Data Reports.

from productivity loss from collisions with transiting vessels apply to each of the species represented.

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Appendices

Appendix IR9-03-A	Summary of Representative Species Selection Rationale and Update to the Effects Assessment for Marine Birds

APPENDIX IR9-03-A

SUMMARY OF REPRESENTATIVE SPECIES SELECTION RATIONALE AND UPDATE TO THE EFFECTS ASSESSMENT FOR MARINE BIRDS

Table IR9-03-A1 Summary of Representative Species Selection Rationale and How the Conclusions of the Assessment Apply to each of the Species Represented

Species	Representative Species Rationale	Effects Assessment Relevance
American avocet (*Recurvirostra americana*)	American avocet are represented by red knot for the following reasons: • Like red knot, American avocet forage for aquatic invertebrates from shallow nearshore water habitats by pecking sediment. Both species forage in coastal shallow water habitats, including tidal mudflats, saltwater marshes, and intertidal areas, and are not found using offshore marine environments. American avocet are blue-listed while red knot are red-listed and Threatened/Endangered on Schedule 1 of the *Species at Risk Act* (*SARA*). In the LAA, both species occur most commonly during northward and southward migrations, though a few individuals occur throughout the year. • Differences include foraging techniques, with American avocet using slightly deeper habitat, although relatively quite shallow (<30 cm deep). These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on American avocet is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on American avocet from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for American avocet due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to American avocet productivity are not anticipated.
American bittern (*Botaurus lentiginosus*)	American bittern are represented by red knot for the following reasons: • Like red knot, American bittern forage for aquatic invertebrates and crustaceans in shallow water habitats, and are not found using offshore marine environments. Both species are of conservation concern (i.e., American bittern are blue-listed while red knot are red-listed and Threatened/Endangered on Schedule 1 of *SARA*). • Differences include American bittern's habitat preference: American bittern occasionally use tidal marshes, but have a much greater tendency to remain in freshwater habitat. Foraging techniques used also differ, with American bittern locating food items by sight and using a forward neck/head dart to capture prey; red knot peck, plow, and probe for prey below the surface substrate. Red knot regularly occur during the northward and southward migrations in low numbers, while American bittern occur year-round, though in low densities. These differences do not influence the relevance of the effects assessment conclusions, as both species use habitats close to shore and interactions with Project-associated vessels will be similar when they occur. • The use of red knot to assess effects on American bittern is considered appropriate as they possess similar distributions within the LAA, occupying habitats close to shore or onshore that largely remove them from potential interactions with marine shipping vessels.	Potential effects on American bittern from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are considered conservative as American bittern's behaviour of almost exclusively remaining in freshwater habitat removes them from potential interaction with marine shipping traffic. • Effects to American bittern productivity are not anticipated.
American coot (*Fulica Americana*)	American coot are represented by brant for the following reasons: • Like brant, American coot are waterfowl that primarily consume aquatic vegetation. American coots generally inhabit freshwater ponds and wetlands, but can also be found in coastal bays, lagoons, and other marine habitats during migration and winter. • Differences include American coot's greater tendency to remain close to nearshore habitat and avoid open marine waters. American coot occurs in the LAA year-round, while brant is most abundant during migration and winter. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on American coot is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on American coot from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as American coot's greater propensity to use nearshore habitat likely lowers its potential for interaction with vessels compared to brant. • Effects to American coot productivity are not anticipated.
American golden-plover (*Pluvialis dominica*)	American golden-plover are represented by red knot for the following reasons: • Like red knot, American golden-plover forage for aquatic invertebrates from shallow water habitats by pecking sediment. Both species forage in coastal shallow water habitats, including mudflats, shorelines, and estuaries and are not found using offshore marine environments. American golden-plover are blue-listed while red knot are red-listed and Threatened/Endangered on Schedule 1 of *SARA*. • Differences include foraging techniques, with American golden-plover using more terrestrial habitat than red knot. In the LAA, red knot occur commonly during northward and southward migrations while American golden-plover are more common along the B.C. coast during the southward fall migration. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on American golden-plover is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on American golden-plover from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for American golden-plover due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to American golden-plover productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
American wigeon (*Anas americana*)	American wigeon are represented by brant for the following reasons: • Like brant, American wigeon are waterfowl that primarily consumes aquatic vegetation. American wigeon generally inhabit intertidal zone and marsh habitat while in the LAA, regularly found foraging near the tideline, on mudflats, and at the edge of marshes. • Similar to brant, American wigeon are most abundant in the LAA during migration and winter. • Differences include American wigeon's greater tendency to remain close to nearshore habitat and avoid open marine waters. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on American wigeon is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on American wigeon from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as American wigeon's greater propensity to use nearshore habitat likely lowers its potential for interaction with vessels compared to brant. • Effects to American wigeon productivity are not anticipated.
American white pelican (*Pelecanus erythrorhynchos*)	American white pelican are represented by marbled murrelet, fork-tailed storm-petrel, and brant for the following reasons: • Like fork-tailed storm-petrel, American white pelican forage for fish from the water's surface. • Like marbled murrelet and brant, American white pelican use nearshore habitat to swim and forage. Marine habitat of the American white pelican generally includes coastal bays, inlets, and estuaries. Marine foraging by this species is poorly understood; however, there are few records of American white pelican using open marine waters in the LAA. Marbled murrelet and American white pelican are both of conservation concern (i.e., marbled murrelet are blue-listed, American white pelican are red-listed). • Differences include the foraging technique employed by each species: American white pelican dip their large bills into the water, scooping prey into their pouch; fork-tailed storm-petrel hover over, or land briefly on, the ocean surface to seize prey; brant feed on eelgrass while walking or swimming. American white pelican are typically observed in the LAA during the breeding season, but are not known to breed in the area. American white pelican occur in low numbers in the LAA compared to marbled murrelet and brant. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur. • The use of marbled murrelet, brant, and fork-tailed storm-petrel to assess effects on American white pelican is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on American white pelican from increased marine shipping traffic have been assessed through the use of marbled murrelet, brant, and fork-tailed storm-petrel as representative species' (see MSA Section 8.3.6). Details are provided below. • Potential for effects to marbled murrelet, brant, and fork-tailed storm-petrel from collisions with transiting vessels is assessed to be moderate to low (MSA Section 8.3.6.2). American white pelican's greater propensity to use nearshore habitat and limited temporal overlap with the LAA likely lowers its potential for interaction with vessels compared to marbled murrelet and fork-tailed storm-petrel, and aligns with that of brant (low). • Effects to American white pelican productivity are not anticipated.
Ancient Murrelet (*Synthliboramphus antiquus*)	Ancient murrelet are represented by marbled murrelet for the following reasons: • Like marbled murrelet, ancient murrelet use nearshore habitat and are active in winter during the day. Both species are of conservation concern (i.e., both are blue-listed and ancient murrelet also Special Concern on Schedule 1 of *SARA*). Both species are found in the LAA year-round, but are not known to breed in the LAA. • Differences include habitat use, with ancient murrelet often found over the continental shelf out of sight of land, although many feed close to shore where food concentrates near surface. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of marbled murrelet to assess effects on ancient murrelet is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on ancient murrelet from increased marine shipping traffic have been assessed through the use of marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for ancient murrelet due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to ancient murrelet productivity are not anticipated.
Baird's sandpiper (*Calidris bairdii*)	Baird's sandpiper are represented by red knot for the following reasons: • Like red knot, Baird's sandpiper forage for aquatic invertebrates and crustaceans from shallow water habitats by pecking and probing for prey in sediment. Both species forage in coastal shallow water habitats, including tidal mudflats, beaches, and estuaries, and are not found using offshore marine environments. • Differences include the temporal period when Baird's sandpiper and red knot are in the LAA: red knot occur commonly during northward and southward migrations while Baird's sandpiper are more common along the B.C. coast during the southward fall migration. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on Baird's sandpiper is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Baird's sandpiper from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for Baird's sandpiper due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to Baird's sandpiper productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Barrow’s goldeneye (*Bucephala islandica*)	Barrow’s goldeneye are represented by surf scoter for the following reasons: • Like surf scoter, Barrow's goldeneye is a common sea duck that spends fall and winter on salt water or estuaries along the coast in subtidal and intertidal habitats feeding on bivalves. • Differences include pair's tendency to isolate themselves close to shore and not form large flocks similar to surf scoter. • The use of surf scoter to assess effects on Barrow's goldeneye is considered appropriate and conservative as surf scoter are more abundant, generally occur in deep water, and therefore are more likely to interact with marine shipping traffic.	Potential effects on Barrow's goldeneye from increased marine shipping traffic have been assessed through the use of surf scoter as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Barrow's goldeneye's greater propensity to use nearshore habitat likely lowers its potential for interaction with vessels and therefore the assessment is likely conservative for this species. • Effects to Barrow's goldeneye productivity are not anticipated.
Black oystercatcher (*Haematopus bachmani*)	Black oystercatcher are represented by red knot for the following reasons: • Black oystercatcher is represented by red knot that share numerous ecological traits that will cause them to experience potential interactions with Project-associated vessels similarly and justify the selection of red knot as a representative species for black oystercatcher. • Like red knot, black oystercatcher forage for aquatic invertebrates, bivalves, and crustaceans from shallow water habitats by jabbing and probing for prey. Both species forage in coastal shallow water habitats, including intertidal mudflats, sandy shores, or bays, and are not found using offshore marine environments. • Differences include the temporal period when black oystercatcher and red knot are in the LAA and differences in intertidal habitat usage. Red knot regularly occur during the northward and southward migrations in low numbers, while black oystercatcher are year-round residents and nest within the LAA. Regarding differences in intertidal habitats used, black oystercatcher forage heavily on rocky shores exposed to surf action and on sheltered gravel or cobble shores, as well as sandy shores and mudflats of bays and sounds. Rocky, gravel, and cobble shores are generally avoided by red knot, which prefer to hunt on falling or rising tides over tidal sand flats, mudflats, and beaches. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar (when they occur) as the species are both restricted to using nearshore habitats, which are far removed from transiting vessels, and therefore will be affected by transiting vessels in a similar manner. • The use of red knot to assess effects on black oystercatcher is considered appropriate as they share numerous ecological traits, are restricted to nearshore environments, and largely possess overlapping distributions within the LAA.	Potential effects on black oystercatcher from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for black oystercatcher due to overlap in spatial distribution, habitat use (i.e., use of nearshore habitats far removed from transiting vessels), and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to black oystercatcher productivity are not anticipated.
Black scoter (*Melanitta americana*)	Black scoter are represented by surf scoter for the following reasons: • Like surf scoter, black scoter is a sea duck that feeds on bivalves and crustaceans, inhabiting subtidal and intertidal waters. Black scoter is distributed similarly to surf scoter in the LAA, but generally occurs in lower abundance. Both species are blue-listed within B.C. • The use of surf scoter to assess effects to black scoter is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on black scoter from increased marine shipping traffic have been assessed through the use of surf scoter as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for black scoter due to overlap in spatial distribution habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to black scoter productivity are not anticipated.
Black turnstone (*Arenaria melanocephala*)	Black turnstone are represented by red knot for the following reasons: • Like red knot, black turnstone forage for aquatic invertebrates, bivalves, and crustaceans from shallow water habitats by jabbing and probing for prey. Both species forage in coastal shallow water habitats, including sand beaches and intertidal mudflats, and are not found using offshore marine environments. • Differences include the temporal period when black turnstone and red knot are in the LAA: both species occur commonly during northward and southward migrations, but black turnstone also overwinter in the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on black turnstone is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on black turnstone from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for black turnstone due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to black turnstone productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Black-bellied plover (*Pluvialis squatarola*)	Black-bellied plover are represented by red knot for the following reasons: • Like red knot, black-bellied plover forage for aquatic invertebrates, bivalves, and crustaceans from shallow water habitats by pecking for prey. Both species forage in coastal shallow water habitats, including intertidal mudflats, and are not found using offshore marine environments. • Differences include the temporal period when black-bellied plover and red knot are in the LAA: both species occur commonly during northward and southward migrations, but black-bellied plover also overwinter in the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on black-bellied plover is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on black-bellied plover from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for black-bellied plover due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to black-bellied plover productivity are not anticipated.
Black-crowned night-heron (*Nycticorax nycticorax*)	Black-crowned night-heron are represented by red knot for the following reasons: • Like red knot, black-crowned night-heron forage for aquatic invertebrates, bivalves, and crustaceans from shallow water habitats by pecking and probing for prey in sediment. Both species forage in coastal shallow water habitats, including bays, estuaries, tidal mudflats, and salt marshes, and are not found using offshore marine environments. Both species are provincially red-listed and red knot is also Threatened/Endangered on Schedule 1 of *SARA*. • Differences include the temporal period when black-crowned night-heron and red knot are in the LAA: red knot regularly occur during northward and southward migrations in low numbers, while black-crowned night-heron are a rare visitor to the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on black-crowned night-heron is considered appropriate as their overlapping usage of intertidal habitats indicates they will interact with marine shipping traffic similarly.	Potential effects on black-crowned night-heron from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for black-crowned night-heron due to overlap in spatial distribution and habitat use that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to black-crowned night-heron productivity are not anticipated.
Black-footed albatross (*Phoebastria nigripes*)	Black-footed albatross are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, black-footed albatross forage for squid and crustaceans from the water's surface. Black-footed albatross are considered an offshore (pelagic) species in B.C., but are commonly seen over waters within a few nautical miles of the coast outside Juan de Fuca Strait (i.e., the LAA). • Like marbled murrelet, black-footed albatross also forage for fish and squid. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, while black-footed albatross are blue-listed provincially and Special Concern on Schedule 1 of *SARA*). • Differences include the habitat used by each species in the LAA: black-footed albatross almost exclusively use open water habitat further off the coast, over open water; fork-tailed storm-petrel and marbled murrelet occur closer to land. Black-footed albatross generally occur in the western edge of the LAA/Juan de Fuca Strait, while marbled murrelet and fork-tailed storm-petrel have been documented throughout the LAA. These differences indicate that fork-tailed storm-petrel and marbled murrelet are more likely to be exposed to and affected by collision with Project-associated marine shipping than are black-footed albatross. Black-footed albatross are only observed in the LAA from May to October, and do not breed in the area. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on black-footed albatross is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on black-footed albatross from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Black-footed albatross' propensity to use pelagic habitat likely lowers its potential for interaction with vessels in the LAA and therefore the assessment is likely conservative for this species. • Effects to black-footed albatross productivity are not anticipated.
Black-legged kittiwake (*Rissa tridactyla*)	Black-legged kittiwake are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, black-legged kittiwake forage for fish in surface waters during day and night during the winter and use surface-plunging, surface-seizing, and surface-dipping techniques. Individuals dive to depths of 0.5 to 1.0 m (0.6 m for fork-tailed storm-petrel). • Like marbled murrelet, black-legged kittiwake forage for squid and euphaeids (shrimp). Black-legged kittiwake are commonly found over deep water (>200 m), but are also observed within the Salish Sea (within LAA) regularly. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, while black-legged kittiwake are red-listed provincially). The number of documented occurrences and the species' distribution within the LAA are similar for fork-tailed storm-petrel and black-legged kittiwake. • Differences include the temporal period when black-legged kittiwake are in the LAA: black-legged kittiwakes occur occasionally during the breeding season in the LAA, but do not breed here, and occur regularly in winter. Individuals occur in a range of habitats, from nearshore to open ocean. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on black-legged kittiwake is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on black-legged kittiwake from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species' (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for black-legged kittiwake due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to black-legged kittiwake productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Blue-winged teal (*Anas discors*)	Blue-winged teal are represented by brant for the following reasons: • Like brant, blue-winged teal are waterfowl that consumes aquatic vegetation, but also feeds on aquatic invertebrates. Blue-winged teal generally inhabit intertidal zones and marshes where it forages in shallow waters. Blue-winged teal are also found in estuaries. • Differences include blue-winged teal's greater tendency to remain close to nearshore habitat and avoid open marine waters. Also, blue-winged teal occurs in the LAA during migration and the breeding season, while brant is most abundant during migration and winter. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on blue-winged teal is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on blue-winged teal from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as blue-winged teal's greater propensity to use nearshore habitat likely lowers its potential for interaction with vessels compared to brant. • Effects to blue-winged teal productivity are not anticipated.
Bonaparte's gull (*Chroicocephalus philadelphia*)	Bonaparte's gull are represented by glaucous-winged gull for the following reasons: • Like glaucous-winged gull, Bonaparte's gull are a gull species that consumes marine fish and crabs. Bonaparte's gull generally forage in coastal bays, mudflats, and beaches. Both species are found in the LAA year-round. • Differences include glaucous-winged gull breeding within the LAA, unlike Bonaparte's gull, and Bonaparte's gull being more pelagic, often frequenting offshore upwellings up to 20 km offshore. • The use of glaucous-winged gull to assess effects on Bonaparte's gull is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on Bonaparte's gull from increased marine shipping traffic have been assessed through the use of glaucous-winged gull as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to glaucous-winged gull from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for Bonaparte's gull due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to Bonaparte's gull productivity are not anticipated.
Brandt's cormorant (*Phalacrocorax penicillatus*)	Brandt's cormorant are represented by marbled murrelet for the following reasons: • Like marbled murrelet, Brandt's cormorants forage for fish by diving from the water's surface. Brandt's cormorants generally inhabit subtidal and intertidal habitat over sand or mud bottoms. Both species are of conservation concern (i.e., marbled murrelet are blue-listed while Brandt's cormorants are red-listed). Both species are found in the LAA year-round. • Differences include the foraging technique employed by each species: Brandt's cormorants dive some distance away from their prey, then resurface, driving fish to the surface, where they are caught; marbled murrelet dive beneath water's surface, and pursue prey by flying underwater. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of marbled murrelet to assess effects on Brandt's cormorant is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Brandt's cormorant from increased marine shipping traffic have been assessed marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for Brandt's cormorant due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to Brandt's cormorant productivity are not anticipated.
Bufflehead (*Bucephala albeola*)	Bufflehead are represented by surf scoter for the following reasons: • Like surf scoter, bufflehead is a sea duck that feeds on molluscs and other benthic invertebrates. Bufflehead possess a similar distribution to surf scoter within the LAA; however, they generally avoid open coast lines, preferring shallow estuarine or intertidal waters, largely keeping them close to shore. • The use of surf scoter to assess effects on bufflehead is considered appropriate and conservative as they share numerous ecological traits, but surf scoter generally occur in deeper water, further from shore, and therefore are more likely to interact with marine shipping traffic compared to bufflehead.	Potential effects on bufflehead from increased marine shipping traffic have been assessed through the use of surf scoter as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Bufflehead's greater propensity to use nearshore habitat likely lowers its potential for interaction with vessels. • Effects to bufflehead productivity are not anticipated.
Buller's shearwater (*Puffinus bulleri*)	Buller's shearwater are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, Buller's shearwater forage for fish, squid, and crustaceans from the water's surface. • Like marbled murrelet, Buller's shearwater forage for fish and squid. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, while Buller's shearwater are blue-listed). • Differences include the habitat used by each species in the LAA: Buller's shearwater almost exclusively use pelagic habitat off the coast; fork-tailed storm-petrel and marbled murrelet occur closer to land and are often within the Salish Sea. Buller's shearwater are only observed in the LAA from August to October, and do not breed in the area. Buller's shearwater's distribution in the LAA is restricted to the western end of the Juan de Fuca Strait, where sightings are infrequent. These differences indicate that fork-tailed storm-petrel and marbled murrelet are more likely to be exposed to and affected by collision with Project-associated marine shipping than are Buller's shearwater; however, these differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on Buller's shearwater is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Buller's shearwater from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for Buller's shearwater due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to Buller's shearwater productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
California gull (*Larus californicus*)	California gull are represented by glaucous-winged gull for the following reasons: • Like glaucous-winged gull, California gull are a gull species that consumes marine fish, small birds and bird eggs, and invertebrates. California gull generally inhabit subtidal and intertidal zones, as well as mudflats, beaches, and estuaries, where it forages in shallow waters. Both species are found in the LAA year-round. • Differences include California gull's blue-listed status (glaucous-winged gull is not of conservation concern). Additionally, California gull occurs in the LAA during the breeding season, but is not known to breed here; glaucous-winged gull breed in the LAA. • The use of glaucous-winged gull to assess effects on California gull is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on California gull from increased marine shipping traffic have been assessed through the use of glaucous-winged gull as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to glaucous-winged gull from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for California gull due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to California gull productivity are not anticipated.
Canada goose (*Branta canadensis*)	Canada goose are represented by brant for the following reasons: • Like brant, Canada geese are waterfowl that primarily consumes aquatic vegetation. Canada geese commonly inhabit coastal salt marshes, bays, extensive mud and sand tidal flats, sand and gravel bars, shallow brackish ponds. • Differences include Canada goose's greater tendency to remain close to nearshore habitat and avoid open marine waters. Canada goose occurs in the LAA year-round, while brant is most abundant during migration and winter. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on Canada goose is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Canada goose from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as Canada goose's behaviour of inhabiting nearshore marine habitats and avoiding open marine waters lowers its potential for interaction with vessels compared to brant. • Effects to Canada goose productivity are not anticipated.
Cassin's auklet (*Ptychoramphus aleuticus*)	Cassin's auklet are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Both fork-tailed storm-petrel and Cassin's auklet breed at the same nesting site approximately 15 km outside the LAA. • Like marbled murrelet, Cassin's auklets forage for fish, euphausiids (shrimp), and squid by diving from the water's surface, and forage during day and night. Both species are of conservation concern (i.e., marbled murrelet are blue-listed while Cassin's auklet are red-listed). Both species are round in the LAA year-round. • Differences include habitat use, with Cassin's auklets often found in open ocean, often in upwellings over the continental shelf and are less abundant within the LAA than marbled murrelet. These differences indicate that fork-tailed storm-petrel and marbled murrelet are more likely to be exposed to and affected by collision with Project-associated marine shipping than are Cassin's auklet; however, these differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on Cassin's auklet is considered appropriate as Cassin's auklets forage in the same habitat types and they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Cassin's auklet from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species' (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for Cassin's auklet due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to Cassin's auklet productivity are not anticipated.
Cinnamon teal (*Anas cyanoptera*)	Cinnamon teal are represented by brant for the following reasons: • Like brant, cinnamon teal are waterfowl that consume aquatic vegetation, but also feed on aquatic invertebrates. Cinnamon teal generally inhabit shallow waters with emergent vegetation. Cinnamon teal are also found in tidal estuaries, and brackish and salt marshes. • Differences include cinnamon teal's greater tendency to remain on fresh waters. Also, cinnamon teal occurs in the LAA during migration and the breeding season, while brant is most abundant during migration and winter. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on cinnamon teal is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on cinnamon teal from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as cinnamon teal's greater propensity to use nearshore habitat likely lowers its potential for interaction with vessels compared to brant. • Effects to cinnamon teal productivity are not anticipated.
Clark's grebe (*Aechmophorus clarkii*)	Clark's grebe are represented by marbled murrelet for the following reasons: • Like marbled murrelet, Clark's grebes forage for fish from the water's surface. Clark's grebes generally inhabit salt or brackish bays, estuaries, or sheltered sea coasts in winter. Both species are of conservation concern (i.e., marbled murrelet are blue-listed while Clark's grebe are red-listed). • Differences include the foraging technique employed by each species: Clark's grebes peer into water with eyes below surface, presumably searching for prey or potential predators, with fish pursued under water; and marbled murrelet dive and pursue their prey by flying underwater. Clark's grebe do not occur often in the LAA, and are generally absent during the breeding season. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of marbled murrelet to assess effects on Clark's grebe is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Clark's grebe from increased marine shipping traffic have been assessed through the use of marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Clark's grebe's low relative abundance in the LAA and greater propensity to forage for fish species in nearshore habitats likely lowers its potential for interaction with vessels and therefore the assessment rating is considered conservative. • Effects to Clark's grebe productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Common goldeneye (*Bucephala clangula*)	Common goldeneye are represented by surf scoter for the following reasons: • Like surf scoter, common goldeneye is a sea duck that feeds on bivalves and crustaceans, inhabiting subtidal and intertidal waters. Common goldeneye is distributed similarly to surf scoter in the LAA, but generally does not form large flocks when foraging or roosting, so generally occur in lower abundances when found. • The use of surf scoter to assess effects to common goldeneye is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on common goldeneye from increased marine shipping traffic have been assessed through the use of surf scoter as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for common goldeneye due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to common goldeneye productivity are not anticipated.
Common loon (*Gavia immer*)	Common loon are represented by marbled murrelet for the following reasons: • Like marbled murrelet, common loons forage for fish by diving from the water's surface. In winter, common loons typically occupy inshore waters but may range up to 100 km offshore across the continental shelf. Both species are found in the LAA year-round. • Differences include habitat use, with common loons typically found closer to shore. Differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of marbled murrelet to assess effects on common loon is considered appropriate as common loon forage in the same habitat types, share numerous ecological traits, and possess overlapping distributions within the LAA.	Potential effects on common loon from increased marine shipping traffic have been assessed through the use of marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for common loon due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to common loon productivity are not anticipated.
Common murre (*Uria aalge*)	Common murre are represented by marbled murrelet for the following reasons: • Like marbled murrelet, common murre forage for fish, euphausiids (shrimp), and squid by diving from the water's surface, and forage during day and crepuscular period. Both species are of conservation concern (i.e., marbled murrelet are blue-listed while common murre are red-listed). Both species are found in the LAA year-round. • Differences include population structure, with common murres forming large colonies, requiring great quantities of prey (fish) abundance. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of marbled murrelet to assess effects on common murre is considered appropriate as common murre forage in the same habitat types, share numerous ecological traits, and possess overlapping distributions within the LAA.	Potential effects on common murre from increased marine shipping traffic have been assessed through the use of marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for common murre due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to common murre productivity are not anticipated.
Common raven (*Corvus corax*)	Common raven are represented by glaucous-winged gull for the following reasons: • Like glaucous-winged gull, common raven occur in the LAA year-round, and predate on some species of smaller birds and bird eggs. Common raven generally forage in terrestrial habitats, but also make use of exposed intertidal habitat. • Common raven differ from glaucous-winged gull as common ravens do not spend time on open water. This difference in behaviour reduces the potential for interaction of common raven with Project-associated vessels. • The use of glaucous-winged gull to assess effects on common raven is considered appropriate as they share many ecological traits and possess overlapping distributions within the LAA.	Potential effects on common raven from increased marine shipping traffic have been assessed through the use of glaucous-winged gull as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to glaucous-winged gull from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative for common raven due to common raven's avoidance of inundated marine habitats, which lowers its potential for interaction with vessels. • Effects to common raven productivity are not anticipated.
Double-crested cormorant (*Phalacrocorax auritus*)	Double-crested cormorant are represented by marbled murrelet for the following reasons: • Like marbled murrelet, double-crested cormorants forage for fish by diving from the water's surface in marine habitats. Double-crested cormorants generally inhabit intertidal habitat over sandy bottoms or among rocks and in beds of sea grass or kelp. Both marbled murrelet and double-crested cormorant are blue-listed. Both species are found in the LAA year-round. • Differences include the relative importance and usage of marine and freshwater habitats to forage. Marbled murrelets primarily feeds in marine habitats with some usage of freshwater lakes during the breeding season. Double-crested cormorants commonly use marine, estuarine, and freshwater habitats. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of marbled murrelet to assess effects on double-crested cormorant is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on double-crested cormorant from increased marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for double-crested cormorant due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to double-crested cormorant productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Dunlin (*Calidris alpina*)	Dunlin are represented by red knot for the following reasons: • Like red knot, dunlin forage for aquatic invertebrates from shallow water habitats by probing for prey in sediment. Both species forage in coastal shallow water habitats, including estuaries, bays, and tidal mudflats, and are not found using offshore marine environments. • Differences include the temporal period when dunlin and red knot are in the LAA: both species occur during northward and southward migrations, but dunlin also overwinter in the LAA and occur in greater abundance. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on dunlin is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on dunlin from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for dunlin due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to dunlin productivity are not anticipated.
Eared grebe (*Podiceps nigricollis*)	Eared grebe are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, eared grebes forage in surface waters on marine invertebrates, often found in nearshore habitats. • Like marbled murrelet, eared grebes also forage for fish by diving from the water's surface. Eared grebes typically occur in shallow, nearshore situations, often using sandy or rocky beaches and coastal lagoons of mud and marsh in winter. Both marbled murrelet and eared grebe are blue-listed. • Differences include the foraging technique employed by each species: eared grebes use four capture methods: diving, head-skimming, dipping, and pecking, depending on season and prey availability. Eared grebe are generally absent from the LAA during the breeding season, but are present during winter. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on eared grebe is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on eared grebe from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Eared grebe's greater propensity to forage nearshore likely lowers its potential for interaction with vessels. • Effects to eared grebe productivity are not anticipated.
Eurasian wigeon (*Anas penelope*)	Eurasian wigeon are represented by brant for the following reasons: • Like brant, Eurasian wigeon are waterfowl that primarily consume aquatic vegetation. Eurasian wigeon generally inhabit intertidal zone and marsh habitat. Regularly found foraging near the tideline, on mudflats, and at the edge of marshes. • Similar to brant, Eurasian wigeon are most abundant in the LAA during migration and winter. • Differences include Eurasian wigeon's greater tendency to remain close to nearshore habitat and avoid open marine waters, and occurring in much lower abundances in the LAA compared to brant. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on Eurasian wigeon is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Eurasian wigeon from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as Eurasian wigeon's greater propensity to use nearshore habitat likely lowers its potential for interaction with vessels compared to brant. • Effects to Eurasian wigeon productivity are not anticipated.
Flesh-footed shearwater (*Puffinus carneipes*)	Flesh-footed shearwater are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, flesh-footed shearwater forage for fish, squid, and crustaceans from the water's surface. • Like marbled murrelet, flesh-footed shearwater forage for fish and squid. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, while flesh-footed shearwater are blue-listed). • Differences include the habitat used by each species in the LAA: flesh-footed shearwater almost exclusively use pelagic habitat off the coast, over open water; fork-tailed storm-petrel and marbled murrelet occur closer to land and are often within the Salish Sea. Flesh-footed shearwater are only observed in the LAA from May to October, and do not breed in the area. Flesh-footed shearwater's distribution in the LAA is restricted to the western end of Juan de Fuca Strait, where sightings are rare. These differences indicate that fork-tailed storm-petrel and marbled murrelet are more likely to be exposed to and affected by collision with Project-associated marine shipping than are flesh-footed shearwater; however, these differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on flesh-footed shearwater is considered appropriate as they share many ecological traits and possess overlapping distributions within the LAA.	Potential effects on flesh-footed shearwater from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Flesh-footed shearwater's propensity to use pelagic habitat likely lowers its potential for interaction with vessels in the LAA and therefore the assessment is likely conservative for this species. • Effects to flesh-footed shearwater productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Gadwall (*Anas strepera*)	Gadwall are represented by brant for the following reasons: • Like brant, gadwall are waterfowl that consume aquatic vegetation, but also feed on aquatic invertebrates. Gadwalls commonly inhabit shallow to deep wetlands, and coastal marshes and other marine habitats during migration and winter. • Similar to brant, gadwalls are most abundant in the LAA during migration and winter. • Differences include gadwall's greater tendency to remain close to nearshore habitat and avoid open marine waters. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on gadwall is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on gadwall from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as gadwall's greater propensity to use nearshore habitat likely lowers its potential for interaction with vessels compared to brant. • Effects to gadwall productivity are not anticipated.
Great blue heron (*Ardea Herodias fannini*)	Great blue heron are represented by red knot for the following reasons: • Like red knot, great blue heron forage for aquatic invertebrates and crustaceans in shallow water habitats. Both species forage in coastal shallow water habitats, including estuaries, intertidal beaches, and salt marshes, and are not found using offshore subtidal marine environments. Both species are of conservation concern (i.e., the local *fannini* subspecies of great blue heron are blue-listed and Special Concern on Schedule 1 of *SARA* while red knot are red-listed and Threatened/Endangered on Schedule 1 of *SARA*). • Differences include the temporal period when great blue heron and red knot are in the LAA: red knot regularly occur during the northward and southward migrations in low numbers, while great blue heron are year-round residents. Foraging techniques also differ, with great blue heron locating food items by sight and using a forward neck/head thrust to capture prey; red knot peck, plow, and probe for prey below the surface substrate. Great blue heron are also much larger than red knot. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on great blue heron is considered appropriate as they share ecological traits and possess overlapping habitat distributions within the LAA.	Potential effects on great blue heron from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for great blue heron due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to great blue heron productivity are not anticipated.
Greater scaup (*Aythya marila*)	Greater scaup are represented by surf scoter for the following reasons: • Like surf scoter, greater scaup is a sea duck that feeds on bivalves and crustaceans. Typically found inhabiting nearshore, shallow marine waters within the LAA. Similar to surf scoter, greater scaup is distributed throughout the LAA, but generally occurs in lower abundance, although large flocks can be documented during migration. • The use of surf scoter to assess effects to greater scaup is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways. •	Potential effects on greater scaup from increased marine shipping traffic have been assessed through the use of surf scoter as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Greater scaup's greater propensity to use nearshore habitat, away from shipping lanes, lowers its potential for interaction with vessels. • Effects to greater scaup productivity are not anticipated.
Greater white-fronted goose (*Anser albifrons*)	Greater white-fronted goose are represented by brant for the following reasons: • Like brant, greater white-fronted geese are waterfowl that primarily consume aquatic vegetation. Greater white-fronted geese commonly inhabit tidal mudflats and vegetated intertidal areas for grazing. • Similar to brant, greater white-fronted geese are most abundant in the LAA during migration and winter. • Differences include greater white-fronted goose's greater tendency to remain close to nearshore habitat and avoid open marine waters, and to occur in much lower abundance in the LAA compared to brant. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on white-fronted goose is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on greater white-fronted goose from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as greater white-fronted goose's behaviour of inhabiting nearshore marine habitats and avoiding open marine waters lowers its potential for interaction with vessels compared to brant. • Effects to greater white-fronted goose productivity are not anticipated.
Greater yellowlegs (*Tringa melanoleuca*)	Greater yellowlegs are represented by red knot for the following reasons: • Like red knot, greater yellowlegs forage for aquatic invertebrates by probing and plowing in shallow water habitats. Both species forage in coastal marshes and intertidal mudflats, and are not found using offshore marine environments. • Differences include foraging techniques, with greater yellowlegs foraging more from the water column than in sediment. Red knot regularly occur during the northward and southward migrations in low numbers, while greater yellowlegs occur year-round. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on greater yellowlegs is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on greater yellowlegs from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for greater yellowlegs due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to greater yellowlegs productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Green heron (*Butorides virescens*)	Green heron are represented by red knot for the following reasons: • Like red knot, green heron forage for aquatic invertebrates from shallow water habitats. Both species forage in coastal shallow water habitats, including salt marshes and mudflats, and are not found using offshore marine environments. Both species are listed as being of conservation concern either provincially or federally. Green heron are blue-listed while red knot are red-listed and Threatened/Endangered on Schedule 1 of *SARA*. • Differences include foraging techniques: green heron stand in a crouched position, looking into water, for long periods of time, while red knot peck at surface prey, and plow or probe for prey buried below the surface substrate. In the LAA, green heron migrate to sites outside the LAA for the breeding season (few observations from winter), while red knot occur most commonly during northward and southward migrations. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on green heron is considered appropriate as they share ecological traits and possess overlapping distributions within the LAA being restricted to nearshore habitats.	Potential effects on green heron from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for green heron due to overlap in spatial distribution and use of nearshore habitats that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to green heron productivity are not anticipated.
Green-winged teal (*Anas crecca*)	Green-winged teal are represented by brant for the following reasons: • Like brant, green-winged teal are waterfowl that consume aquatic vegetation, but also feed on aquatic invertebrates, molluscs, and crustaceans. Green-winged teal generally inhabit coastal marshes, typically with heavy vegetation and muddy bottoms. Green-winged teal are also found in estuaries. • Similar to brant, green-winged teals are most abundant in the LAA during migration and winter. • Differences include green-winged teal's greater tendency to remain close to nearshore habitat and avoid open marine waters. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on green-winged teal is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on green-winged teal from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as green-winged teal's behaviour of using nearshore intertidal, marsh, and estuarine habitats lowers its potential for interaction with vessels compared to brant. • Effects to green-winged teal productivity are not anticipated.
Harlequin duck (*Histrionicus histrionicus*)	Harlequin duck are represented by surf scoter for the following reasons: • Like surf scoter, Harlequin duck is a sea duck that primarily feeds on intertidal and subtidal marine invertebrates and crustaceans while in the LAA. Harlequin ducks are typically found inhabiting nearshore environments; however, they will use areas further offshore during specific times of year. Similar to surf scoter, Harlequin duck is distributed throughout the LAA. • The use of surf scoter to assess effects to Harlequin duck is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on Harlequin duck from increased marine shipping traffic have been assessed through the use of surf scoter as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for Harlequin duck due to overlap in spatial distribution habitat use, and foraging ecology. • Effects to Harlequin duck productivity are not anticipated.
Herring gull (*Larus argentatus*)	Herring gull are represented by glaucous-winged gull for the following reasons: • Like glaucous-winged gull, herring gull are a gull species that consumes marine fish, crabs, other seabird species, and bird eggs. Herring gull generally forage in intertidal and shallow subtidal zones, in coastal bays, mudflats, and beaches. • Unlike glaucous-winged gull, herring gull are largely absent from the LAA from April through August and have not been documented breeding within the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of glaucous-winged gull to assess effects on herring gull is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Herring gull from increased marine shipping traffic have been assessed through the use of glaucous-winged gull as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to glaucous-winged gull from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for herring gull due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to Herring gull productivity are not anticipated.
Horned grebe (*Podiceps auritus*)	Horned grebe are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, horned grebes forage in shallow waters in all seasons for amphipods and small fish and are often found using inshore habitats. • Like marbled murrelet, horned grebes also forage for fish by diving from the water's surface. Horned grebes typically occur in shallow, nearshore habitats in all seasons. Marble murrelet and horned grebe are both species of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, horned grebe is Special Concern on Schedule 1 of *SARA*). • Differences include horned grebe occurring in lower abundances during the breeding season than winter in the LAA compared to marbled murrelet. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on horned grebe is considered appropriate as they share ecological traits and possess overlapping distributions within the LAA.	Potential effects on horned grebe from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Horned grebe's greater propensity to forage using nearshore habitats likely lowers its potential for interaction with vessels. Therefore, the effects assessment is considered conservative for this species. • Effects to horned grebe productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Horned puffin (*Fratercula corniculata*)	Horned puffin are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, horned puffin forage for fish species including greenling, and euphausiids (shrimp). • Like marbled murrelet, horned puffin forage for fish species including pollock, capelin, squid, and euphausiids (shrimp). Both marbled murrelet and horned puffin are of conservation concern (i.e., marbled murrelet are blue-listed while horned puffin are red-listed). Similar to marbled murrelet, horned puffin can be seen nearshore, but are also observed regularly (in spring and summer) from 200 to 800 km offshore. • Differences include the temporal period when horned puffin are in the LAA: horned puffin occur occasionally during the breeding season in the LAA, but do not breed in the LAA, and are absent in winter, and horned puffin occur in much lower abundances than marbled murrelet. • The use of marbled murrelet and fork-tailed storm-petrel to assess effects on horned puffin is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on horned puffin from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). The use of fork-tailed storm-petrel and marbled murrelet to assess effects on horned puffin is considered conservative as horned puffins are rare summer visitor to the LAA, with individuals generally preferring shallow water to forage, and therefore are less likely to interact with marine shipping traffic. • Effects to horned puffin productivity are not anticipated.
Hudsonian godwit (*Limosa haemastica*)	Hudsonian godwit are represented by red knot for the following reasons: • Like red knot, Hudsonian godwit forage for aquatic invertebrates from shallow water habitats by probing and pecking for prey in sediment. Both species forage in coastal shallow water habitats, including salt marshes, estuaries, and tidal mudflats, and are not found using offshore marine environments. Both species are listed as being of conservation concern either provincially or federally (i.e., both are provincially red-listed and red knot is also Threatened/Endangered on Schedule 1 of *SARA*). • Differences include the temporal period when Hudsonian godwit and red knot are in the LAA: red knot regularly occur during northward and southward migrations in low numbers, while Hudsonian godwit are a rare visitor to the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on Hudsonian godwit is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Hudsonian godwit from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for Hudsonian godwit due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to Hudsonian godwit productivity are not anticipated.
Killdeer (*Charadrius vociferus*)	Killdeer are represented by red knot for the following reasons: • Like red knot, killdeer forage for aquatic invertebrates from shallow water habitats by probing for prey in sediment. Both species forage in coastal shallow water habitats, including tidal mudflats, and are not found using offshore marine environments. • Differences include the temporal period when killdeer and red knot are in the LAA: red knot regularly occur during the northward and southward migrations in low numbers, while killdeer are year-round residents. Also, killdeer are known to frequent terrestrial environments where they feed heavily on terrestrial invertebrates, such as earthworms, beetles, and grasshoppers, and removes them from potential interactions with Project-associated vessels. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on killdeer is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on killdeer from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are anticipated to be conservative for killdeer due to differences in foraging ecology, with killdeer using terrestrial habitats to a greater degree then red knot. When using intertidal environments, potential interactions with Project-associated vessels will be similar for the two species. • Effects to killdeer productivity are not anticipated.
Least sandpiper (*Calidris minutilla*)	Least sandpiper are represented by red knot for the following reasons: • Like red knot, least sandpiper forage for aquatic invertebrates from shallow water habitats by pecking and probing for prey in sediment. Both species forage in coastal shallow water habitats and are not found using offshore marine environments. • Differences include preferences in foraging habitat used while in the LAA. Least sandpiper prefers coastal wetlands to forage while red knot hunt on falling or rising tides over open tidal sand flats, mudflats, and beaches, following the shoreline. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on least sandpiper is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on least sandpiper from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for least sandpiper due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to least sandpiper productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Lesser scaup (*Aythya affinnis*)	Lesser scaup are represented by surf scoter for the following reasons: • Like surf scoter, lesser scaup is a sea duck that feeds on bivalves, crustaceans, and other aquatic invertebrates. Unlike surf scoter, aquatic plants can also comprise a large portion of their diet. They are generally coastal, but can be found offshore within the LAA. Similar to surf scoter, lesser scaup are distributed throughout the LAA, but generally occur in lower abundance, although large flocks can be documented during migration. • The use of surf scoter to assess effects to lesser scaup is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on lesser scaup from increased marine shipping traffic have been assessed through the use of surf scoter as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Lesser scaup's greater propensity to use nearshore habitat, away from shipping lanes, lowers its potential for interaction with vessels. • Effects to lesser scaup productivity are not anticipated.
Lesser yellowlegs (*Tringa flavipes*)	Lesser yellowlegs are represented by red knot for the following reasons: • Like red knot, lesser yellowlegs forage for aquatic invertebrates by pecking and probing in shallow water habitats. Both species forage in coastal marshes, estuaries, and intertidal mudflats, and are not found using offshore marine environments. • Differences include the temporal period when lesser yellowlegs and red knot are in the LAA: both species occur commonly during northward and southward migrations, but lesser yellowlegs are also common in the summer the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on lesser yellowlegs is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on lesser yellowlegs from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for lesser yellowlegs due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to lesser yellowlegs productivity are not anticipated.
Long-billed curlew (*Numenius americanus*)	Long-billed curlew are represented by red knot for the following reasons: • Like red knot, long-billed curlew forage for aquatic invertebrates, bivalves, and crustaceans by pecking and probing in shallow water habitats. Both species forage in coastal shallow water habitats, including salt marshes and tidal mudflats, and are not found using offshore marine environments. Both species are listed as being of conservation concern (i.e., long-billed curlew are blue-listed and Special Concern on Schedule 1 of *SARA* while red knot are red-listed and Threatened/Endangered on Schedule 1 of *SARA*). In the LAA, both species occur most commonly during northward and southward migrations. • Differences include foraging techniques, with long-billed curlew using slightly deeper habitat, although relatively quite shallow (<16 cm deep). This difference does not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on long-billed curlew is considered appropriate as they share ecological traits and possess overlapping distributions within the LAA.	Potential effects on long-billed curlew from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for long-billed curlew due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to long-billed curlew productivity are not anticipated.
Long-billed dowitcher (*Limnodromus scolopaceus*)	Long-billed dowitcher are represented by red knot for the following reasons: • Like red knot, long-billed dowitcher forage for aquatic invertebrates, bivalves, and crustaceans by jabbing and probing in shallow water habitats. Both species forage in coastal shallow water habitats, including tidal mudflats, though long-billed dowitcher prefer freshwater habitats. Both species do not use offshore marine environments. • Differences include the temporal period when long-billed dowitcher and red knot are in the LAA: both species occur commonly during northward and southward migrations, but long-billed dowitcher are common in the summer and a few individuals also overwinter in the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on long-billed dowitcher is considered appropriate as they share ecological traits and possess overlapping distributions within the LAA.	Potential effects on long-billed dowitcher from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for long-billed dowitcher due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to long-billed dowitcher productivity are not anticipated.
Long-tailed duck (*Clangula hyemalis*)	Long-tailed duck are represented by surf scoter for the following reasons: • Like surf scoter, long-tailed duck is a sea duck that largely feeds on crustaceans and other epibenthic invertebrates while in the LAA, inhabiting subtidal and intertidal waters. Long-tailed duck is distributed similarly to surf scoter in the LAA, but generally occurs in lower abundance. Both species are blue-listed within B.C. • The use of surf scoter to assess effects to long-tailed duck is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on long-tailed duck from increased marine shipping traffic have been assessed through the use of surf scoter as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for long-tailed duck due to overlap in spatial distribution, habitat use, and foraging ecology. • Effects to long-tailed duck productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Mallard (*Anas platyrhychos*)	Mallard are represented by brant for the following reasons: • Like brant, mallard are waterfowl that consume aquatic vegetation, but also feed on aquatic invertebrates. Mallard commonly inhabit intertidal zones and estuaries. • Differences include mallard's greater tendency to remain close to nearshore habitat and avoid open marine waters. Mallard occurs in the LAA year-round, while brant is most abundant during migration and winter. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on mallard is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on mallard from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as mallard's behaviour of using nearshore intertidal and estuarine habitats lowers its potential for interaction with vessels compared to brant. • Effects to mallard productivity are not anticipated.
Marbled godwit (*Limosa fedoa*)	Marbled godwit are represented by red knot for the following reasons: • Like red knot, marbled godwit forage for aquatic invertebrates, bivalves, and crustaceans from shallow water habitats by probing and pecking for prey in sediment. Both species forage in coastal shallow water habitats, including salt marshes, estuaries, and tidal mudflats and are not found using offshore marine environments. In the LAA, both species occur most commonly during northward and southward migrations, with a few individuals overwintering. • Differences include foraging techniques, with marbled godwit using slightly deeper habitat, although relatively quite shallow (<13 cm deep). These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on marbled godwit is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on marbled godwit from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for marbled godwit due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to marbled godwit productivity are not anticipated.
Mew gull (*Larus canus*)	Mew gull are represented by glaucous-winged gull for the following reasons: • Like glaucous-winged gull, mew gull are a gull species that consumes marine fish, crabs, mussels, other seabird species, and bird eggs. Mew gull generally forage in nearshore waters, estuaries, beaches, and mudflats. Both species are found in the LAA year-round. • Mew gull differs from glaucous-winged gull as mew gull typically nest in freshwater lakes and other interior wetlands outside the LAA, while glaucous-winged gull breed in proximity to coastal habitat within the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of glaucous-winged gull to assess effects on mew gull is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on mew gull from increased marine shipping traffic have been assessed through the use of glaucous-winged gull as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to glaucous-winged gull from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for mew gull due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to mew gull productivity are not anticipated.
Northern fulmar (*Fulmarus glacialis*)	Northern fulmar are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, northern fulmar forage for fish, squid, and crustaceans from the water's surface by dipping, surface-plunging, and surface seizing. • Like marbled murrelet, northern fulmar forage for squid and fish by pursuit-diving to depths >3 m. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, while northern fulmar are red-listed). • Differences include the temporal period when northern fulmar are in the LAA: northern fulmar occur occasionally during the breeding season in the LAA, but do not breed here, and occur regularly during migration and in winter within the LAA in low abundance. Individuals occur in a range of habitats, from nearshore to open ocean. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on northern fulmar is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on northern fulmar from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for northern fulmar due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to northern fulmar productivity are not anticipated.
Northern pintail (*Anas acuta*)	Northern pintail are represented by brant for the following reasons: • Like brant, northern pintail are waterfowl that consume aquatic vegetation, but also feed on aquatic invertebrates, and crustaceans. Northern pintail commonly inhabit intertidal habitats, tidal wetlands, bays, and estuaries. • Similar to brant, northern pintails are most abundant in the LAA during migration and winter. • Differences include northern pintail's greater tendency to remain close to nearshore habitat and avoid open marine waters. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on mallard is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on northern pintail from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as northern pintail's behaviour of using nearshore intertidal, wetlands, and estuarine habitats lowers its potential for interaction with vessels compared to brant. • Effects to northern pintail productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Northern shoveler (*Anas clypeata*)	Northern shoveler are represented by brant for the following reasons: • Like brant, northern shoveler are waterfowl that consume aquatic vegetation, though this is a small component of their diet, which is mainly composed of aquatic invertebrates and seeds. Northern shoveler commonly inhabit shallow water marine marshes. • Similar to brant, northern shoveler are most abundant in the LAA during migration and winter. • Differences include northern shoveler's greater tendency to remain in shallow water habitat and avoid open marine waters. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on northern shoveler is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on northern shoveler from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as northern shoveler's behaviour of inhabiting shallow water marine marshes lowers its potential for interaction with vessels compared to brant. • Effects to northern shoveler productivity are not anticipated.
Northwestern crow (*Corvus caurinus*)	Northwestern crow are represented by glaucous-winged gull for the following reasons: • Like glaucous-winged gull, northwestern crow occur in the LAA year-round, and predate on invertebrates, fish, small birds, and bird eggs. Northwestern crow forages extensively on intertidal beaches and reefs, and along tidal pools as well in terrestrial habitats. • Northwestern crow differs from glaucous-winged gull as northwestern crow do not spend time on open water. This difference in behaviour reduces the potential for interaction of northwestern crow with Project-associated vessels. • The use of glaucous-winged gull to assess effects on northwestern crow is considered appropriate as they share many ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on northwestern crow from increased marine shipping traffic have been assessed through the use of glaucous-winged gull as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to glaucous-winged gull from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative for northwestern crow due to northwestern crow's avoidance of inundated marine habitats, which lowers its potential for interaction with vessels. • Effects to northwestern crow productivity are not anticipated.
Pacific golden-plover (*Pluvialis fulva*)	Pacific golden-plover are represented by red knot for the following reasons: • Like red knot, Pacific golden-plover forage for aquatic invertebrates from shallow water habitats by pecking sediment. Both species forage in coastal shallow water habitats, including mudflats, shorelines, and estuaries, and are not found using offshore marine environments. • Differences include foraging techniques, with Pacific golden-plover using more terrestrial habitat than red knot. In the LAA, red knot occur commonly during northward and southward migrations while Pacific golden-plover are more common along the B.C. coast during the southward fall migration. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on Pacific golden-plover is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Pacific golden-plover from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are considered conservative for Pacific golden-plover due to its greater dependence on terrestrial habitats that remove it from potential interactions with marine vessels. • Effects to Pacific golden-plover productivity are not anticipated.
Parasitic jaeger (*Stercorarius parasiticus*)	Parasitic jaeger are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, parasitic jaeger forage for fish and crustaceans from the water's surface by dipping into the water while swimming or plunging from flight. • Like marbled murrelet, parasitic jaeger forage opportunistically, feeding on prey such as fish and crabs as available. Often found in open ocean over continental shelf, they also regularly occur in coastal bays, estuaries, and other nearshore areas. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, while parasitic jaeger are red-listed). • Differences include the foraging technique employed by each species: parasitic jaeger will often take (steal) prey from other species of seabirds, they hunt small birds and mammals (e.g., lemmings, voles, shrews), and they eat seeds, berries, and carrion; marbled murrelet and fork-tailed storm-petrel feed exclusively on aquatic prey. Parasitic jaeger occur in the LAA during the breeding season (i.e., May through November), but do not breed in the LAA, and occur during migration in low abundance. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on parasitic jaeger is considered appropriate as they share ecological traits and possess overlapping distributions within the LAA.	Potential effects on parasitic jaeger from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for parasitic jaeger due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to parasitic jaeger productivity are not anticipated.
Pectoral sandpiper (*Calidris melanotos*)	Pectoral sandpiper are represented by red knot for the following reasons: • Like red knot, pectoral sandpiper forage for aquatic invertebrates from shallow water habitats by pecking, probing, and jabbing for prey in sediment. Both species forage in coastal shallow water habitats, including tidal mudflats, beaches, and estuaries, and are not found using offshore marine environments. • The use of red knot to assess effects on pectoral sandpiper is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on pectoral sandpiper from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for pectoral sandpiper due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to pectoral sandpiper productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Pink-footed shearwater (*Puffinus creatopus*)	Pink-footed shearwater are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, pink-footed shearwater forage for fish, squid, and crustaceans from the water's surface. • Like marbled murrelet, pink-footed shearwater forage for fish and squid. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, while pink-footed shearwater are blue-listed provincially and Threatened on Schedule 1 of *SARA*). • Differences include the habitat used by each species in the LAA: pink-footed shearwater prefer more pelagic habitat further from shore than the other species, but are also occasionally found in the Salish Sea and the LAA; fork-tailed storm-petrel and marbled murrelet regularly occur closer to land. Pink-footed shearwater are typically observed in the LAA from May to November in low abundances, and do not breed in the LAA. These differences indicate that fork-tailed storm-petrel and marbled murrelet are more likely to be exposed to and affected by collision with Project-associated marine shipping than are pink-footed shearwater; however, these differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on pink-footed shearwater is considered appropriate as they share many ecological traits and possess overlapping distributions within the LAA.	Potential effects on pink-footed shearwater from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species' (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Pink-footed shearwater's propensity to use pelagic habitat likely lowers its potential for interaction with vessels in the LAA and therefore the assessment is likely conservative for this species. • Effects to pink-footed shearwater productivity are not anticipated.
Red phalarope (*Phalaropus fulicaria*)	Red phalarope are represented by surf scoter and red knot for the following reasons: • Red phalarope is taxonomically classified as a shorebird (such as red knot); however, its habitat usage while in the LAA, and therefore its potential to experience adverse Project effects, are most similar to that of a seabird, such as surf scoter. • Like red knot, red phalarope can be found using habitats close to shore. • Like surf scoter, red phalarope occupies nearshore and offshore habitat during migration and the overwintering period where it swims while foraging for marine copepods, amphipods, fish eggs, larval fish, and zooplankton, as well as other marine invertebrates. • Similar to surf scoter and red knot, red phalaropes are largely absent from the LAA during the breeding season. • Similar to surf scoter, red phalaropes can swim, dive, or fly to avoid potential disturbances. • During migration and the overwintering periods, the majority of red phalaropes occupy pelagic habitats associated with ocean fronts and upwelling zones, which reduces their usage of the LAA and results in low annual abundances in the LAA. • The use of surf scoter and red knot to assess effects on red phalarope is considered appropriate as their use of nearshore and offshore habitats results in overlapping distributions within the LAA.	Potential effects on red phalarope from increased marine shipping traffic have been assessed through the use of surf scoter and red knot as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter and red knot from collisions with transiting vessels is assessed to be low and very low, respectively (MSA Section 8.3.6). Assessment results for red phalarope are the same as that as surf scoter due to overlap in spatial distribution and habitat use. Red phalarope annually occur in much lower abundance within the LAA than surf scoter, which lowers its potential for interaction with vessels. • Effects to red phalarope productivity are not anticipated.
Red-necked phalarope (*Phalaropus lobatus*)	Red-necked phalarope are represented by surf scoter and red knot for the following reasons: • Red-necked phalarope is taxonomically classified as a shorebird (such as red knot); however, its habitat usage while in the LAA, and therefore its potential to experience adverse Project effects, are most similar to that of a seabird, such as surf scoter. • Like red knot, red phalarope can be found using habitats close to shore. • Similar to surf scoter and red knot, red-necked phalarope can be found in the LAA during migration; however, the species overwinters off the coast of Peru/Ecuador and breeds in northern Canada and Alaska, reducing its temporal usage of the LAA compared to surf scoter. • Migration mainly occurs offshore, at sea, with low numbers annually documented using the LAA. • Like surf scoter, red-necked phalarope occupies nearshore and offshore habitat within the LAA where it swims while foraging for marine copepods and small crustaceans. • Similar to surf scoter, red-necked phalaropes can swim, dive, or fly to avoid potential disturbances. • Similar to surf scoter, red-necked phalarope are blue-listed, but are also listed as special concern by COSEWIC. • The use of surf scoter and red knot to assess effects on red-necked phalarope is considered appropriate as their use of nearshore and offshore habitats results in overlapping distributions within the LAA.	Potential effects on red-necked phalarope from increased marine shipping traffic have been assessed through the use of surf scoter and red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter and red knot from collisions with transiting vessels is assessed to be low and very low, respectively (MSA Section 8.3.6). Assessment results for red-necked phalarope are the same as that as surf scoter due to overlap in spatial distribution and habitat use. Red-necked phalarope annually occur in much lower abundance, and for shorter duration, within the LAA than surf scoter, which lowers its potential for interaction with vessels. • Effects to red-necked phalarope productivity are not anticipated.
Ring-billed gull (*Larus delawarensis*)	Ring-billed gull are represented by glaucous-winged gull for the following reasons: • Like glaucous-winged gull, ring-billed gull are a gull species that consumes marine fish and invertebrates, and bird eggs. Ring-billed gull forage in shallow waters, estuaries, beaches, and mudflats. Both species can be found in the LAA year-round. • Ring-billed gull differs from glaucous-winged gull as ring-billed gull typically nest in freshwater lakes and other interior wetlands; glaucous-winged gull breed in proximity to coastal habitat with colonies occurring within the LAA. • The use of glaucous-winged gull to assess effects on ring-billed gull is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on ring-billed gull from increased marine shipping traffic have been assessed through the use of glaucous-winged gull as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to glaucous-winged gull from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for ring-billed gull due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to ring-billed gull productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Ruddy duck (*Oxyura jamaicensis*)	Ruddy duck are represented by brant for the following reasons: • Like brant, ruddy duck are waterfowl that consume aquatic vegetation, though this is a small component of their diet, which is mainly composed of aquatic invertebrates, crustaceans, zooplankton, and seeds. Ruddy duck commonly inhabit freshwater lakes and large wetlands as well as brackish coastal bays, marshes, and tidal estuaries. • Similar to brant, ruddy duck are most abundant in the LAA during migration and winter. • Differences include ruddy duck's behaviour of remaining in shallow water habitat and avoiding open marine waters, and its occurrence in much lower numbers in the LAA compared to brant. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on ruddy duck is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on ruddy duck from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as ruddy duck's behaviour of inhabiting shallow water habitats and avoiding open marine waters lowers its potential for interaction with vessels compared to brant. • Effects to ruddy duck productivity are not anticipated.
Sanderling (*Calidris alba*)	Sanderling are represented by red knot for the following reasons: • Like red knot, sanderling forage for aquatic invertebrates, bivalves, and crustaceans from shallow water habitats by pecking and probing for prey in sediment. Both species forage in coastal shallow water habitats, including tidal mud and sandflats, and are not found using offshore marine environments. • Differences include the temporal period when sanderling and red knot are in the LAA: both species occur commonly during northward and southward migrations, but sanderling are common in the winter and a few non-breeding individuals spend summers in the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on sanderling is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on sanderling from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for sanderling due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to sanderling productivity are not anticipated.
Sandhill crane (*Grus canadensis*)	Sandhill crane are represented by red knot for the following reasons: • Like red knot, sandhill crane forage for invertebrates in intertidal habitats. • Differences include sandhill crane's habitat preference: sandhill crane use shallow marshes with emergent vegetation, but have a much greater tendency to remain in terrestrial habitat. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on sandhill crane is considered appropriate as they possess similar distributions within the LAA, occupying habitats close to shore or onshore that largely remove them from potential interactions with marine shipping vessels.	Potential effects on sandhill crane from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). The use of red knot to assess effects on sandhill crane is considered conservative as sandhill crane's behaviour of heavily using terrestrial habitat removes them from potential interaction with marine shipping traffic. • Effects to sandhill crane productivity are not anticipated.
Semipalmated plover (*Charadrius semipalmatus*)	Semipalmated plover are represented by red knot for the following reasons: • Like red knot, semipalmated plover forage for aquatic invertebrates and bivalves from shallow water habitats by pecking and probing for prey in sediment. Both species forage in coastal shallow water habitats, including salt marshes, tidal mudflats, and beaches, and are not found using offshore marine environments. • Differences include the temporal period when semipalmated plover and red knot are in the LAA: both species occur commonly during northward and southward migrations, but semipalmated plover are also found in the summer the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on semipalmated plover is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on semipalmated plover from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for semipalmated plover due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to semipalmated plover productivity are not anticipated.
Short-billed dowitcher (*Limnodromus griseus*)	Short-billed dowitcher are represented by red knot for the following reasons: • Like red knot, short-billed dowitcher forage for aquatic invertebrates by jabbing and probing in shallow water habitats. Both species forage in coastal shallow water habitats, including tidal flats, beaches, salt marshes, and mudflats, and are not found using offshore marine environments. Both species are of conservation concern (i.e., short-billed dowitcher are blue-listed while red knot are red-listed and Threatened/Endangered on Schedule 1 of *SARA*). • Differences include the temporal period when short-billed dowitcher and red knot are in the LAA: both species occur commonly during northward and southward migrations, but short-billed dowitcher are also regularly documented in the summer the LAA. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of red knot to assess effects on short-billed dowitcher is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on short-billed dowitcher from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for short-billed dowitcher due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to short-billed dowitcher productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Short-tailed albatross (*Phoebastria albatrus*)	Short-tailed albatross are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, short-tailed albatross forage for fish, squid, and crustaceans from the water's surface. Short-tailed albatross are considered a pelagic species in B.C., but are commonly seen over waters within a few nautical miles of the coast. • Like marbled murrelet, short-tailed albatross' forage for fish and squid. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, while and short-tailed albatross are red-listed provincially and Threatened on Schedule 1 of *SARA*). • Differences include the habitat used by each species in the LAA: short-tailed albatross almost exclusively use pelagic habitat far from shore; fork-tailed storm-petrel and marbled murrelet occur closer to land and are often within the Salish Sea. Short-tailed albatross are rarely observed in the LAA, and do not breed in the area. These differences indicate that fork-tailed storm-petrel and marbled murrelet are more likely to be exposed to and affected by collision with Project-associated marine shipping than are short-tailed albatross; however, these differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on short-tailed albatross is considered appropriate as they share many ecological traits and possess overlapping distributions within the LAA.	Potential effects on short-tailed albatross from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Short-tailed albatross' propensity to use pelagic habitat likely lowers its potential for interaction with vessels in the LAA and therefore the assessment is likely conservative for this species. • Effects to short-tailed albatross productivity are not anticipated.
Snow goose (*Chen caerulescens*)	Snow goose are represented by brant for the following reasons: • Like brant, snow goose are waterfowl that consume aquatic vegetation, but their diet is also heavily composed of terrestrial vegetation. Snow goose commonly inhabit brackish marshes, estuaries, marine inlets and bays, shallow tidal waters, and terrestrial habitats, such as agricultural fields. • Similar to brant, snow goose are most abundant in the LAA during migration and winter. • Differences include snow goose's greater tendency to remain onshore or close to nearshore habitat and avoid open marine waters. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on snow goose is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on snow goose from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as snow goose's behaviour of inhabiting nearshore marine and terrestrial habitats and avoiding open marine waters lowers its potential for interaction with vessels compared to brant. • Effects to snow goose productivity are not anticipated.
Thayer's gull (*Larus glaucoides*)	Thayer's gull, also known as Iceland gull, are represented by glaucous-winged gull for the following reasons: • Like glaucous-winged gull, Thayer's gull are a gull species that consumes marine fish (e.g., capelin and other surface fish), marine invertebrates, and bird eggs. Thayer's gull generally forage in shallow tidal zones and occasionally along beaches. • Unlike glaucous-winged gull that breed in the LAA, Thayer's gull breed outside the LAA and are largely absent from the LAA from May through August. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of glaucous-winged gull to assess effects on Thayer's gull is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on Thayer's gull from increased marine shipping traffic have been assessed through the use of glaucous-winged gull as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to glaucous-winged gull from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for Thayer's gull due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to Thayer's gull productivity are not anticipated.
Thick-billed murre (*Uria lomvia*)	Thick billed murre are represented by marbled murrelet for the following reasons: • Like marbled murrelet, thick-billed murre forage for fish, euphausiids (shrimp), and squid by diving from the water's surface, and forage during day and night. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA* while thick-billed murre are red-listed). Thick-billed murre are most typically found in deep waters, which overlaps with marbled murrelet's usage of both nearshore and offshore habitats in the LAA. • Differences include population structure, with thick-billed murre forming large colonies, requiring great quantities of prey (fish) abundance. Thick-billed murre are generally absent from the LAA during the breeding season, with low abundances during winter. • The use of marbled murrelet to assess effects on thick-billed murre is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on thick-billed murre from increased marine shipping traffic have been assessed through the use of marbled murrelet as representative species' (see MSA Section 8.3.6). Details are provided below. • Potential for effects to marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for thick-billed murre due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to thick-billed murre productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Trumpeter swan (*Cygnus buccinator*)	Trumpeter swan are represented by brant for the following reasons: • Like brant, trumpeter swans are waterfowl that primarily consume aquatic vegetation, but occasionally also forage on fish and fish eggs, and terrestrial vegetation. • Similar to brant, trumpeter swans are most abundant in the LAA during migration and winter. • Differences include trumpeter swan's habitat preference: trumpeter swan use brackish estuaries during migration and overwintering, but have a much greater tendency to remain on freshwater habitat and avoid open marine waters. Also, trumpeter swan occur in much lower abundance in the LAA than brant. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on trumpeter swan is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on trumpeter swan from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as trumpeter swan's behaviour of using nearshore marine and terrestrial habitats and avoiding open marine waters lowers its potential for interaction with vessels compared to brant. • Effects to trumpeter swan productivity are not anticipated.
Tufted puffin (*Fratercula cirrhata*)	Tufted puffin are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, tufted puffin forage for fish species including greenling, lanternfish, rockfish, and euphausiids (shrimp) and will forage far from shore. • Like marbled murrelet, tufted puffin forage for fish species including capelin, sand lance, pollock, squid, and euphausiids (shrimp). Similar to marbled murrelet, tufted puffin occur in a range of habitats, from nearshore to deep marine habitats. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, and tufted puffin are blue-listed). • Differences include the temporal period when tufted puffin are in the LAA. Marbled murrelet are found year round within the LAA, while tufted puffin occur occasionally during the breeding season in the LAA, but are not known to breed in the LAA, and are absent in winter. Unlike marbled murrelet, tufted puffin will also use marine habitats that are far offshore. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on tufted puffin is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on tufted puffin from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for tufted puffin due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to tufted puffin productivity are not anticipated.
Tundra swan (*Cygnus columbianus*)	Tundra swan are represented by brant for the following reasons: • Like brant, tundra swans are waterfowl that primarily consume aquatic vegetation, but also forage terrestrial vegetation and occasionally on mollusks. • Similar to brant, tundra swans are most abundant in the LAA during migration and winter. Both species are of conservation concern (i.e., blue-listed within B.C). • Differences include tundra swan's habitat preference: tundra swan typically inhabit freshwater habitat and avoid open marine waters, but can be found using shallow estuarine tidal areas in winter in small numbers. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of brant to assess effects on tundra swan is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on tundra swan from increased marine shipping traffic have been assessed through the use of brant as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to brant from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are considered conservative as tundra swan's behaviour of typically inhabiting freshwater habitat and avoiding open marine waters lowers its potential for interaction with vessels compared to brant. • Effects to tundra swan productivity are not anticipated.
Wandering tattler (*Tringa incana*)	Wandering tattler are represented by red knot for the following reasons: • Like red knot, wandering tattler forage for aquatic invertebrates and crustaceans by pecking and probing in shallow water habitats. Both species forage in coastal shallow water habitats, including estuaries and mudflats, and are not found using offshore marine environments. Both species are of conservation concern (i.e., wandering tattler are blue-listed while red knot are red-listed and Threatened/Endangered on Schedule 1 of *SARA*). • Differences include the temporal period when wandering tattler and red knot are in the LAA: both species occur commonly during northward and southward migrations, but wandering tattler are also found in the summer the LAA. • The use of red knot to assess effects on wandering tattler is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on wandering tattler from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for wandering tattler due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to wandering tattler productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Western grebe (*Aechmophorus occidentalis*)	Western grebe are represented by marbled murrelet and fork-tailed storm-petrel for the following reasons: • Like fork-tailed storm-petrel, western grebe forage in surface waters at night during the winter. • Like marbled murrelet, western grebe forage for fish from the water's surface. Western grebe generally inhabit salt or brackish bays, estuaries, or sheltered sea coasts in winter. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, while western grebe are red-listed and Special Concern on Schedule 1 of *SARA*). Both species are present in the LAA year-round. • Differences include the foraging technique employed by each species: western grebe peer into water with eyes below surface, presumably searching for prey or potential predators, with fish pursued under water; storm-petrel hover over, or land briefly on, the ocean surface to seize prey; and marbled murrelet dive and pursue their prey by flying underwater. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the species when they occur. • The use of fork-tailed storm-petrel and marbled murrelet to assess effects on western grebe is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on western grebe from increased marine shipping traffic have been assessed through the use of fork-tailed storm-petrel and marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to fork-tailed storm petrel and marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for western grebe due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to tufted puffin productivity are not anticipated.
Western gull (*Larus occidentalis*)	Western gull are represented by glaucous-winged gull for the following reasons: • Like glaucous-winged gull, western gull are a gull species that consumes marine fish, crabs, gastropods, bivalves, barnacles, sea urchins, other sea birds, and bird eggs. Western gull generally forage in intertidal areas, and along rocky shores and beaches. Both species are found in the LAA year-round. • Unlike glaucous-winged gull that breed in the LAA, western gull breed outside the LAA with few individuals documented during the breeding season (~May-August). These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of glaucous-winged gull to assess effects on western gull is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on western gull from increased marine shipping traffic have been assessed through the use of glaucous-winged gull as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to glaucous-winged gull from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for western gull due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to western gull productivity are not anticipated.
Western sandpiper (*Calidris mauri*)	Western sandpiper are represented by red knot for the following reasons: • Like red knot, western sandpiper forage for aquatic invertebrates and bivalves from shallow water habitats by pecking and probing for prey in sediment. Both species forage in coastal shallow water habitats, including tidal mud and sandflats, and are not found using offshore marine environments. • Differences include the temporal period when western sandpiper and red knot are in the LAA: both species occur during northward and southward migrations, but western sandpiper are common in the summer and a few individuals also overwinter in the LAA. Western sandpiper also forage on biofilm, a substance found on some intertidal mudflats. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species. • The use of red knot to assess effects on western sandpiper is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on western sandpiper from increased marine shipping traffic have been assessed through the use of red knot as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to red knot from collisions with transiting vessels is assessed to be very low (MSA Section 8.3.6.2). Assessment results are the same for western sandpiper due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to western sandpiper productivity are not anticipated.
White-winged scoter (*Melanitta fusca*)	White-winged scoter are represented by surf scoter for the following reasons: • Like surf scoter, white-winged scoter is a sea duck that feeds on bivalves and crustaceans, inhabiting subtidal and intertidal waters. White-winged scoter are distributed similarly to surf scoter in the LAA, but generally occur in lower abundance. • The use of surf scoter to assess effects to white-winged scoter is considered appropriate as they share numerous ecological traits and possess overlapping distributions within the LAA. Sharing these attributes would result in the species experiencing potential Project effects in similar ways.	Potential effects on white-winged scoter from increased marine shipping traffic have been assessed through the use of surf scoter as a representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to surf scoter from collisions with transiting vessels is assessed to be low (MSA Section 8.3.6.2). Assessment results are the same for white-winged scoter due to overlap in spatial distribution, habitat use, and foraging ecology. • Effects to white-winged scoter productivity are not anticipated.

Species	Representative Species Rationale	Effects Assessment Relevance
Yellow-billed loon (*Gavia adamsii*)	Yellow-billed loon are represented by marbled murrelet for the following reasons: • Like marbled murrelet, yellow-billed loon forage for fish by diving from the water's surface. In winter, yellow-billed loon seem to prefer nearshore marine waters in protected embayments. Both species are of conservation concern (i.e., marbled murrelet are blue-listed provincially and Threatened on Schedule 1 of *SARA*, while yellow-billed loon are blue-listed). • Differences include the foraging technique employed by each species: yellow-billed loon peer into water with eyes below surface, presumably searching for prey, with fish pursued under water and marbled murrelet dive and pursue their prey by flying underwater. Yellow-billed loon are generally absent from the LAA during the breeding season, but are present in winter, with marbled murrelet present year-round. These differences do not influence the relevance of the effects assessment conclusions, as interactions with Project-associated vessels will be similar for the two species when they occur. • The use of marbled murrelet to assess effects on yellow-billed loon is considered appropriate as yellow-billed loon forage in the same habitat types as they share numerous ecological traits and possess overlapping distributions within the LAA.	Potential effects on yellow-billed loon from increased marine shipping traffic have been assessed through the use of marbled murrelet as representative species (see MSA Section 8.3.6). Details are provided below. • Potential for effects to marbled murrelet from collisions with transiting vessels is assessed to be moderate (MSA Section 8.3.6.2). Assessment results are the same for yellow-billed loon due to overlap in spatial distribution, habitat use, and foraging ecology that will result in the species experiencing potential effects related to transiting Project-associated vessels similarly. • Effects to yellow-billed loon productivity are not anticipated.

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IR9-04 Coastal Birds – Short-eared Owl

Information Source(s)

EIS Volume 3: Section 15.5.7.1

TDR TW-3 Wintering Raptor Study (CEAR Doc#388): Section 3.3

CEAR Doc#581

Context

In the Wintering Raptor Study Technical Data Report, the Proponent indicated that study methods used for surveying raptors were based on incidental observations while conducting the Upland Waterbird Study, Coastal Waterbird Distribution and Abundance Study, and the Abundance and Distribution of Overwintering Shorebirds Report. Environment and Climate Change Canada (CEAR Doc#581) noted that such incidental observation methods are not sufficient to establish the abundance and habitat usage of Short-eared Owls.

The raptor report also indicated that since the studies were time-constrained and surveyors were instructed to concentrate their efforts on study-specific focal species, diurnal raptors may not have been documented consistently throughout the study period. Furthermore, survey stations and transects were selected to increase the probability of observing waterfowl and shorebirds and not to maximize the detection of wintering raptors.

Environment and Climate Change Canada stated that given their special concern status under the *Species at Risk Act*, specific surveys for Short-eared Owls should have been conducted. Environment and Climate Change Canada commented that by evaluating the habitat requirements of Short-eared Owls, the Proponent would have been able to determine whether mitigation measures proposed in the EIS for reducing Barn Owl vehicle collisions could be effective for Short-eared Owls, given that both owl species share similar foraging habitat (grassland and open farmland areas) within the Project area. Environment and Climate Change Canada also stated that Short-eared Owl abundance fluctuates strongly from year to year and recommended baseline surveys over multiple years to account for interannual variation.

Additional information is needed to assess the adequacy of the baseline information provided by the Proponent for Short-eared Owls.

Information Request

Given that no surveys were conducted specifically for raptors, provide an assessment of the overall adequacy and statistical confidence of the baseline for Short-eared Owls.

Describe how the methods used account for inter-annual variation for Short-eared Owls.

Describe how the results obtained would inform the development of mitigation measures specific for Short-eared Owls. Take into consideration mitigation measures developed for road mortality as part of IR9-01 when developing this response.

VFPA Response

Based on existing knowledge pertaining to short-eared owl abundance and distribution within the local and regional assessment areas (LAA and RAA; see AIR-12.04.15-11 of CEAR Document #388[1]), and decades of previous studies conducted to understand short-eared owl ecology and the potential factors affecting its distribution and abundance (Wiggins et al. 2006), directed surveys were not warranted and a literature-based assessment was judged appropriate for the purposes of the environmental assessment.

Information pertaining to short-eared owl (*Asio flammeus*) has been presented as part of the EIS, responses to information requests received from the Canadian Environmental Assessment Agency (CEA Agency) during the completeness phase, and responses to subsequent additional information requests received from the CEA Agency during the completeness phase. For additional information not presented in this response, see Section 15.5.7 of the EIS, IR-7.31.15-09 of CEAR Document #314[2] and AIR-12.04.15-09 of CEAR Document #388 (*Species in the Local and Regional Assessment Area*), IR-7.31.15-11 of CEAR Document #314 and AIR-12.04.15-11 of CEAR Document #388 (*Species at Risk*), and IR-7.31.15-25 of CEAR Document #314 (*Project Lighting Effects*).

Given that no surveys were conducted specifically for raptors, provide an assessment of the overall adequacy and statistical confidence of the baseline for Short-eared Owls.

While no surveys specifically targeting short-eared owls (*Asio flammeus*) were conducted as part of RBT2 studies, surveys targeting upland waterbirds, coastal waterbirds, and shorebirds were adequate for detecting diurnal raptors (Hemmera 2014; TDR CB-2 and TDR CB-8 in Appendix AIR10-C of CEAR Document #388) and are supplemented with multiple years of citizen science data collected through the eBird[3] program (eBird 2018), which collectively provide data sufficient to assess the short-eared owl baseline. Upland waterbird, coastal waterbird, and shorebird surveys were conducted across a variety of habitat types during the winter, when raptor abundance is highest in Metro Vancouver (i.e., migrants from around the province overwinter in southwestern B.C. where the climate is generally more temperate). Additionally, surveys for songbirds conducted during the breeding season were located in habitat conducive to short-eared owl breeding.

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[1] CEAR Document #388 From Port Metro Vancouver to the Canadian Environmental Assessment Agency re: Completeness Review - Responses to Additional Information Requirements Follow-Up (See Reference Document # 345) including 22 Technical Data Reports.
[2] CEAR Document #314 From Port Metro Vancouver to the Canadian Environmental Assessment Agency re: Completeness Review - Responses to Additional Information Requirements (See reference document # 271) for the Environmental Impact Statement.
[3] eBird is an online database of bird observations providing scientists, researchers, and amateur naturalists with real-time data about bird distribution and abundance.

Surveys conducted for songbirds, shorebirds, and coastal and upland waterbirds were conducted across all periods when short-eared owls are known to be active (i.e., day, night, and crepuscular periods; Wiggins et al. 2006). Surveys were conducted at various times throughout the day (Hemmera 2014*a*, *b*; TDR CB-2 and TDR CB-8 in Appendix AIR10-C of CEAR Document #388), while surveys documenting barn owl (*Tyto alba*) habitat use were conducted during the crepuscular period (Hemmera 2014*c*). A summary of results found short-eared owl comprised 1% (14/1,016) of the 2012-2013 Wintering Raptor Study detections (Hemmera 2014*d*), and they were not detected during barn owl surveys and monitoring conducted between July 2012 and July 2013 (Hemmera 2014*c*), signalling a general low abundance in the vicinity of the Project.

The data collected as part of these programs aligns with existing knowledge concerning short-eared owl ecology and annual abundance within the Lower Mainland. The short-eared owl population using the Lower Mainland varies annually and seasonally largely due to fluctuations in the number of overwintering owls, which is influenced by winter conditions and associated prey availability (Cooper and Beauchesne 2004, Wiggins et al. 2006, COSEWIC 2008, CDC 2015). In years where prey abundance is limiting in other areas of B.C. due to harsh winter conditions, more owls tend to move into areas supporting suitable winter habitat (e.g., old fields, pastures, estuaries, golf courses) such as that found in the Fraser River delta, where small mammal populations are accessible. The number of resident (breeding) birds is likely less variable and at least partially dependent on the availability of suitable nesting habitat such as fallow fields, pastures, and marsh.

In the vicinity of the Project (i.e., upland habitat within 5 km of the Project area), citizen science data collected over the last 30 years indicate that winter populations have fluctuated, from a high of approximately 20 individuals in 2012-13 to a low of 0 in 1988-89, 1990-91, 1994-95, and 1998-99 ($\bar{x}$ = 6.1, SD=5.6) (eBird 2018). During the breeding season (i.e., late March through the end of June, Wiggins et al. 2006), short-eared owl abundances were much lower ranging from 0 to 2 owls ($\bar{x}$ = 0.3; SD = 0.7), which were likely associated with a nesting pair due to the timing of the observations (Hemmera et al. 2008, 2010, eBird 2018).

While the data used to inform the short-eared owl baseline was derived from multiple sources, including a citizen science program, the results of that data align with known short-eared owl ecology, and provide overall estimates of annual relative abundance among years that is sufficient to assess baseline conditions for short-eared owls. In summary, estimates indicate the occurrence of a single short-eared owl breeding territory in the vicinity (i.e., within 5 km) of the Project and an overwintering population that varies annually based on winter conditions elsewhere in the province. Short-eared owl ecology also indicates that the continued use of this area by owls will likely be driven by the continued availability of suitable foraging, roosting, and nesting habitat (e.g., fallow fields, pastures, cultivated fields, hayfields, marsh) that support an ample prey base.

Describe how the methods used account for inter-annual variation for Short-eared Owls.

Short-eared owl abundance data in the vicinity of the Project that was collected over multiple years was used to account for inter-annual variation (Hemmera 2014*a*, *b*, *c;* TDR CB-2 and

TDR CB-8 in Appendix AIR10-C of CEAR Document #388; eBird 2018). This data included 30 years of citizen science data reporting short-eared owl observations within 5 km of the Project (eBird 2018). Citizen science data has been recognised for its applicability in evaluating trends in species (Bonney et al. 2009, Sullivan et al. 2009, Dickinson et al. 2012, van Strien et al. 2013). Using the combined Project and eBird datasets allowed for an assessment in the inter-annual variability in short-eared owl abundance to be determined, as described above.

Describe how the results obtained would inform the development of mitigation measures specific for Short-eared Owls. Take into consideration mitigation measures developed for road mortality as part of IR9-01 when developing this response.

Short-eared owl shares many behavioural and life history traits (e.g., in types of prey consumed, habitat use, and foraging behaviour) with its representative species, barn owl. Barn owl are an appropriate representative species for short-eared owl due to their year-round occupancy of the area and because they are also a species of conservation concern (barn owls being Red-listed provincially and Threatened on *Species at Risk Act* (*SARA*) Schedule 1, with short-eared owls being Blue-listed provincially and Special Concern on *SARA* Schedule 1).

However, an important difference between short-eared owl and barn owl is short-eared owl's much lower susceptibility to road mortality associated with collisions with vehicles compared to barn owl. As discussed in IR9-01, barn owls are highly susceptible to road mortalities due to their habit of hunting along roadside verges (Andrusiak 1994, Ramsden 2003, Preston and Powers 2006, COSEWIC 2010). While short-eared owls use a similar hunting mode (i.e., hunting along a low flight path over suitable habitat), they tend to prefer hunting over grasslands, marshes, and fallow fields (avoiding roadside verges), which dramatically decreases their susceptibility to road mortalities. This lower incidence of mortalities has been documented in different parts of their range and is likely a common phenomenon based on their foraging preferences and habitat usage. For example, roadside mortality surveys conducted in Metro Vancouver and the central Fraser Valley in 1987, and from 1995 to 2005, documented <2% (13/952) of mortalities to be from short-eared owl compared to 57% (542/952) for barn owl (Preston and Powers 2006). A second study in northern California documented similarly low short-eared owl road mortality rates (i.e., <0.5%, 1/283) (Moore and Mangel 1996).

While the risk of road mortality for short-eared owl is considered much lower than for barn owl, a number of mitigation measures will be implemented for barn owl that will also be beneficial for short-eared owl. They are as follows:

- Connect and collaborate with local authorities to explore speed management within the LAA, as feasible, to decrease the potential for bird-vehicle collisions for multiple avian species, including short-eared owls;
- Manage vegetation within verges associated with the Project's footprint adjacent to terrestrial upland and marsh habitat potentially used by barn and short-eared owls to decrease its habitat suitability to foraging owls; and

- Implement measures to increase education and awareness of owl-vehicle collisions along roads to influence driving habits.

With the above mitigation, effects to short-eared owl are considered negligible (see response to AIR-12.04.15-11 of CEAR Document #388).

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IR9-05 Coastal Birds – Residual Effects

Information Source(s)

EIS Volume 3: Section 15; Section 17

EIS Guidelines: Section 12

Proponent Response to Additional Information Requirements of July 31, 2015 (CEAR Doc#314): IR12

Proponent Response to Follow-up Additional Information Requirements of December 4, 2015 (CEAR Doc#388): IR13

Context

In Section 15 of the EIS, the Proponent assessed potential effects of the Project on coastal birds resulting from noise and other disturbance, water quality, artificial lighting, biotic and abiotic effects, vehicle-bird collisions, and changes to habitat quantity. The Proponent concluded that, with the implementation of mitigation measures, residual effects to coastal bird productivity were predicted to be negligible or so small as not to be measurable, except for diving birds. As such, the Proponent did not carry forward any potential Project effects to the significance determination and to the cumulative effects assessment, with the exception of loss of habitat for diving birds.

The conclusions of the Proponent relied heavily on the productivity of the local assessment area to support a group or species. While this approach may inform the significance determination, it is not an appropriate justification for the conclusion that the Project would not have residual effects and would therefore not require a cumulative effects assessment. For example, the Proponent reported that effects to passerines would include small unmitigated habitat loss, effects from disturbance such as artificial light, and road mortality. For road mortality, the Proponent stated that passerines accounted for 54% of vehicle collision mortalities within the local assessment area and predicted an increase in mortality due to anticipated higher traffic volume. The Proponent determined that the mortalities resulting from the Project were considered negligible compared to population estimates for these species. No mitigation measures were proposed for this effect. The Proponent then concluded that the Project would have negligible to minor effects on the productive potential of the local assessment area to support Barn Swallow (and other passerines). Due to the Proponent's reliance on the productivity of the local assessment area rather than direct effects to bird or bird habitat, effects on passerines were not carried forward to the significance determination and to the cumulative effects assessment. In this instance, rather than concluding that the effects were negligible, the Proponent should have characterized the residual effects, made a significance determination and conducted a cumulative effects assessment for this subcomponent.

Further, in response to follow up to additional information requirement #12 from the Canadian Environmental Assessment Agency (CEAR Doc#314), the Proponent stated that several mitigation measures for coastal birds would only be partially effective in reducing the adverse effects of the Project. For residual effects to be considered negligible or non-existent, mitigation measures would have to be fully effective and reduce any adverse effects to zero. Mitigation measures proposed in Section 15 and 17 of the EIS were also not explicitly associated with the potential effects on coastal birds to which they could apply. The Proponent has not adequately substantiated the conclusions that the Project would not have residual effects, since the relationship between the effectiveness of the mitigation measures and their capacity to reduce the effects is not clearly nor systematically described.

The EIS Guidelines Section 12.1.1 required that residual effects, even if very small or deemed insignificant, be described. This is particularly important in consideration of cumulative effects assessment, where small residual project effects could combine with effects of other projects and activities that have been or will be carried out.

Additional information is required to understand the links between the project effects to coastal birds, the mitigation measures and the residual effects.

Information Request

For each subcomponent of coastal birds, describe:

- how the mitigation measures would mitigate each potential adverse effect of the Project; and
- where the mitigation measures are not fully effective, provide a characterization of the residual effects, a significance determination and a cumulative effects assessment.

For this response, a residual effect is any effect on birds and bird habitat that cannot be fully mitigated even if very small or deemed insignificant by the Proponent. Productivity of the local assessment area to support a group or species should not be the basis for determining whether there would be a residual effect of the Project.

The cumulative effects assessment must provide an analysis of the overall cumulative effects over the life of the Project, similar to additional information request #13 - Cumulative Effects Assessment from the Canadian Environmental Assessment Agency (CEAR Doc#388), and must include a consideration of:

- how the environmental component or subcomponent has been affected by past projects and activities;
- how the environmental component or subcomponent could be further affected by the residual effects of the Project; and
- how other certain and reasonably foreseeable projects and activities may also affect the environmental component or subcomponent.

VFPA Response

Background

For the coastal bird valued component (VC), the EIS described potential Project interactions that may adversely affect coastal bird populations by assessing selected representative bird species within seven distinct sub-components. The selected sub-components and associated representative species appropriately reflect the broad and diverse groups of species present within the local assessment area (LAA) and regional assessment area (RAA), each with differing life history strategies and habitat requirements (Table IR9-4 in IR-7.31.15-09 of

CEAR Document #314[1], Appendix AIR9-A in AIR-12.04.15-09 of CEAR Document #388[2]). Project-related change on coastal birds was assessed through several selected indicators. These measurable parameters provided the means to assess coastal bird populations and habitat change (collectively analogous to productivity change in the EIS). The indicators for coastal birds (EIS Table 15-2) included modelled productivity, abundance, density (number of birds/area), species diversity, distribution, foraging opportunity (energy/area/site safety), suitable habitat (habitat quantity), and contaminant levels. The applicability of the different indicators varied among sub-components (EIS Table 15-3).

The assessment focused on all Project-VC interactions that have the potential to result in *measurable* adverse effects prior to mitigation, or that are expected to be of particular concern to government, Indigenous groups, or the public. Potential project interactions considered to result in no detectable or measurable (i.e., no or negligible) adverse effects on the population were not considered in the effects assessment (see EIS Section 8.0). Section 15.7.1 of the EIS presented the rationale for the screening out of such interactions (e.g., contaminant re-suspension, water velocity, sedimentation, etc.), which are anticipated not to influence the short-term or long-term viability of coastal bird sub-components and their habitats.

For identified Project-VC interactions that have the potential to result in Project-specific adverse environmental effects, mitigation measures were then identified to avoid, eliminate, or reduce potential effects on the representative coastal bird populations and their habitats. It is important to note that not all changes in the environment constitute adverse effects; a change in a physical or biological parameter may be positive, neutral, or adverse. Moreover, each predicted change in the physical or biological environment (such as a change in habitat) must be examined to determine whether it would in fact result in an adverse effect on the population of the VC or sub-component being assessed. As the focus of concern is the sustained viability of coastal bird populations, the assessment examined residual effects at the population level. Thus, after taking into account the implementation of mitigation measures, the assessment identified adverse residual effects expected to persist and be measurable for these distinct coastal bird populations and their habitats. This approach follows the Canadian Environmental Assessment Agency's (CEA Agency's) Interim Technical Guidance (CEA Agency 2018), which defines a residual environmental effect as "*an environmental effect of a project that remains, or is predicted to remain, after mitigation measures have been implemented*". If, after taking mitigation into account, the assessment concluded that there would be no measurable or detectable residual effect on the population of the sub-component, the residual effect was deemed to be negligible. A negligible residual effect cannot be characterised, as there is no measurable magnitude, extent, frequency, duration, etc. With no detectable or measurable residual effect, significance cannot be determined.

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[1] CEAR Document #314 From Port Metro Vancouver to the Canadian Environmental Assessment Agency re: Completeness Review - Responses to Additional Information Requirements (See reference document # 271) for the Environmental Impact Statement.

[2] CEAR Document #388 From Port Metro Vancouver to the Canadian Environmental Assessment Agency re: Completeness Review - Responses to Additional Information Requirements Follow-Up (See Reference Document # 345) including 22 Technical Data Reports.

The determination of residual effects considered multiple lines of evidence, including existing information, empirical data, including Project-specific field studies, models, including the productivity model, and Indigenous traditional knowledge (IR5-29 of CEAR Document #1185[3]). The merit of each line of evidence was examined using expert opinion to draw robust conclusions. Measurable (i.e., non-negligible) residual effects were characterised using the standard criteria with specific and relevant VC definitions (EIS Table 15-14). Significance of a measurable (i.e., non-negligible) residual adverse effect was then determined by considering the nature of the residual effect and the context within which it is expected to occur. Cumulative effects assessment was completed for all measurable (i.e., non-negligible) residual effects, regardless of their significance, as per Section 8.1.9 of the EIS.

For each subcomponent of coastal birds, describe: how the mitigation measures would mitigate each potential adverse effect of the Project; and where the mitigation measures are not fully effective, provide a characterization of the residual effects, a significance determination and a cumulative effects assessment.

To respond to the Panel's request, the VFPA has developed a series of tables (**Appendix IR9-05-A** and **Appendix IR9-05-B**) to provide greater clarity around how specific mitigation measures will serve to avoid, eliminate, or reduce predicted potential measurable adverse environmental effects of the Project on coastal bird sub-component populations and habitats. The objectives of the tables for shorebirds, waterfowl, herons, diving birds, raptors, gulls and terns, and passerines in **Appendix IR9-05-A** are as follows:

- List all potential Project effects relevant to predicted changes in habitat quantity, noise and other disturbance, artificial lighting, direct mortality from vehicles, and biotic and abiotic interactions (e.g., changes in prey availability due to abiotic and abiotic interactions);
- Identify all proposed mitigation measures by potential Project effect;
- Describe how each mitigation measure would mitigate each potential adverse effect and the effectiveness[4] of each mitigation measure (i.e., whether the mitigation measure will work as it is intended); and
- Present the residual effect prediction post-mitigation (i.e., taking mitigation into account), and significance determination for any measurable (i.e., non-negligible) residual effects, including rationale for each prediction.

Each of the mitigation measures listed in **Appendix IR9-05-A** contributes to mitigating the adverse effect in whole or in part with various degrees of expected effectiveness. The residual effect predictions considered the collective and synergistic influence of the suite of mitigation measures implemented together. The mitigation measures presented in **Appendix IR9-05-A** mirror those listed in **Appendix IR13-30-A** (a compilation of mitigation measures and other commitments pertaining to the RBT2 Project). Thus, the mitigation presented in this response represents the most up-to-date information and thus supersedes the information presented

[3] CEAR Document #1185 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Requests IR5-28 and IR5-29 (See Reference Document #975).

[4] 'Effectiveness' of mitigation measures refers to the demonstrated ability of the measure to perform the function it is designed to, while 'effective' measures are required to contribute to effect reduction/avoidance, an 'effective' measure does not necessarily equate to `zero' effect.

in the EIS. In particular, **Appendix IR9-05-A** presents mitigation reflective of updated Project design; the results of, and information from, additional studies completed since EIS submission; and information received during consultation and engagement with Indigenous groups, regulators, and stakeholders.

In summary, **Appendix IR9-05-A** reconfirms that there is no measurable or discernable residual effect of the Project on six of the seven coastal birds sub-components considered, with diving ducks remaining the exception. As described in the EIS, the VFPA anticipates a residual adverse effect for diving ducks—that is, a measurable change in the population of diving ducks, measured by productivity and anticipated habitat loss—as a result of the terminal footprint removing the opportunity for diving birds to forage within the associated subtidal sand habitat (EIS Section 15.9). The assessment described in the EIS predicted that the residual effect associated with diving bird foraging will be of low magnitude, occur locally, be permanent, be irreversible, be infrequent as the habitat loss is a one-time event, and occur within a dynamic and diverse estuarine environment already surrounded with anthropogenic development.

EIS Table 15-13 presents the detailed rationale and supporting evidence for the predicted residual effect on diving birds. The residual effect was determined to be non-significant as the extent of the loss of subtidal foraging habitat within the LAA and RAA (7% and 1%, respectively) is not anticipated to limit foraging opportunities given the amount of alternate habitat (EIS Section 15.10). The assessment of future cumulative effects (EIS Section 15.11) examined the potential for the aforementioned residual effect associated with changes to diving bird populations to combine with effects of other certain or reasonably foreseeable projects and activities not already considered in the existing and expected conditions cases[5]. The Project's contribution to potential residual cumulative effects was considered negligible (EIS Section 15.11.5). For the remaining six coastal bird sub-components, the LAA will continue to support bird populations in similar abundances, densities, and richness/diversity as under existing conditions. The assessment concluded that there would be no measurable change in the populations of these sub-components, therefore no measurable residual effects that can be characterised and no significance determination that can be made. Moreover, a cumulative effects assessment is not required for those six coastal bird sub-components as there is no measurable contribution to cumulative effects.

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[5] The assessment of Project effects on coastal birds inherently considered the context of the current cumulative impacts to the sub-components within the LAA and RAA. As explained in IR-7.31.15-13 of CEAR Document #314, the description of existing conditions considers how each component has been or is being affected by other projects and activities that have been carried out. The assessment also considered expected conditions, which is the consideration of other projects and activities that have not yet been carried out but will have been carried out prior to the commencement of RBT2 (construction and operation phases), which could alter pre-Project conditions within the assessment area. In the case of coastal birds, expected conditions for coastal birds will be primarily influenced by natural environmental conditions and physical processes at Roberts Bank rather than other projects or activities (EIS section 15.6).

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Appendices

Appendix IR9-05-A	Effect Pathways for Coastal Birds, Mitigation Measures, Mitigation Effectiveness, and Predicted Residual Effects and Significance Determination by Sub-component
Appendix IR9-05-B	Aerial Extent of Habitats within the Local Assessment Area, Habitats Affected by the Project Footprint, and Habitats Used by Coastal Bird Sub-components

APPENDIX IR9-05-A

EFFECT PATHWAYS FOR COASTAL BIRDS, MITIGATION MEASURES, MITIGATION EFFECTIVENESS, AND PREDICTED RESIDUAL EFFECTS AND SIGNIFICANCE DETERMINATION BY SUB-COMPONENT

Appendix IR9-05-A Effect Pathways for Coastal Birds, Mitigation Measures, Mitigation Effectiveness, and Predicted Residual Effects and Significance Determination by Sub-component

Table IR9-05-A1 Effect Pathways for the Shorebird Sub-component, Mitigation Measures, Mitigation Effectiveness, and Predicted Residual Effects and Significance Determination

Phase: Construction	Phase: Operation	Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect, Supporting Rationale, and Significance
✓		Loss of 46.2 hectares (ha) of intertidal sand-mud, rock, intertidal marsh, and intertidal sand-mud habitat containing eelgrass, of which 0.01 ha[1] supports biofilm potentially used by shorebirds	*Construction and Operation:* *Avoidance and Project Design Mitigation* • Terminal placement in subtidal waters • Reducing the width of the causeway • Incorporation of rocky shoreline in portions of the terminal and causeway perimeters *Other Mitigation (Offsetting):* • Creation of mudflat (capable of supporting biofilm) • Creation of intertidal marsh	*Construction and Operation:* • Placing the terminal in subtidal waters (~5 km offshore) minimised the direct effects (including habitat loss) to shorebirds and their prey, which use intertidal habitats, so shorebird foraging habitat is protected and their productivity is not compromised. • Similarly, reducing the width of the causeway widening reduced effects to intertidal habitat used by shorebirds and their prey, minimised habitat loss, and protected shorebird foraging habitat. • Incorporating rocky shoreline into the terminal and causeway perimeter design creates habitat for some shorebirds and their prey, enhancing the local assessment area (LAA) for some shorebird species. • Creating onsite mudflat habitat offsets some of the predicted losses in marine invertebrates and biofilm, which are food sources for shorebirds and partially offsets habitat lost due to Project construction. • Creating onsite intertidal marsh provides foraging and roosting habitat for some species of shorebird, enhancing feeding opportunities for shorebird populations.	The mitigation is effective as intended. Avoidance mitigation is the first measure in the mitigation hierarchy to minimise effects to valued components (VCs) and is a proven effective technique. Onsite habitats (Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, the loss of intertidal foraging habitat is predicted to result in no measurable residual effect to shorebird populations. This determination is also based on empirical data indicating there exists >3,600 ha of alternate comparable foraging habitat within the LAA to support shorebird populations and their prey. The amount of foraging habitat removed (~40.4 ha sand-mud and intertidal marsh, 5.8 ha rock, and 0.01 ha of biofilm) represents approximately 1.3% of intertidal sand-mud/marsh and rock, and < 0.1% biofilm habitat of available in the LAA. Hence, foraging opportunities will not be limited. Multiple models using different modelling approaches and datasets indicate the LAA possesses a large surplus capacity of habitat supporting shorebird prey (invertebrates and biofilm) that will not be affected and will be available under 'with Project' conditions. With the Project in place, the LAA will continue to be able to support at least seven times more shorebirds than the typical peak shorebird abundances documented in the LAA, before prey limitations are experienced. This equates to >1 million shorebirds occupying Roberts Bank on a single day.
✓	✓	Noise and other disturbance	*Avoidance and Project Design Mitigation* • Placement of terminal in subtidal waters • Project optimisation associated with the Project Construction Update (PCU; CEAR Document #1210[2]) that reduced intensity of equipment use at the peak of construction *Other Mitigation during Construction:* *Noise Management Plan* • Shutdown of equipment and vehicles when not in use	*Avoidance and Project Design Mitigation* • Placing the terminal in subtidal waters (~5 km offshore) minimises the potential for disturbance during construction and operation activities, as shorebirds will be physically separated from activities associated with the terminal in the subtidal zone. • Project optimisation associated with the PCU reduced the intensity of equipment used during the peak of construction, reducing the potential for activities to disturb shorebirds.	Effective as intended. The mitigation measures that will be employed are proven approaches to reduce noise to acceptable levels and minimise the potential for adverse effects during construction activities that would reduce shorebird populations. Temporarily disturbed shorebirds are expected to relocate a short distance to access the large quantity of alternative suitable habitat in the LAA, or habituate.	Taking mitigation into account, noise and other disturbance during construction and operation is predicted to result in no measurable residual effect to shorebird populations. This determination is also based on a number of factors, including: • Placement of the terminal in subtidal waters reduced the potential for shorebirds to interact with this effect pathway, as shorebirds are restricted to the intertidal zone • The existing Roberts Bank terminals are an industrial site and are generally considered a noisy environment. Despite this, the area around the

[1] Note that direct biofilm loss presented in Section 11.0 of the EIS is 2.5 ha (0.8% of total biofilm in the LAA), based on hyperspectral mapping. The value of direct biofilm loss presented above (0.01 ha) is based on habitat mapping of biofilm ≥5% cover, which used hyperspectral data, along with field sampling and orthophoto interpretation, to identify complex polygons categorised by dominant vegetation type. In other words, 2.49 ha of the 2.5 ha mapped using hyperspectral are dominated by other habitat types (e.g., intertidal marsh, mudflat). Habitat mapping was the standard methodology applied to all habitat types within the LAA.
[2] CEAR Document #1210 From the Vancouver Fraser Port Authority to the Review Panel re: Project Construction Update (See Reference Document #995) (NOTE: Updated June 13, 2018).

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect, Supporting Rationale, and Significance
Construction	Operation					
			• Utilisation of equipment that produces less noise where feasible • Awareness and training for construction crew • Using barriers (e.g., acoustic blankets) to shield wildlife from abrupt loud noise where feasible • Increasing or ramping-up sound levels slowly to allow birds to habituate or temporarily leave the area where feasible • Where possible, implementing measures to minimise impulsive noise • During piling, use of vibratory hammer instead of impact pile driving when practical • Compliance checking for above-ground and underwater noise • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing) *Operation:* *Noise Management Plan* • Optimised tonality of equipment alarms to limit audibility on shore while meeting safety requirements • Operator awareness and training • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing)	*Construction and Operation:* The intent of these mitigation measures is to minimise the potential for disturbance effects that could affect shorebird populations by conducting activities under sound levels that may elicit flight behaviours or harm (injury or mortality) to the birds, thereby maintaining habitat quality. • Mitigation that will be implemented during construction and operation are proven techniques to reduce the overall amount and levels of noise that will be produced, and potential for the generation of excessive noise. • Turning equipment and vehicles off when not in use, using equipment that produces less noise, and performing regular maintenance activities reduces the overall noise in the surrounding environment. • Awareness training informs construction workers of the importance of the implementation of noise reduction measures and works to modify behaviours by ensuring staff understand the intent of mitigation measures and their responsibility to meet compliance. Results of this measure benefit the surrounding environment and subsequently avian health. • The use of noise barriers, such as acoustic blankets, are a proven method to shield surrounding environment from abrupt noise and reduce the ambient noise levels. These types of technologies also act as visual barriers, further reducing disturbance. • The use of ramp-up periods (soft start) is a proven technique that allows birds to gradually habituate to noise or temporarily position themselves away from potentially disruptive noise, thereby remaining within the LAA. • Vibratory hammers produce less noise (~15 dB) compared to impact hammers, and will be used when possible to reduce the incidence of impulsive noise that could disturb shorebirds. • The physical separation of shorebirds using the mud-sandflats from the causeway and terminal where construction activities will occur, along with noise reduction mitigation, minimises the potential for disturbance and the disruption of shorebird activities, ensuring shorebird populations can continue to occupy the LAA and habitat quality within the LAA is maintained.	Should mitigation measure be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account the fact that birds have habituated to current noise levels from the existing terminals, and previous construction activities (e.g., Deltaport Third Berth) and are likely to habituate to any Project-related noise increases.	terminals experiences extremely high shorebird usage, indicating likely habituation or tolerance of birds to the existing acoustic environment • Documented negligible behavioural responses and demonstrated habituation to construction activities by shorebirds associated with the Deltaport Third Berth construction indicate a likely similar response to RBT2 construction • The determination is based on anticipated noise levels, shorebirds would have to be within 100 to 140 m of pile driving or 60 to 100 m of other construction activities to encounter noise levels anticipated to initiate a flight response (i.e., ~85 dBA). Given the large quantity of suitable alternative habitat in the LAA (>3,600 ha), and that many construction activities generating loud noise will occur >140 m from the Project's land-marine interface, interactions that may disturb shorebirds will likely be infrequent and localised • The determination that there is a large amount of suitable alternative foraging habitat (>3,600 ha) available to shorebirds within the LAA. If disturbed, shorebirds are anticipated to move a short distance within the LAA (within Roberts Bank) to an area away from the disturbance, which would result in a negligible, non-measurable effect to shorebird populations • Shorebirds are intertidal species that do not use submerged habitats and are not anticipated to interact with the underwater noise effects pathway

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect, Supporting Rationale, and Significance
Construction	Operation					
				The combination of measures described herein reduces the overall levels of noise in the environment, as well as minimise the level and potential generation of impulsive noise to maintain habitat quality for shorebirds.		
✓	✓	Direct mortality from vehicles	*Construction and Operation:* As described in the EIS, there are a number of proven effective mitigation measures to reduce barn owl collisions and other coastal birds, which will also mitigate collision risk to shorebirds. These measures were expanded upon in the response to IR9-01 (CEAR Document #1322[3]). • Connect and collaborate with local authorities to support speed management within the LAA to reduce the likelihood of bird-vehicle mortalities.	*Construction and Operation:* The intent of the mitigation is to support the management of vehicular speed limits along the causeway to reduce the incidence and likelihood of bird-vehicle collisions, thereby maintaining shorebird population viability.	Effective as intended. Reducing the speed at which vehicles travel is a proven technique in reducing the potential for bird-vehicle collisions.	Taking mitigation into account, the direct mortality of shorebirds resulting from collisions with vehicles in the LAA is predicted to result in no measurable residual effect to shorebird populations based on the anticipated low frequency of shorebird-vehicle collisions.
✓	✓	Disturbance and disorientation from artificial lighting	*Construction*: • Orienting lights downward and away from known bird-occupied areas where possible • Using shielding to minimise light trespass • Controlling light levels and limiting light use to areas where activities are occurring, where possible • Where possible, using fixtures that emit light at specific wavelengths • Ensuring dredge lighting system shields light from spilling outside the basic working footprint of the dredge • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures *Operation*: • Minimising the number of light installations	*Construction and Operation:* To minimise the potential for disturbance and disorienting effects to birds from artificial light, thereby maintaining habitat quality and the continued use of an area by shorebirds. Orienting lights downward, using shielding, and ensuring dredge lighting systems shield light from spilling outside the basic working footprint are methods intended to minimise light trespass and skyglow and maintain coastal bird population (including shorebird) health. The proposed terminal will be semi-automated. As part of design mitigation, the Light Management Plan will ensure areas not occupied by humans stay dark or minimally lit, which will further reduce the likelihood of adverse effects from artificial light. Similarly, the Project design purposefully minimises the number of light installations and avoids the use of exterior decorative lights that have the potential to draw birds from distance. As proven collision avoidance measures, the proposed Project will avoid the use of solid burning or slow pulsing warning lights, use the minimum amount of on-terminal navigational obstruction	Effective as intended. The mitigation measures that will be implemented as part of the Project are a suite of measures that are proven to reduce light trespass and sky glow. Should mitigation measure be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account potential habituation by birds and the (bright) light levels from the existing terminals and the associated incremental increase with the Project. Even if shorebirds are temporarily disturbed, they would likely relocate a short distance away within alternative suitable habitat in the LAA on Robert Bank, thus not affecting shorebird populations	Taking mitigation into account, changes to artificial light is predicted to result in no measurable residual effect to shorebird populations. This determination is also based on a number of factors, including: • The existing Roberts Bank terminals being a well-lit industrial site • Additional light fixtures installed along causeway as part of the Project in the intertidal zone will not increase light levels above existing conditions. The majority of new light fixtures (94%) consist of terminal lighting located 5 km off shore. Existing data indicate shorebirds are habituated to existing lighting conditions within the intertidal zone, which will not change with the proposed Project in place • Shorebirds appear to be habituated to artificial lighting at the Roberts Bank terminals, as they nocturnally forage in close proximity to the existing terminals. Studies show light may enhance nocturnal foraging for some species • Light may affect nocturnal predation risk close to terminal; however, vast areas of alternative suitable habitat are available away from the terminal within the LAA on Roberts Bank

[3] CEAR Document #1322 From the Vancouver Fraser Port Authority to the Review Panel re: Response to Information Requests IR9-01 to IR9-04, IR10-01, IR10-27, IR10-28, IR11-06, IR11-24, IR12-08, and IR12-12 (See Reference Documents #1122, 1130, 1179, and 1206).

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect, Supporting Rationale, and Significance
Construction	Operation					
			• Orienting lights downwards and away from known bird-occupied areas where possible • Using down-shielded lighting fixtures to minimise light pollution • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures • Using of only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada • Avoiding the use of exterior decorative lights, especially on humid, foggy, or rainy nights, when illumination glow can draw birds from distance • Controlling light levels and limiting light use to areas where activities are occurring • Where possible, using fixtures that emit light at wavelengths shown to minimise disorienting effects to birds • Establishing a centralised lighting control system to select lighting where required	avoidance lighting on tall structures, and use only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada.		• There is no evidence demonstrating light disorienting shorebirds at the Roberts Bank terminals is lacking. There have been no mass stranding or mortality events documented over the 50+ years the Roberts Bank terminals have been operating (unlike elsewhere). The existing Roberts Bank terminals are one component along an existing well-lit coastline • If shorebirds are affected by Project illumination, there is >3,600 ha of alternative habitat available away from the terminal on Roberts Bank
✓	✓	Biotic and abiotic interactions (e.g., changes in prey availability)	*Avoidance and Project Design Mitigation:* The following measures were taken that directly reduced effects to habitat for shorebird prey: • Rounding the northwest terminal corner to reduce bed scour post construction • Reducing the footprint of the causeway widening to minimise effects to prey and shorebird habitat • Placing the terminal in subtidal waters to minimise effects within the intertidal zone used by shorebirds and their prey • Incorporating rocky shoreline in portions of the terminal and	The intent of the avoidance mitigation measures employed as part of the proposed Project design was to minimise potential adverse effects to coastal birds, including shorebirds. A primary mitigation measure employed early on in the Project, as part of the alternatives assessment, was the placement of the proposed Project in subtidal waters. This not only minimised the direct loss of intertidal habitat used by shorebirds, but also minimised potential indirect abiotic effects, such as changes in geomorphology, which could affect shorebird prey and impact shorebird populations. The intent of onsite habitat creation is to provide habitat to shorebirds and increase the productivity of the prey they consume.	The mitigation is effective as intended. The avoidance mitigation employed is effective in minimising potential adverse effects to shorebird populations and their prey through minimising potential geomorphic changes to the LAA (based on the analysis presented in EIS Section 5.0 and IR1-07 of CEAR Document #897[5]). Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining	Taking mitigation into account, changes to biotic and abiotic interactions is predicted to result in no measurable residual effect to shorebird populations. This determination is also based on a number of factors, including: • Through extensive and robust scientific studies, statistical analyses, modelling, and a greater understanding of factors affecting shorebird prey, it has been determined that potential effects due to changes in abiotic conditions (i.e., water column salinity) will not adversely affect shorebird populations within the LAA on Roberts Bank • Shorebirds and their prey (i.e., biofilm and invertebrates) are evolutionarily adapted to thrive in a dynamic estuarine environment. Potential changes in water column salinity with the proposed Project in place will be small compared to the annual,

[5] CEAR Document #897 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Request Package 1 (See Reference Document #559).

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect, Supporting Rationale, and Significance
Construction	Operation					
			causeway perimeters that provides habitat for shorebirds *Other Mitigation (Offsetting)*: Creation of the following onsite habitats to benefit waterfowl prey: • Mudflat (capable of supporting biofilm) – to promote productivity increases in biofilm and marine invertebrates consumed by shorebirds • Intertidal marsh – to promote productivity increases for invertebrates consumed by shorebirds and provide roosting habitat. For mitigation measures benefiting shorebird prey see EIS Sections 11.0, 12.0, and 17.0, and the response to IR13-30 (CEAR Document #1331[4]).		to conditions necessary to create functioning habitats and are anticipated to be fully effective.	seasonal, and daily changes in salinity experienced under existing conditions • Multiple models and lines of evidence based on shorebird, biofilm, and invertebrate ecology indicate the LAA annually possesses a vast surplus of prey to support shorebirds, which will continue to be available to support healthy shorebird populations with the proposed Project in place • Also, due to the placement of the proposed terminal in subtidal waters, models and studies indicate there will be no change in the predation risk to shorebirds, or in the foraging opportunity within the LAA

[4] CEAR Document #1331 From the Vancouver Fraser Port Authority to the Review Panel re: Response to Information Requests IR13-29 and IR13-30 (See Reference Document #1228).

Table IR9-05-A2 Effect Pathways for the Diving Bird Sub-component, Pertinent Mitigation Measures, Mitigation Effectiveness, and Predicted Residual Effects and Significance Determination

Phase: Construction	Phase: Operation	Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect, Supporting Rationale, and Significance
✓		Loss of 127.0 ha of soft-bottom subtidal and 33.7 ha of intertidal habitat used by diving birds	*Construction and Operation:* *Avoidance and Project Design Mitigation*: • Incorporation of rocky shoreline in portions of the terminal and causeway perimeters • Rounding the northwest corner of the terminal *Other Mitigation (Offsetting)*: • Creation of eelgrass • Creation of subtidal rock reef • Creating of sandy gravel beach	*Construction and Operation:* • Modelling indicates the design modification to round the northwest corner of the terminal will reduce the projected scour area and minimise the potential for tidal channel formation that could affect diving bird habitat. • Incorporation of rocky shoreline into the terminal and causeway perimeter design and the creation of subtidal rocky reef creates habitat for the prey of piscivorous and invertebrate eating diving birds (e.g., scoters, grebes, loons, cormorants, goldeneye), enhancing the LAA and partially offsetting habitat losses. • Similarly, the creation of onsite eelgrass habitat offsets some of the predicted losses in marine invertebrates (e.g., cockles) and forage fish fed on by a number of species in this sub-component and is anticipated to partially offset habitat loss due to the Project. • The creation of onsite sandy gravel beach habitat partially offsets some of the predicted losses to Pacific sand lance by creating spawning habitat for the species.	The mitigation is effective as intended. Avoidance mitigation is the first measure in the mitigation hierarchy to minimise effects to VCs and is a proven effective technique. Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, the loss of soft-bottom subtidal habitat foraging habitat is predicted to result in a non-significant residual effect to diving bird populations that is of low magnitude, of local extent, permanent duration, irreversible, with infrequent frequency. This determination is based on multiple lines of evidence detailing that diving bird populations are unlikely to be habitat limited and the potential effects from loss of subtidal foraging habitat due to the footprint are anticipated to be reduced through mitigation. Rationale for this determination includes: • Empirical data showing the affected subtidal foraging habitat comprises approximately 7% of the ~1,800 ha of soft-bottom subtidal foraging habitat within the LAA and the intertidal habitat comprises approximately 1% of the ~2,890 ha of similar intertidal habitat • The Roberts Bank ecosystem model predicting a 6-8% decrease in the productive capacity of the LAA to support diving birds (pre-mitigation) • Total macrofauna biomass (i.e., prey for invertebrate consuming diving birds) within this affected area is estimated to account for a relatively small proportion (3%) of average subtidal biomass • A not significant residual effects prediction of a reduction in suitable subtidal burying habitat for Pacific sand lance • A recent examination of peer-reviewed literature yielding no results identifying a linkage between orange sea pens and forage fish populations or orange sea pens and diving bird populations. Further, a review of site-specific technical data reports underpinning the EIS also showing no evidence of orange sea pen habitat supporting abundant forage fish populations • No direct or incidental observations of forage fish or coastal birds utilising orange sea pen habitat despite considerable survey effort via a variety of methods, including SCUBA, towed underwater video, trawl, purse seine, and remotely operated vehicle (ROV) • In contrast, there are well documented associations—in both the literature as well as in the baseline studies conducted for this Project—between forage fish populations and native eelgrass habitat. Five species of forage fish, including surf smelt, northern anchovy, Pacific sand lance, Pacific herring,

Phase: Construction	Phase: Operation	Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect, Supporting Rationale, and Significance
						and longfin smelt, as well as shiner perch, were caught in the large eelgrass bed on the north side of the causeway during eelgrass community surveys, by seine, in 2012/13. The Project is anticipated to have a negligible effect on native eelgrass habitat
✓	✓	Noise and other disturbance	*Avoidance and Project Design Mitigation* • Project optimisation associated with the PCU that reduced intensity of equipment use at the peak of construction • The restriction of in-water work below -5 m chart datum (CD) (e.g., dredging) during DFO's fisheries-sensitive window for Dungeness crab (i.e., no in-water works from October 15 to March 31 below -5.0 m CD). *Other Mitigation during Construction:* *Noise Management Plan* • Shutdown of equipment and vehicles when not in use • Utilisation of equipment that produces less noise where feasible • Awareness and training for construction crew • Using barriers (e.g., acoustic blankets) or other technology (e.g., bubble curtains) to shield diving birds from abrupt loud noise, where feasible, to lower sound levels below thresholds • Increasing or ramping-up sound levels slowly to allow birds to habituate or temporarily leave the area where feasible • Environmental management plan (EMP) will specify the sensitive areas (e.g., Roberts Bank Wildlife Management Area (WMA)) to be avoided by marine vessel traffic operating in the Project area during construction • Where possible, implementing measures to minimise impulsive noise • During piling, use of vibratory hammer instead of impact pile driving when practical	*Avoidance and Project Design Mitigation* • Project optimisation associated with the PCU reduced the intensity of equipment used during the peak of construction, reducing the potential for activities to disturb diving birds. • The restriction of in-water work below -5 m CD from October 15 to March 31 aligns with peak abundances of many diving bird populations in the LAA and will reduce the likelihood of disturbance. *Construction and Operation:* The intent of these mitigation measures is to minimise the potential for disturbance effects that could affect diving bird populations by conducting activities under sound levels that may elicit flight behaviours or harm (injury or mortality) to the birds or their prey (e.g., fish) and thereby maintaining habitat quality. • Mitigation that will be implemented during construction and operation are proven techniques to reduce the overall amount and levels of noise that will be produced, and potential for the generation of excessive noise. • Turning equipment and vehicles off when not in use, using equipment that produces less noise, and performing regular maintenance activities reduces the overall noise in the surrounding environment. • Awareness training informs construction workers of the importance of the implementation of noise reduction measures and works to modify behaviours by ensuring staff understand the intent of mitigation measures and their responsibility to meet compliance. Results of this measure benefit the surrounding environment and subsequently avian health. • The use of barriers and noise reduction technologies, such as acoustic blankets and bubble curtains, are a proven method to shield surrounding environment from abrupt noise and reduce the ambient noise levels. Technologies such as acoustic blankets also act as visual barriers, further reducing disturbance.	Effective as intended. The mitigation measures that will be employed are proven approaches to reduce noise to acceptable levels and minimise the potential for adverse effects during construction activities that would reduce diving bird populations. Temporarily disturbed diving birds are expected to relocate a short distance to access the large quantity of alternative suitable habitat in the LAA, or habituate. Should mitigation measures be ineffective, a change in the residual effects prediction is not anticipated, as the determination took into account the fact that diving birds have habituated to current noise levels from the existing terminals, and previous construction activities (e.g., Deltaport Third Berth) and are likely to habituate to any Project-related noise increases.	Taking mitigation into account, noise and other disturbance during construction and operation is predicted to result in no measurable residual effect to diving birds populations. This determination is also based on a number of factors, including: • The existing Roberts Bank terminals are an industrial site and are generally considered a noisy environment. Despite this, the area around the terminals experiences high diving bird usage (including a cormorant nesting colony on the Westshore Terminals coal loading jetty at the end of the Roberts Bank causeway), indicating likely habituation or tolerance of birds to noise and other disturbance associated with industrial container and coal terminals • Documented negligible behavioural responses and demonstrated habituation to construction activities by diving birds associated with the Deltaport Third Berth construction indicate a likely similar response to RBT2 construction • The restriction of in-water work below -5 m CD from October 15 to March 31, which aligns with annual high abundances of diving birds within the LAA, will reduce the potential for disturbance to diving birds during construction • Peer-reviewed literature and reports have documented few effects from underwater noise on diving birds and underwater noise levels from Project construction activities are below levels known to cause injury to diving birds. However, to reduce noise during piling, a vibratory hammer instead of impact pile driving will be used when practical. Sound reduction or dampening technologies, such as bubble curtains, will be used, if required • The determination that based on anticipated noise levels, diving birds would have to be within 100 to 140 m of pile driving, or 60 to 100 m of other construction activities, to encounter atmospheric noise levels anticipated to initiate a flight response (i.e., ~85 dBA). Given the large quantity of suitable alternative habitat in the LAA (>4,500 ha), and that

Phase: Construction	Phase: Operation	Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect, Supporting Rationale, and Significance
			• Compliance checking for above-ground and underwater noise • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing *Operation* *Noise Management Plan* • Optimised tonality of equipment alarms to limit audibility on shore while meeting safety requirements • Operator awareness and training • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing)	• The use of ramp-up periods (soft start) is a proven technique that allows birds to gradually habituate to noise or temporarily position themselves away from potentially disruptive noise, thereby remaining within the LAA. • Vibratory hammers produce less noise (~15 dB) compared to impact hammers, and will be used when possible to reduce the incidence of impulsive noise that could disturb diving birds. • The combination of measures described herein, reduce the overall levels of noise in the environment, as well as minimise the level and potential generation of impulsive noise to maintain habitat quality for diving birds.		many construction activities generating loud noise will occur >140 m from the Project's land-marine interface, interactions that could disturb diving birds will likely be infrequent and localised. If disturbed, diving birds are anticipated to move a short distance within the LAA (within Roberts Bank) to an area away from the disturbance, which would result in result in no measurable residual effect to diving birds populations • The determination that there is a large amount of suitable alternative foraging and roosting habitat (>4,500 ha) available to diving birds within the LAA.
✓	✓	Direct mortality from vehicles	*Construction and Operation:* As described in the EIS, there are a number of proven effective mitigation measures to reduce barn owl collisions and other coastal birds, which will also mitigate collision risk to diving birds. These measures were expanded upon in the response to IR9-01 (CEAR Document #1322). • Connect and collaborate with local authorities to support speed management within the LAA to reduce the likelihood of bird-vehicle mortalities.	*Construction and Operation:* The intent of the mitigation is to support the management of vehicular speed limits along the causeway to reduce the incidence and likelihood of bird-vehicle collisions, thereby maintaining diving bird population viability.	Effective as intended. Reducing the speed at which vehicles travel is a proven technique in reducing the potential for bird-vehicle collisions.	Taking mitigation into account, the direct mortality of diving birds resulting from collisions with vehicles in the LAA is predicted to result in no measurable residual effect to diving bird populations based on the anticipated low frequency of diving bird-vehicle collisions.
✓	✓	Disturbance and disorientation from artificial lighting	*Construction*: • Orienting lights downward and away from known bird-occupied areas, where possible • Using shielding to minimise light trespass • Controlling light levels and limiting light use to areas where activities are occurring, where possible • Where possible, using fixtures that emit light at specific wavelengths	*Construction and Operation:* To minimise the potential for disturbance and disorienting effects to birds from artificial light, thereby maintaining habitat quality and the continued use of an area by diving birds. Orienting lights downward, using shielding, and ensuring dredge lighting systems shield light from spilling outside the basic working footprint are methods intended to minimise light trespass and skyglow and maintain coastal bird population (including diving birds) viability.	Effective as intended. The mitigation measures that will be implemented as part of the Project are a suite of measures that are proven to reduce light trespass and sky glow. Should mitigation measure be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account potential habituation by birds and the	Taking mitigation into account, changes to artificial light is predicted to result in no measurable residual effect to diving bird populations. This determination is also based on a number of factors, including: • The existing Roberts Bank terminals being a well-lit industrial site • Diving birds appear to be habituated to artificial lighting at the Roberts Bank terminals • As piscivorous diving birds are largely visual hunters, they tend to forage during the day and roost nocturnally. Increased illumination close to the

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect, Supporting Rationale, and Significance
Construction	Operation					
			• Ensuring dredge lighting system shields light from spilling outside the basic working footprint of the dredge • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures *Operation*: • Minimising the number of light installations • Orienting lights downwards and away from known bird-occupied areas where possible • Using down-shielded lighting fixtures to minimise light pollution • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures • Using of only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada • Avoiding the use of exterior decorative lights, especially on humid, foggy, or rainy nights, when illumination glow can draw birds from distance • Controlling light levels and limiting light use to areas where activities are occurring • Where possible, using fixtures that emit light at wavelengths shown to minimise disorienting effects to birds • Establishing a centralised lighting control system to select lighting where required	The proposed terminal will be semi-automated. As part of design mitigation, the Light Management Plan will ensure areas not occupied by humans stay dark or minimally lit, which will further reduce the likelihood of adverse effects from artificial light. Similarly, the Project design purposefully minimises the number of light installations and avoids the use of exterior decorative lights that have the potential to draw birds from distance. As proven collision avoidance measures, the proposed Project will avoid the use of solid burning or slow pulsing warning lights, use the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures, and use only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada.	(bright) light levels from the existing terminals and the associated incremental increase with the Project. Even if diving birds are temporarily disturbed, they would likely relocate a short distance away within alternative suitable habitat in the LAA on Robert Bank, thus not affecting diving bird populations.	terminal may increase nocturnal foraging opportunities, especially if prey (e.g., molluscs, forage fish) are found in association with the RBT2 structure • Evidence for light disorienting diving birds at the Roberts Bank terminals is lacking. There have been no mass stranding or mortality events documented over the 50+ years the Roberts Bank terminals have been operating (unlike elsewhere). The existing Roberts Bank terminals are one component along an existing well-lit coastline • The LAA provides a large amount (>1,600 ha) of alternative suitable subtidal roosting within the LAA on Roberts Bank
✓	✓	Biotic and abiotic interactions (e.g., changes in prey availability)	*Avoidance and Project Design Mitigation:* The following measures were taken that directly reduced effects to habitat for diving bird prey: • Rounding the northwest terminal corner to reduce bed scour post construction	The intent of the avoidance mitigation measures employed as part of the proposed Project design was to minimise potential adverse effects to coastal bird populations, including diving birds. Abiotic effects (e.g., changes in salinity, total suspended solids (TSS), and sedimentation) to diving bird foraging habitat productivity within the LAA are predicted to be negligible. Increases in TSS	The avoidance and design mitigation employed is anticipated to be effective in minimising potential adverse effects to diving bird populations and their prey through minimising potential geomorphological changes to the LAA (based on the	Taking mitigation into account, changes to biotic and abiotic interactions are predicted to result in no measurable residual effect to diving bird populations. This determination is also based on a number of factors, including: • Diving birds and their prey (e.g., bivalves and forage fish) are evolutionarily adapted to thrive in a dynamic estuarine environment, with many species within the

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect, Supporting Rationale, and Significance
Construction	Operation					
			• Reducing the footprint of the causeway widening to minimise effects to prey and diving bird habitat • Placing the terminal in subtidal waters to minimise geomorphic changes to the LAA that could have unanticipated effect to some diving bird prey • Incorporating rocky shoreline in portions of the terminal and causeway perimeters that provides habitat for diving bird prey • Incorporation of refuge habitat within caisson face that provides habitat for fish • Alignment of construction activities to avoid fisheries-sensitive windows for juvenile salmon (i.e., diving bird prey) • Alignment of construction activities to avoid fisheries sensitive window for crab, benefitting marine fish (i.e., diving bird prey) that overlap spatially and temporally *Other Mitigation (Offsetting)*: Creation of the following onsite habitats to benefit diving bird prey: • Eelgrass – to promote productivity increases for juvenile salmon, juvenile rockfish, forage fish, small demersal fish, and bivalves • Intertidal marsh – to promote productivity increases for juvenile salmon and bivalves • Mudflat – to promote productivity increase in benthic invertebrates, which are also food sources for fish • Sandy gravel beach – to promote increase in forage fish and bivalve productivity • Subtidal rock reef – to promote reef fish and bivalve shellfish productivity • For mitigation measures benefiting diving birds prey, see EIS Sections 11.0, 12.0, 13.0, and 17.0, and the response to IR13-30 (CEAR Document #1331).	levels associated with Project construction will be temporary and are not anticipated to affect diving birds. Concentrations of TSS from dredging and marine works are within the natural variation of ambient TSS concentrations within the Fraser River estuary to which these birds are already accustomed. Similarly, changes to salinity levels with the proposed Project in place are anticipated to be within the natural variability currently experienced in the estuary and will not adversely affect diving birds. The intent of onsite habitat creation is to provide compensatory foraging habitat to diving birds.	analysis presented in EIS Section 5.0 and IR1-07 of CEAR Document #897). Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	sub-component occupying both freshwater and marine habitats during different parts of their annual cycle. Therefore, the potential changes in water column salinity with the proposed Project in place will be small compared to the annual, seasonal, and daily changes in salinity experienced under existing conditions and will not affect diving bird productivity or population viability • Effects to diving bird prey are considered negligible to minor, and are as follows: ○ For Pacific salmon, there is potential that the Project may affect juvenile salmon migration, prior to mitigation, which would decrease productivity. It is expected that increases in juvenile salmon productivity from increases in prey (e.g., macrofauna), predicted increases in intertidal marsh habitat through changes in environmental conditions, and from onsite offsetting will counterbalance losses. Overall, predicted net changes in Pacific salmon productive potential from the Project are expected to be negligible, with mitigation ○ For reef fish and small demersal fish, potential productivity loss from injury and mortality and changes in the acoustic environment (during construction if impact pile driving is used) will be minimised through mitigation, resulting in no measurable residual effect ○ For forage fish, potential effects of injury and mortality, acoustic harm, and changes in the light environment are anticipated to be reduced through mitigation ○ For Pacific herring, minor behaviour disturbance is predicted due to exposure to underwater sound ○ Pacific sand lance are anticipated to experience reduced productivity due to reduction in suitable subtidal burying habitat ○ For infaunal and epifaunal invertebrates, short-term productivity losses associated with construction activities (direct mortality, changes in water quality) will be offset by gains from improved habitat suitability shoreward of the terminal. Overall, a minor increase in productive potential is predicted for the sub-component ○ For bivalve shellfish, residual loss of productivity is expected through (1) direct mortality and loss of habitat in the Project footprint; and (2) reduction in suitable habitat shoreward of the terminal

Table IR9-05-A3 Effect Pathways for the Waterfowl Sub-component, Mitigation Measures, Mitigation Effectiveness, and Predicted Residual Effects and Significance Determination

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
✓		Loss of 29.8 ha of intertidal waterfowl foraging habitat composed of mudflat, biomat, eelgrass, and intertidal marsh habitat used by waterfowl. Loss of 126.9 ha of potential subtidal roosting habitat.	*Avoidance and Project Design Mitigation*: • Terminal placement in subtidal waters • Reducing the width of the causeway *Other Mitigation (Offsetting)*: • Creation of intertidal marsh • Creation of sandy gravel beach • Creation of mudflat (capable of supporting biofilm) • Creation of eelgrass	*Construction and Operation:* • Placing the terminal in subtidal waters (~5 km offshore) minimised the direct effects (including habitat loss) to waterfowl and their prey, which use intertidal habitats, so foraging habitat is protected and waterfowl population is not compromised. • Similarly, reducing the width of the causeway widening reduced effects to intertidal habitat used by waterfowl and their prey, minimised habitat loss, and protected waterfowl foraging habitat. • Creation of onsite mudflat habitat facilitates productivity increases in marine invertebrates, which are food sources for some waterfowl and partially offsets habitat lost due to Project construction. • Creation of onsite eelgrass habitat provides forage and foraging habitat to waterfowl and promotes productivity increases for marine invertebrates consumed by some waterfowl species. • Creation of onsite intertidal marsh provides forage and foraging habitat for waterfowl, enhancing feeding opportunities and maintaining population viability. • Creation of sandy gravel beach providing grit for waterfowl gizzards necessary for digestion.	The mitigation is effective as intended. Avoidance mitigation is the first measure in the mitigation hierarchy to minimise effects to VCs and is a proven effective technique. Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, the loss of intertidal foraging habitat is predicted to result in no measurable residual effect to waterfowl populations. This determination is also based on a number of factors, including: • Terminal placement in subtidal waters minimised direct intertidal habitat loss used by waterfowl and their prey (e.g., aquatic vegetation and marine invertebrates) • Reducing the footprint of causeway widening reduced effects to habitat used by waterfowl and their prey • The Roberts Bank ecosystem model predicted a minor increase (8%) in the overall potential of the LAA to support waterfowl productive potential. However, not all changes within the ecosystem model are supported by other lines of evidence, and this change is considered within the margin of error of the model • The amount of foraging habitat removed due to the Project is very small (i.e., 1.5% of the total comparable habitat in the LAA, totaling <1% of mudflat, 0% of biomat, 1% of eelgrass, and 6% of intertidal marsh), compared to similarly suitable alternative habitat in the LAA (i.e., >2,000 ha of similar alternative habitat). Similarly, with the proposed Project in place, potential subtidal roosting habitat will not be limiting, as >1,600 ha of similarly suitable habitat exists at Roberts Bank within the LAA • The removal of this habitat is not anticipated to affect waterfowl population viability in the LAA
✓	✓	Noise and other disturbance	*Avoidance and Project Design Mitigation* • Placement of terminal in subtidal waters • Project optimisation associated with the Project Construction Update that reduced intensity of equipment use at the peak of construction *Other Mitigation during Construction:* *Noise Management Plan* • Shutdown of equipment and vehicles when not in use	*Avoidance and Project Design Mitigation* • Placing the terminal in subtidal waters (~5 km offshore) minimises the potential for disturbance during to construction and operation activities, as most waterfowl usage within the LAA occurs within the intertidal zone, which is physically separated from activities associated with the terminal in the subtidal zone. • Project optimisation associated with the PCU reduced the intensity of equipment used during the peak of construction, reducing the potential for activities to disturb waterfowl.	Effective as intended. The mitigation measures that will be employed are proven approaches to reduce noise to acceptable levels and minimise the potential for adverse effects during construction activities that would reduce waterfowl populations. Temporarily disturbed waterfowl are expected to relocate a short distance to access the large quantity of alternative suitable habitat in the LAA at Roberts	Taking mitigation into account, noise and other disturbance during construction and operation is predicted to result in no measurable residual effect to waterfowl populations. This determination is also based on a number of factors, including: • The placement of the terminal in subtidal waters reduced the potential for waterfowl to interact with this effect pathway, as the majority of waterfowl usage of the LAA (Roberts Bank) is restricted to the intertidal zone

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			• Utilisation of equipment that produces less noise where feasible • Awareness and training for construction crew • Using barriers (e.g., acoustic blankets) or other technology (e.g., bubble curtains) to shield waterfowl from abrupt loud noise, where feasible, to lower sound levels below thresholds • Increasing or ramping-up sound levels slowly to allow birds to habituate or temporarily leave the area where feasible • Where possible, implementing measures to minimise impulsive noise • During piling, use of vibratory hammer instead of impact pile driving when practical • Compliance checking for above-ground and underwater noise • EMP will specify the sensitive areas (e.g., Roberts Bank WMA) to be avoided by marine vessel traffic operating in the Project area during construction • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing *Operation* *Noise Management Plan* • Optimised tonality of equipment alarms to limit audibility on shore while meeting safety requirements • Operator awareness and training • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing)	*Construction and Operation*: The intent of these mitigation measures is to minimise the potential for disturbance effects that could affect waterfowl populations by conducting activities under sound levels that may elicit flight behaviours or harm (injury or mortality) to birds and thereby maintaining habitat quality. • Mitigation that will be implemented during construction and operation are proven techniques to reduce the overall amount and levels of noise that will be produced, and potential for the generation of excessive noise. • Turning equipment and vehicles off when not in use, using equipment that produces less noise, and performing regular maintenance activities reduces the overall noise in the surrounding environment. • Awareness training informs construction workers of the importance of the implementation of noise reduction measures and works to modify behaviours by ensuring staff understand the intent of mitigation measures and their responsibility to meet compliance. Results of this measure benefit the surrounding environment and subsequently avian health. • The use of noise barriers and noise reduction technologies, such as acoustic blankets and bubble curtains, are a proven method to shield surroundings from abrupt noise and reduce the ambient noise within the surrounding environment. Technologies such as acoustic blankets also act as visual barriers, further reduce disturbance. • The use of ramp-up periods (soft start) is a proven technique that allows birds to gradually habituate to noise or temporarily position themselves away from potentially disruptive noise, thereby remaining within the LAA. • Vibratory hammers produce less noise (~15 dB) compared to impact hammers, and will be used when possible to reduce the incidence of impulsive noise that could disturb waterfowl. • The physical separation of waterfowl using the intertidal habitats from the causeway and terminal where construction activities will occur, along with noise reduction mitigation, minimises the potential for disturbance and the disruption of waterfowl activities, ensuring waterfowl	Bank, or habituate. Should mitigation measure be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account the fact that waterbirds have habituated to current noise levels from the existing terminals, and previous construction activities (e.g., Deltaport Third Berth) and are likely to habituate to any Project-related noise increases.	• Terminal placement in subtidal waters also reduced the potential for disturbance to waterfowl by reducing the amount of dredging required to construct the Project • The existing Roberts Bank terminals are an industrial site and are generally considered a noisy environment. Despite this, the area around the terminals experiences extremely high waterfowl usage, indicating likely habituation or tolerance of birds to the existing acoustic environment • Documented negligible behavioural responses and demonstrated habituation to construction activities by waterfowl associated with the Deltaport Third Berth construction indicate a likely similar response to RBT2 construction • The determination that based on anticipated noise levels, waterfowl would have to be within 100 to 140 m of pile driving or 60 to 100 m of other construction activities to encounter atmospheric noise levels anticipated to initiate a flight response (i.e., ~85 dBA). Given the large quantity of suitable alternative habitat in the LAA (>2,000 ha of foraging and >1,600 ha of roosting habitat), and that many construction activities generating loud noise will occur > 140 m from the Project's land-marine interface, interactions that may disturb waterfowl will likely be infrequent and localised • The determination that there is a large amount of suitable alternative foraging habitat (>2,000 ha) available to waterfowl within the LAA. If disturbed, waterfowl are anticipated to move a short distance within the LAA (within Roberts Bank) to an area away from the disturbance, which is likely to results in no measurable residual effect to waterfowl populations or their productivity • Waterfowl predominantly forage on vegetation within the LAA at Roberts Bank and can submerge their heads when foraging. Due to the limited duration of submersion and the physical separation of intertidal foraging activities from activities generating underwater noise, waterfowl are not anticipated to interact with the underwater noise effects pathway

Phase: Construction	Phase: Operation	Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
				populations can continue to occupy the LAA and habitat quality within the LAA is maintained. • The combination of measures described herein reduce the overall levels of noise in the environment, as well as minimise the level and potential generation of impulsive noise to maintain habitat quality for waterfowl.		
✓	✓	Direct mortality from vehicles	*Construction and Operation:* As described in the EIS, there are a number of proven effective mitigation measures to reduce barn owl collisions and other coastal birds, which will also mitigate collision risk to waterbirds. These measures were expanded upon in the response to IR9-01 (CEAR Document #1322) • Connect and collaborate with local authorities to support speed management within the LAA to reduce the likelihood of bird-vehicle mortalities.	*Construction and Operation:* The intent of the mitigation is to support the management of vehicular speed limits along the causeway to reduce the incidence and likelihood of bird-vehicle collisions, thereby maintaining waterfowl population viability.	Effective as intended. Reducing the speed at which vehicles travel is a proven technique in reducing the potential for bird-vehicle collisions.	Taking mitigation into account, the direct mortality of waterfowl resulting for collisions with vehicles in the LAA is predicted to result in no measurable residual effect to waterfowl populations based on the anticipated low frequency of waterfowl-vehicle collisions, as no waterfowl mortalities attributed to vehicle collisions were documented during an 18-month study conducted within the LAA.
✓	✓	Disturbance and disorientation from artificial lighting	*Construction:* • Orienting lights downward and away from known bird-occupied areas, where possible • Using shielding to minimise light trespass • Controlling light levels and limiting light use to areas where activities are occurring, where possible • Where possible, using fixtures that emit light at specific wavelengths • Ensuring dredge lighting system shields light from spilling outside the basic working footprint of the dredge • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures *Operation:* • Minimising the number of light installations • Orienting lights downwards and away from known bird-occupied areas where possible	*Construction and Operation:* To minimise the potential for disturbance and disorienting effects to birds from artificial light, thereby maintaining habitat quality and the continued use of an area by waterfowl. Orienting lights downward, using shielding, and ensuring dredge lighting systems shield light from spilling outside the basic working footprint are methods intended to minimise light trespass and skyglow and maintain coastal bird population (including waterfowl) viability. The proposed terminal will be semi-automated. As part of design mitigation, the Light Management Plan will ensure areas not occupied by humans stay dark or minimally lit, which will further reduce the likelihood of adverse effects from artificial light. Similarly, the Project design purposefully minimises the number of light installations and avoids the use of exterior decorative lights, that have the potential to draw birds from distance. As proven collision avoidance measures, the proposed Project will avoid the use of solid burning or slow pulsing warning lights, use the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures, and use only strobe lights at night, at the minimum intensity and	Effective as intended. The mitigation measures that will be implemented as part of the Project are a suite of measures that are proven to reduce light trespass and sky glow. Should mitigation measure be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account potential habituation by birds and the (bright) light levels from the existing terminals and the associated incremental increase with the Project. Even if waterfowl are temporarily disturbed, they would likely relocate a short distance away within alternative suitable habitat in the LAA on Robert Bank, thus not affecting waterfowl populations.	Taking mitigation into account, changes to artificial light is predicted to result in no measurable residual effect to waterfowl populations. This determination is also based on a number of factors, including: • Few effects have been documented locally to waterfowl from artificial lighting at existing Roberts Bank terminals • Effects of artificial light on nocturnal waterfowl likely differ by species, with some avoiding lit areas and other using increased illumination to increase foraging efficiency or duration, or reduce predation risk • During winter, when waterfowl are most abundant, waterfowl spend 50% or more of their nocturnal distribution foraging on grasses and waste crops on farm fields away from the Project, minimising potential interaction with Project lighting • Overwintering waterfowl have been documented locally in their highest abundances, in southwest Delta, on well-lit agricultural fields adjacent to greenhouses, indicating a potential preference for well-lit conditions. Preferred fields possessed mean illumination levels greater than anticipated levels adjacent to the proposed terminal (i.e., 3.36 lux versus 1.85 lux at POR11). Species preferring well-illuminated fields are the same abundant species

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			• Using down-shielded lighting fixtures to minimise light pollution • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures • Using of only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada • Avoiding the use of exterior decorative lights, especially on humid, foggy, or rainy nights, when illumination glow can draw birds from distance • Controlling light levels and limiting light use to areas where activities are occurring • Where possible, using fixtures that emit light at wavelengths shown to minimise disorienting effects to birds • Establishing a centralised lighting control system to select lighting where required	minimum number of flashes per minute allowable by Transport Canada.		found in the LAA (i.e., American wigeon, mallard, northern pintail, and green-winged teal) • There have been no reports of disorientation or other adverse effects to waterfowl from artificial illumination in the existing Roberts Bank terminals' 50+ years of operation • Existing data indicate waterfowl are habituated to existing lighting conditions at Roberts Bank terminals • Additional light fixtures installed along causeway as part of the Project in intertidal zone will not increase light levels above existing conditions • The LAA provides a large amount (>1,600 ha) of suitable alternative roosting habitat away from the terminal
✓	✓	Biotic and abiotic interactions (e.g., changes in prey availability)	*Avoidance and Project Design Mitigation:* The following measures were taken that directly reduced effects to waterfowl prey/habitats, thereby providing benefits to waterfowl: • Rounding the northwest terminal corner to reduce bed scour post construction • Reducing footprint of the causeway widening to minimise effects to prey and waterfowl habitat • Placing the terminal in subtidal waters to minimise geomorphic changes to the LAA that could have unanticipated effect to some waterfowl and their prey • Incorporating of rocky shoreline in portions of the terminal and causeway perimeters that provides habitat for waterfowl prey *Other Mitigation (Offsetting)*:	The intent of the avoidance mitigation measures employed as part of the proposed Project design was to minimise potential adverse effects to waterfowl populations. A primary mitigation measure employed early on in the Project, as part of the alternatives assessment, was the placement of the proposed Project in subtidal waters. This not only minimised the direct loss of intertidal habitat used by waterfowl, but was also minimised potential indirect abiotic effects, such as changes in geomorphology, which could affect waterfowl prey and impact waterfowl population. For waterfowl, abiotic effects (e.g., changes in salinity, TSS, and sedimentation) to foraging habitat productivity within the LAA are predicted to be minimal. Increases in TSS levels associated with Project construction will be temporary and are not anticipated to affect waterfowl. Concentrations of TSS from dredging and marine works are within the natural variation of ambient TSS concentrations within the Fraser River estuary to which these birds are already accustomed.	The avoidance mitigation employed was effective in minimising potential adverse effects to waterfowl populations and their prey through minimising potential geomorphic changes to the LAA (based on the analysis presented in EIS Section 5.0 and IR1-07 of CEAR Document #897). Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, changes to biotic and abiotic interactions are predicted to result in no measurable residual effect to waterfowl populations. This determination is also based on a number of factors, including: • Waterfowl and their prey (e.g., aquatic and marsh vegetation and marine invertebrates) are evolutionarily adapted to thrive in a dynamic estuarine environment, with many species within the sub-component occupying both freshwater and marine habitats during different parts of their annual cycle. Therefore, the potential changes in water column salinity with the proposed Project in place will be small compared to the annual, seasonal, and daily changes in salinity experienced under existing conditions and will not affect waterfowl productivity or population viability • Effects to other abiotic factors (e.g., TSS and sedimentation) affecting waterfowl foraging habitat productivity within the LAA are predicted to be negligible

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			Creation of the following onsite habitats to benefit waterfowl prey: • Eelgrass – to promote productivity increases for an aquatic plant species consumed by numerous waterfowl species and to promote productivity increases in marine invertebrates consumed by some waterfowl • Intertidal marsh – to promote productivity increases in plant species directly consumed by waterfowl, and which provides habitat for invertebrates preyed upon by waterfowl • Mudflat – to promote productivity increase in benthic invertebrates consumed by some waterfowl species For mitigation measures benefiting waterfowl prey, see EIS Sections 11.0, 12.0, and 17.0, and the response to IR13-30 (CEAR Document #1331).	The intent of onsite habitat creation is to provide habitat to waterfowls and increase the productivity of the prey they consume.		• The ability of the LAA to support waterfowl populations is predicted to remain unchanged with the Project, as: ○ No adverse residual effects are anticipated for marine vegetation sub-components ○ Short-term infaunal and epifaunal invertebrates productivity losses associated with construction activities (direct mortality, changes in water quality) will be offset by gains from improved habitat suitability, with an overall minor increase in productive potential predicted for the sub-component

Table IR9-05-A4 Effect Pathways for the Gulls and Terns Sub-component, Mitigation Measures, Mitigation Effectiveness, and Predicted Residual Effects and Significance Determination

Phase: Construction	Phase: Operation	Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
✓		Loss of 173.1 ha of intertidal and subtidal habitat composed of sand-flat/mudflat, eelgrass, tidal marsh habitat, rock, and open water used by gulls and terns for foraging and roosting, comprising approximately 3.2% of the total comparable habitat within LAA.	*Avoidance and Project Design Mitigation*: • Terminal placement in subtidal waters • Reducing the width of the causeway • Incorporation of rocky shoreline in portions of the terminal and causeway perimeters that provides habitat for gull and tern prey (e.g., fish, marine invertebrates) and species on which prey depend *Other Mitigation (offsetting)*: • Creation of intertidal marsh • Creation of mudflat (capable of supporting biofilm) • Creation of eelgrass	*Construction and Operation:* • Placing the terminal in subtidal waters (~5 km offshore) minimised the direct effects (including habitat loss) to gulls and terns and their prey. These avian species predominantly occupy intertidal habitats. • Reducing the width of the causeway widening reduced effects to intertidal habitat used by gulls and terns and their prey, minimised habitat loss, and protected foraging habitat. • Incorporation of rocky shoreline into the terminal and causeway perimeter design and the creation of subtidal rocky reef creates habitat for the prey for gulls and terns (e.g., forage fish, marine invertebrates), enhancing the LAA and partially offsetting habitat losses. • Creation of onsite eelgrass – to promote productivity increases for juvenile salmon, juvenile rockfish, forage fish, and small demersal fish (potential gull and tern prey species). • Creation of onsite intertidal marsh – to promote productivity increases for juvenile salmon (potential gull and tern prey species). • Creation of onsite mudflat – to promote productivity increase in benthic invertebrates, which are food sources for fish and other marine invertebrates (potential gull and tern prey species). • Creation of onsite sandy gravel beach – to promote increase in forage fish (potential gull and tern prey species). • Creation of onsite subtidal rock reef – to promote increase in reef fish productivity (potential gull and tern prey species).	The mitigation is effective as intended. Avoidance mitigation is the first measure in the mitigation hierarchy to minimise effects to VCs and is a proven effective technique. Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, the loss of intertidal and subtidal habitats is predicted to result in no measurable residual effect to gull and tern populations. This determination is also based on a number of factors, including: • Terminal placement in subtidal waters minimised direct intertidal habitat loss used by gulls and terns and their prey • Reducing the footprint of causeway widening reduced effects to habitat used by gulls and terns and their prey • The Roberts Bank ecosystem model predicting a 1-3% decrease in the productive capacity of the LAA to support gulls and terns (pre-mitigation), largely resulting from the proposed Project's footprint • The amount of habitat removed due to the Project is very small compared to similarly suitable alternative habitat in the LAA (>3,600 ha of intertidal and >1,600 ha of subtidal habitat). The removal of this habitat is not anticipated to affect gull and tern populations using the LAA or the ability of the LAA to support existing gull and tern populations into the future.
✓	✓	Noise and other disturbance	*Avoidance and Project Design Mitigation* • Placement of terminal in subtidal waters • Project optimisation associated with the PCU that reduced intensity of equipment use at the peak of construction *Other Mitigation during Construction:* *Noise Management Plan* • Shutdown of equipment and vehicles when not in use	*Avoidance and Project Design Mitigation* • Placing the terminal in subtidal waters (~5 km offshore) minimises the potential for disturbance during to construction and operation activities, as most gull and tern usage within the LAA occurs within the intertidal zone, which is physically separated from activities associated with the terminal in the subtidal zone. • Project optimisation associated with the PCU reduced the intensity of equipment used during	Effective as intended. The mitigation measures that will be employed are proven approaches to reduce noise to acceptable levels and minimise the potential for adverse effects during construction activities that would reduce gull and tern populations. Temporarily disturbed gulls and terns are expected to relocate a short distance to access the large quantity of alternative suitable	Taking mitigation into account, noise and other disturbance during construction and operation is predicted to result in no measurable residual effect to gull and tern populations. This determination is also based on a number of factors, including: • Terminal placement in subtidal waters reduced the potential for disturbance to gulls and terns by reducing the amount of dredging required to construct the Project • The placement of the terminal in subtidal waters reduced the potential for gulls and terns to interact

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			• Utilisation of equipment that produces less noise where feasible • Awareness and training for construction crew • Using barriers (e.g., acoustic blankets) or other technology (e.g., bubble curtains) to shield gulls and terns from abrupt loud noise, where feasible, to lower sound levels below thresholds • Increasing or ramping-up sound levels slowly to allow birds to habituate or temporarily leave the area where feasible • Where possible, implementing measures to minimise impulsive noise • During piling, use of vibratory hammer instead of impact pile driving when practical • Compliance checking for above-ground and underwater noise • EMP will specify the sensitive areas (e.g., Roberts Bank WMA) to be avoided by marine vessel traffic operating in the Project area during construction • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing) *Operation* *Noise Management Plan* • Optimised tonality of equipment alarms to limit audibility on shore while meeting safety requirements • Operator awareness and training • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing)	the peak of construction, reducing the potential for activities to disturb gulls and terns. *Construction and Operation:* The intent of these mitigation measures is to minimise the potential for disturbance effects that could affect gull and tern populations by conducting activities under sound levels that may elicit flight behaviours or harm (injury or mortality) to gulls and terns or their prey (e.g., fish) and thereby maintaining habitat quality. • Mitigation that will be implemented during construction and operation are proven techniques to reduce the overall amount and levels of noise that will be produced, and potential for the generation of excessive noise. • Turning equipment and vehicles off when not in use, using equipment that produces less noise, and performing regular maintenance activities reduces the overall noise in the surrounding environment. • Awareness training informs construction workers of the importance of the implementation of noise reduction measures and works to modify behaviours by ensuring staff understand the intent of mitigation measures and their responsibility to meet compliance. Results of this measure benefit the surrounding environment and subsequently avian health. • The use of noise barriers and noise reduction technologies, such as acoustic blankets and bubble curtains, are a proven method to shield surroundings from abrupt noise and reduce the ambient noise within the surrounding environment. Technologies such as acoustic blankets also act as visual barriers, further reduce disturbance. • The use of ramp-up periods (soft start) is a proven technique that allows birds to gradually habituate to noise or temporarily position themselves away from potentially disruptive noise, thereby remaining within the LAA. • Vibratory hammers produce less noise (~15 dB) compared to impact hammers, and will be used when possible to reduce the incidence of impulsive noise that could disturb gulls and terns. • The physical separation of gulls and terns using the intertidal habitats from the terminal where	habitat in the LAA at Roberts Bank, or habituate. Should mitigation measure be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account the fact that birds have habituated to current noise levels from the existing terminals, and previous construction activities (e.g., Deltaport Third Berth) and are likely to habituate to any Project-related noise increases.	with this effect pathway, as the majority of gull and tern usage of the LAA (Roberts Bank) is restricted to the intertidal zone • The existing Roberts Bank terminals are an industrial site and are generally considered a noisy environment. Gulls and terns appeared to be habituated to existing operations of the Westshore, Deltaport, and BC Ferries terminals occurring in high abundances close to the terminals and are anticipated to demonstrate similar habituation to RBT2 operational activities • Documented negligible behavioural responses and demonstrated habituation to construction activities by gulls and terns associated with the Deltaport Third Berth construction indicate a likely similar response to RBT2 construction • The determination that based on anticipated noise levels, gulls and terns would have to be within 100 to 140 m of pile driving or 60 to 100 m of other construction activities to encounter atmospheric noise levels anticipated to initiate a flight response (i.e., ~85 dBA). Given the large quantity of suitable alternative habitat in the LAA (>5,000 ha), and that many construction activities generating loud noise will occur >140 m from the Project's land-marine interface, interactions that may disturb gulls and terns will likely be infrequent and localised • The determination that there is a large amount of suitable alternative foraging habitat (>5,000 ha) available to gulls and terns within the LAA. If disturbed, gulls and terns are anticipated to move a short distance within the LAA (within Roberts Bank) to an area away from the disturbance, which is likely to results in no measurable residual effect to gull or tern populations or their productivity • Gulls and terns are only exposed to underwater noise when submerging their heads while foraging (e.g., plunge diving) for aquatic prey (e.g., forage fish), which limits their potential for exposure. Due to the limited duration of submersion (a few seconds), gulls and terns are not anticipated to interact with the underwater noise effect pathways

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
				most construction activities will occur, along with noise reduction mitigation, minimises the potential for disturbance and the disruption of gull and tern activities, ensuring their populations can continue to occupy the LAA and habitat quality within the LAA is maintained. • The combination of measures described herein reduce the overall levels of noise in the environment, as well as minimise the level and potential generation of impulsive noise to maintain habitat quality for gulls and terns.		
✓	✓	Direct mortality from vehicles	*Construction and Operation:* As described in the EIS, there are a number of proven effective mitigation measures to reduce barn owl collisions and other coastal birds. These measures were expanded upon in IR9-01 (CEAR Document #1322). • Connect and collaborate with local authorities to support speed management within the LAA to reduce the likelihood of bird-vehicle mortalities.	*Construction and Operation:* The intent of the mitigation is to support the management of vehicular speed limits along the causeway to reduce the incidence and likelihood of bird-vehicle collisions, thereby maintaining gull and tern population viability.	Effective as intended. Reducing the speed at which vehicles travel is a proven technique in reducing the potential for bird-vehicle collisions.	Taking mitigation into account, the direct mortality of gulls and terns with vehicles in the LAA is predicted to result in no measurable residual effect to gull and tern populations based on the anticipated low frequency of gull and tern-vehicle collisions.
✓	✓	Disturbance and disorientation from artificial lighting	*Construction*: • Orienting lights downward and away from known bird-occupied areas, where possible • Using shielding to minimise light trespass • Controlling light levels and limiting light use to areas where activities are occurring, where possible • Where possible, using fixtures that emit light at specific wavelengths • Ensuring dredge lighting system shields light from spilling outside the basic working footprint of the dredge • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures *Operation*: • Minimising the number of light installations;	*Construction and Operation:* To minimise the potential for disturbance and disorienting effects to birds from artificial light, thereby maintaining habitat quality and the continued use of an area by gulls and terns. Orienting lights downward, using shielding, and ensuring dredge lighting systems shield light from spilling outside the basic working footprint are methods intended to minimise light trespass and skyglow and maintain coastal bird population (including gull and tern) health. The proposed terminal will be semi-automated. As part of design mitigation, the Light Management Plan will ensure areas not occupied by humans stay dark or minimally lit, which will further reduce the likelihood of adverse effects from artificial light. Similarly, the Project design purposefully minimises the number of light installations and avoids the use of exterior decorative lights that have the potential to draw birds from distance. As proven collision avoidance measures, the proposed Project will avoid the use of solid burning or slow pulsing warning lights, use the minimum amount of on-terminal navigational obstruction	Effective as intended. The mitigation measures that will be implemented as part of the Project are a suite of measures that are proven to reduce light trespass and sky glow. Should mitigation measure be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account potential habituation by gulls and terns, and the (bright) light levels from the existing terminals and the associated incremental increase with the Project. Even if gulls and terns are temporarily disturbed, they would likely relocate a short distance away within alternative suitable habitat in the LAA on Robert Bank, thus not affecting gull and tern populations.	Taking mitigation into account, changes to artificial light are predicted to result in no measurable residual effect to gull and tern populations. This determination is also based on a number of factors, including: • There have been no reports of disorientation or other adverse effects to gulls and terns from artificial illumination in the existing Roberts Bank terminals' 50+ years of operation • Existing data indicate gulls and terns are likely habituated to existing lighting conditions at Roberts Bank terminals • Effects of artificial light on gulls and terns using the LAA at night likely differ by species, with some avoiding lit areas and other using increased illumination to increase foraging efficiency or duration, or reduce predation risk • Additional light fixtures installed along causeway as part of the Project in intertidal zone used by gulls and terns for roosting will not increase light levels above existing conditions • The LAA provides a large amount (>5,000 ha) of suitable alternative habitat away from the terminal

Construction	Operation	Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
			• Orienting lights downwards and away from known bird-occupied areas, where possible • Using down-shielded lighting fixtures to minimise light pollution • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures • Using of only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada • Avoiding the use of exterior decorative lights, especially on humid, foggy, or rainy nights, when illumination glow can draw birds from distance • Controlling light levels and limiting light use to areas where activities are occurring • Where possible, using fixtures that emit light at wavelengths shown to minimise disorienting effects to birds • Establishing a centralised lighting control system to select lighting where required	avoidance lighting on tall structures, and use only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada.		
✓	✓	Biotic and abiotic interactions (e.g., changes in prey availability)	*Avoidance and Project Design Mitigation:* The following measures were taken that directly reduced effects to or enhance habitat for gull and tern prey, or flora and fauna on which their prey depend and thereby provided indirect benefits to gulls and terns: • Rounded northwest terminal corner to reduce bed scour post construction • Reduced footprint of causeway widening to minimise effects to prey and gull and tern habitat • Placing the terminal in subtidal waters to minimise effects within the intertidal zone used by gulls, terns, and their prey	The intent of the avoidance mitigation measures employed as part of the proposed Project design was to minimise potential adverse effects to coastal birds, including gulls and terns. A primary mitigation measure employed early on in the Project, as part of the alternatives assessment, was the placement of the proposed Project in subtidal waters. This not only minimised the direct loss of intertidal habitat used by gulls and terns, but was also determined to minimise potential indirect abiotic effects, such as changes in geomorphology, which could affect gull and tern prey and impact their population. For gulls and terns, abiotic effects (e.g., changes in salinity, TSS, and sedimentation) to foraging habitat productivity within the LAA are predicted to be negligible. Increases in TSS levels associated with Project construction will be temporary and are not anticipated to affect gulls and terns. Concentrations	The avoidance and design mitigation employed is anticipated to be effective in minimising potential adverse effects to gull and tern populations and their prey through minimising potential geomorphological changes to the LAA (based on the analysis presented in EIS Section 5.0 and IR1-07 of CEAR Document #897). Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions	Taking mitigation into account, changes to biotic and abiotic interactions is predicted to result in no measurable residual effect to gull and tern populations. This determination is also based on a number of factors, including: • Gulls, terns, and their prey (e.g., bivalves and forage fish) are evolutionarily adapted to thrive in a dynamic estuarine environment, with many species within the sub-component occupying both freshwater and marine habitats. Therefore, the potential changes in water column salinity with the proposed Project in place will be small compared to the annual, seasonal, and daily changes in salinity experienced under existing conditions and will not affect gull and tern productivity or population viability • Effects to gull and tern prey are considered negligible to minor, and are as follows: ○ For Pacific salmon, there is potential that the Project may affect juvenile salmon migration, prior

Phase: Construction	Phase: Operation	Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
			• Incorporation of rocky shoreline in portions of the terminal and causeway perimeters that provides habitat for gull and tern prey (e.g., marine invertebrates) • Alignment of construction activities to avoid fisheries-sensitive windows for juvenile salmon (i.e., gull and tern prey) • Alignment of construction activities to avoid fisheries sensitive window for crab, benefitting marine fish life stages (i.e., gull and tern prey) that overlap spatially and temporally *Other Mitigation (Offsetting)*: Creation of the following habitats to benefit gull and tern prey: • Eelgrass – to promote productivity increases for juvenile salmon, juvenile rockfish, forage fish, small demersal fish, and bivalves • Intertidal marsh – to promote productivity increases for juvenile salmon and bivalves • Mudflat – to promote productivity increase in benthic invertebrates, which are also food sources for fish • Sandy gravel beach – to promote increase in forage fish and bivalves • Subtidal rock reef – to promote reef fish and bivalve shellfish productivity For mitigation measures benefiting gull and tern prey, see EIS Sections 11.0, 12.0, 13.0, and 17.0, and the response to IR13-30 (CEAR Document #1331).	of TSS from dredging and marine works are within the natural variation of ambient TSS concentrations within the Fraser River estuary to which these birds are already accustomed. The intent of onsite habitat creation is to provide habitat to gulls and terns and increase the productivity of the prey they consume.	necessary to create functioning habitats and are anticipated to be fully effective.	to mitigation, which would decrease productivity. It is expected that increases in juvenile salmon productivity from increases in prey (e.g., macrofauna), predicted increases in intertidal marsh habitat through changes in environmental conditions, and from onsite offsetting will counterbalance losses. Overall, predicted net changes in Pacific salmon productive potential from the Project are expected to be negligible, with mitigation ○ For reef fish and small demersal fish, potential productivity loss from injury and mortality and changes in the acoustic environment (during construction if impact pile driving is used) will be minimised through mitigation, resulting in no measurable residual effect ○ For forage fish, potential effects of injury and mortality, acoustic harm, and changes in the light environment are anticipated to be reduced through mitigation ○ For Pacific herring, minor behaviour disturbance is predicted due to exposure to underwater sound ○ Pacific sand lance are anticipated to experience reduced productivity due to reduction in suitable subtidal burying habitat ○ For infaunal and epifaunal invertebrates, short-term productivity losses associated with construction activities (direct mortality, changes in water quality) will be offset by gains from improved habitat suitability shoreward of the terminal. Gulls and terns do not feed on subtidal invertebrates; therefore, the loss of invertebrates under the terminal footprint will not directly affect their prey base. Overall, a minor increase in productive potential is predicted for the sub-component • Gull and tern usage of the LAA, and the ability of the LAA to support gull and tern populations is predicted to remain unchanged with the Project

Table IR9-05-A5 Effect Pathways for the Raptor Sub-component, Mitigation Measures, Mitigation Effectiveness, and Predicted Residual Effects and Significance Determination.

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
✓		Loss of 49.8 ha of intertidal habitat composed of sand-flat/mudflat, eelgrass, sea lettuce, rock, grass, and intertidal marsh habitat used by raptors; this comprises approximately 1.4% of the total suitable intertidal habitat within LAA. Additionally, the loss of 1 ha of upland habitat	*Construction and Operation:* *Avoidance and Project Design Mitigation* • Terminal placement in subtidal waters • Reducing the width of the causeway • Incorporation of rocky shoreline in portions of the terminal and causeway perimeters that provides habitat for raptor prey (e.g., shorebirds) and species on which prey depend *Other Mitigation (Offsetting):* • Creation of intertidal marsh • Creation of mudflat (capable of supporting biofilm) • Creation of eelgrass • Creation of sandy gravel beach • Creation of subtidal rock reef The onsite habitats (i.e., Offsetting Measures) will be capable of supporting various raptor prey species (e.g., herring, adult Chinook salmon, adult chum salmon, American wigeon).	*Construction and Operation* • Placing the terminal in subtidal waters (~5 km offshore) minimises the direct effects (including habitat loss) to raptors and their prey species (e.g., shorebirds), which use intertidal habitats, so raptor foraging habitat is protected and their productivity is not compromised. • Similarly, reducing the width of the causeway widening reduces effects to intertidal habitat use by raptors and their prey (e.g., shorebirds), minimised habitat loss, and protected raptor foraging habitat. • Incorporation of rocky shoreline into the terminal and causeway perimeter design creates habitat for some raptors and their prey (e.g., reef and forage fish), enhancing the LAA for some raptor prey species. • Promote productivity increase of fish, waterfowl, and shorebirds, which are food sources for raptors, through creation of the following onsite habitats: ○ Creation of intertidal marsh – to promote productivity increases for juvenile salmon (potential raptor prey species) ○ Sandy gravel beach – to promote increase in forage fish (potential raptor prey species) ○ Mudflat – to promote productivity increase in benthic invertebrates and biofilm, which are food sources for fish and shorebirds (prey species for certain raptors) ○ Eelgrass – to promote productivity increases for juvenile salmon, juvenile rockfish, forage fish, and small demersal fish (prey species for certain raptors) ○ Subtidal rock reef – to promote increase in reef fish productivity (prey species for certain raptors)	The mitigation is effective as intended. Avoidance mitigation is the first measure in the mitigation hierarchy to minimise effects to VCs and is a proven effective technique. Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, the loss of intertidal and upland foraging habitat is predicted to result in no measurable residual effect to raptor populations. This determination is also based on a number of factors, including: • Raptors have a diverse prey base including waterfowl, diving birds, shorebirds, fish species, and small mammals on which they depend • Empirical data showing the amount of intertidal habitat that supports these prey that will be removed due to the Project comprises approximately 1.4% of existing habitat, and there will exist >3,500 ha of similarly suitable alternative intertidal habitat in the LAA at Roberts Bank with the proposed Project in place • Minor to negligible effects predictions to raptor prey such as shorebirds, waterfowl, and marine fish (e.g., salmon spp., Pacific herring) based on the Roberts Bank ecosystem model results, prior to mitigation being taken into account • Effects to raptor usage of the LAA or population viability are not anticipated with the proposed Project in place In addition to the loss of intertidal habitat, approximately 1 ha (<1% of total suitable foraging habitat in the LAA) of barn owl foraging habitat (i.e., upland habitat) adjacent to Deltaport Way will be affected as part of the Project footprint. • This habitat consists of previously disturbed areas consistent with a working industrial site that includes road, railway right-of-way, and gravelled and grassy roadside verge, habitat that is of poor quality when compared to alternate forage habitat in the area. As such, changes in the areal extent of raptor foraging and roosting habitat within the LAA are limited (<1% of total suitable habitat) and are not expected to affect raptor populations using the LAA or the ability of the LAA to support raptors into the future.
✓	✓	Noise and other disturbance	*Avoidance and Project Design Mitigation* • Placement of terminal in subtidal waters away from nearshore habitats primarily used by species in the sub-component • Project optimisation associated with the PCU to reduce intensity of	*Avoidance and Project Design Mitigation* • Placing the terminal in subtidal waters (~5 km offshore) minimises the potential for disturbance during construction and operation activities, as raptors will mostly be physically separated from activities associated with the terminal in the subtidal zone.	Effective as intended. The mitigation measures that will be employed are proven approaches to reduce noise to acceptable levels and minimise the potential for adverse effects during	Taking mitigation into account, noise and other disturbance during construction and operation is predicted to result in no measurable residual effect to raptor populations. This determination is also based on a number of factors, including:

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			equipment use at the peak of construction *Other Mitigation during Construction:* *Noise Management Plan* • Shutdown of equipment and vehicles when not in use • Utilisation of equipment that produces less noise where feasible • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing) • Awareness and training for construction crew • Using barriers (e.g., acoustic blankets) to shield wildlife from abrupt loud noise where feasible • Implementation of sound reduction or dampening methods or technologies (e.g., bubble curtains) to manage pile-driving sound levels, if required, to lower sound levels below thresholds • Increasing or ramping-up sound levels slowly to allow birds to habituate or temporarily leave the area where feasible • Where possible, implementing measures to minimise impulsive noise • During piling use of vibratory hammer instead of impact pile driving when practical • Compliance checking for above-ground and underwater noise *Operation* *Noise Management Plan* • Optimised tonality of equipment alarms to limit audibility on shore while meeting safety requirements • Operator awareness and training • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers,	• Project optimisation associated with the PCU reduces the intensity of equipment used during the peak of construction, reducing the potential for activities to disturb raptors. *Construction and Operation:* The intent of these mitigation measures is to minimise the potential for disturbance effects that could affect raptor populations by conducting activities under sound levels that may elicit flight behaviours or harm (injury or mortality) to the birds or their prey (e.g., fish, shorebird, waterfowl, small mammals, etc.) and thereby maintaining habitat quality. • Mitigation that will be implemented during construction and operation are proven techniques to reduce the overall amount and levels of noise that will be produced, and potential for the generation of excessive noise. • Turning equipment and vehicles off when not in use, using equipment that produces less noise, and performing regular maintenance activities reduces the overall noise in the surrounding environment. • Awareness training informs construction workers of the importance of the implementation of noise reduction measures and works to modify behaviours by ensuring staff understand the intent of mitigation measures and their responsibility to meet compliance. Results of this measure benefit the surrounding environment and subsequently avian health. • The use of noise barriers, such as acoustic blankets and/or bubble curtains, are a proven method to shield surroundings from abrupt noise and reduce the ambient noise within the surrounding environment. These types of technologies also act as visual barriers, further reduce disturbance. • The use of ramp-up periods (soft start) is a proven technique that allows birds to gradually habituate to noise or temporarily position themselves away from potentially disruptive noise, thereby remaining within the LAA. • Vibratory hammers produce less noise (~15 dB) compared to impact hammers, and will be used when possible to reduce the incidence of impulsive noise that could disturb raptors. • The physical separation of some raptor prey species (e.g., shorebirds) using the mud-	construction activities that would reduce raptor populations. Temporarily disturbed raptors are expected to relocate a short distance to access the large quantity of alternative suitable habitat in the LAA, or habituate. Should mitigation be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account the fact that raptors have habituated to current noise levels from the existing terminals, and previous construction activities (e.g., Deltaport Third Birth) and are likely to habituate to any Project-related noise increases.	• Terminal placement in subtidal waters reduces the potential for disturbance to raptors by positioning terminal in an area less used by raptors and reducing the amount of dredging required to construct the Project • Apparent habituation of raptors to existing disturbance associated with the operating Deltaport, Westshore, and BC Ferries terminals indicates likely future habituation to RBT2 • Documented behavioural responses and habituation to activities by raptors associated with the Deltaport Third Berth construction that would likely be similar to RBT2 construction • The determination that there is a large amount of suitable alternative habitat (>3,500 ha) available to raptors in the LAA. If disturbed, raptors are anticipated to move a short distance to areas away from the disturbance, which would result in a negligible, non-measurable effect to raptor productivity • The determination that based on anticipated noise levels, raptors would have to be within 100 to 140 m of pile driving or 60 to 100 m of other construction activities to encounter atmospheric noise levels anticipated to initiate a flight response (i.e., ~85 dBA). Given the large quantity of suitable alternative habitat in the LAA (>3,500 ha), and that many construction activities generating loud noise will occur >140 m from habitats most frequently used by raptors, interactions that may disturb raptors will likely be infrequent and localised • Raptors, such as the bald eagle, may briefly submerge vulnerable soft tissues (i.e., ears), when attempting to capture prey in the marine environment, and therefore can be exposed to underwater noise; however, because of the hunting techniques of raptors (i.e., diving to catch prey with their talons and only very briefly submerging their heads) and because anticipated underwater noise levels from construction and operation will be below levels known to cause harm to coastal waterbirds, no adverse effects are anticipated for this sub-component from underwater noise.

<table>
<tr><th colspan="2">Phase</th><th rowspan="2">Potential Project-related Effect</th><th rowspan="2">Applicable Mitigation Measures</th><th rowspan="2">Intent of Mitigation to Reduce Effect</th><th rowspan="2">Anticipated Effectiveness and Supporting Rationale</th><th rowspan="2">Residual Effect and Significance</th></tr>
<tr><th>Construction</th><th>Operation</th></tr>
<tr><td></td><td></td><td></td><td>maintaining efficiencies of engines through servicing)</td><td>sandflats from the causeway and terminal where construction activities will occur, along with noise reduction mitigation, minimises the potential for disturbance and the disruption of raptor activities, ensuring raptor populations can continue to occupy the LAA and habitat quality within the LAA is maintained.
The combination of measures described herein reduce the overall levels of noise in the environment, as well as minimise the level and potential generation of impulsive noise to maintain habitat quality for raptors.</td><td></td><td></td></tr>
<tr><td>✓</td><td>✓</td><td>Direct mortality from vehicles</td><td>Construction and Operation
Project-related mitigation measures will be implemented to avoid collisions between barn owls and vehicles within the LAA. Additionally, mitigation will be implemented to increase barn owl population and offset potential mortality risk associated with the Project. Mitigation measures that will effectively minimise the risk to the barn owl population and other raptor species are:
• The establishment and maintenance of barn owl nest boxes (as availability of suitable nest sites is a factor limiting barn owls within the region)
• Connecting and collaborating with local authorities to support speed management within the LAA
• Implementing measures to increase education and awareness of owl-vehicle collisions along roads to influence driving habitats
Managing vegetation within road verges associated with the Project's footprint adjacent to terrestrial upland and marsh habitat potentially used by foraging barn owls. These measures were expanded upon in IR9-01 (CEAR Document #1322).</td><td>Construction and Operation
• High suitability barn owl nesting habitat (i.e., old barns) and foraging habitat (i.e., fields) are both in decline in the region, but suitable nesting habitat is considered more limiting (i.e., old barns are being removed/replaced at a higher rate than fields are being developed). Providing suitable nesting habitat (i.e., nest boxes) in proximity to suitable foraging habitat is anticipated to benefit barn owl population.
• Speed management of vehicles that travel within the LAA (along the causeway) is intended to reduce the incidence and likelihood of bird-vehicle collisions, thereby maintaining raptor (especially barn owl) populations.
• Educating drivers about the increased risk of barn owls suffering bird-vehicle collision mortalities, and the decline of this species in the region, is intended to change the driving habits of drivers (i.e., some drivers may not be fully aware of how their driving decisions can affect local wildlife).
• Managing vegetation within verges associated with the Project's footprint is intended to decrease the suitability of this habitat for barn owl prey species (e.g., small mammals), thereby keeping barn owls from foraging here.</td><td>Effective as intended. The use of nest boxes is a proven technique to increase barn owl population. Barn owls are a highly fecund species that readily take to nest boxes. Reducing vehicle speeds is a proven technique in reducing the potential for raptor-vehicle collisions.
Education campaigns are proven ways of getting the public, or a targeted group of individuals, to alter behaviour. Vegetation management (i.e., removing suitable habitat) is a proven technique in reducing small mammal populations along roadsides by creating unsuitable habitat.</td><td>Taking mitigation into account, the direct mortality of raptors resulting from collisions with vehicles in the LAA is considered to be minor, and predicted to result in no measurable residual effect to raptor populations. This was determined by taking the following factors into account:
• No raptor-vehicle collision mortalities, with the exception of barn owls, were documented during 18 months of collision mortality studies to support the EIS. Therefore, it is likely that the incidence of raptor collisions (other than barn owl) with vehicles in the LAA is low
• If non-barn owl raptor-vehicle collisions do occur, mitigation measures that will be implemented are anticipated to reduce the potential for collisions further
Two barn owl mortalities associated with vehicle collisions were documented (during collision monitoring studies) near the east end of the LAA associated with agricultural habitats, indicating activity close to the Project footprint. The suite of mitigation measures that will be implemented are anticipated to be effective in mitigating the potential loss in barn owl population due to vehicle collisions.</td></tr>
</table>

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
✓	✓	Disturbance and disorientation from artificial lighting	*Construction* • Orienting lights downward and away from known bird-occupied areas, where possible • Using shielding to minimise light trespass and skyglow • Controlling light levels and limiting light use to areas where activities are occurring, where possible • Where possible, using fixtures that emit light at specific wavelengths shown to minimise disorienting effects to birds • Ensuring dredge lighting system shields light from spilling outside the basic working footprint of the dredge • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of navigational obstruction avoidance lighting on tall structures *Operation* • Minimising the number of light installations • Orienting lights downwards and away from known bird-occupied areas where possible • Using down-shielded lighting fixtures to minimise light pollution • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of navigational obstruction avoidance lighting on tall structures • Using of only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada • Avoiding the use of exterior decorative lights, especially on humid, foggy, or rainy nights, when illumination glow can draw birds from distance • Controlling light levels and limiting light use to areas where activities are occurring	*Construction and Operation* To minimise the potential for disturbance and disorienting effects to birds from artificial light, thereby maintaining habitat quality and the continued use of an area by raptors. Orienting lights downward, using shielding, and ensuring dredge lighting systems shield light from spilling outside the basic working footprint are methods intended to minimise light trespass and skyglow and maintain coastal bird population (including raptor) health. The proposed terminal will be semi-automated. As part of design mitigation, the Light Management Plan will ensure areas not occupied by humans stay dark or minimally lit, which will further reduce the likelihood of adverse effects from artificial light. Similarly, the Project design purposefully minimises the number of light installations and avoids the use of exterior decorative lights that have the potential to draw raptors from distance. As proven collision avoidance measures, the proposed Project will avoid the use of solid burning or slow pulsing warning lights, use the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures, and use only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada.	Effective as intended. The mitigation measures that will be implemented as part of the Project are a suite of measures that are proven to reduce light trespass and sky glow. Should mitigation measures be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account potential habituation by raptors and the (bright) light levels from the existing terminals and the associated incremental increase with the Project. The likely potential effect if raptors are disturbed is temporary, short distance, relocation within the large quantity of alternative suitable habitat in the LAA on Robert Bank.	Taking mitigation into account, changes to artificial light is predicted to result in no measurable residual effect to raptor populations. This determination is also based on a number of factors, including: • The existing Roberts Bank terminals being a well-lit industrial site • Existing data indicate raptors are habituated to existing lighting conditions within the intertidal zone • Artificial lighting associated with the Project may make potential prey (e.g., shorebirds, waterfowl) close to the terminal more visible, thereby increasing raptor (e.g., snowy owl) productivity through increased foraging efficiency • Additional light fixtures installed along causeway as part of the Project in intertidal zone will not increase light levels above existing conditions. The majority of new light fixtures (94%) consist of terminal lighting located ~5 km off shore • Artificial lighting may also increase the foraging time available to raptors in habitats adjacent to terminal infrastructure • Roberts Bank terminals are one of several coastal artificial light sources that may attract or disorient nocturnally migrating owls. Since the Project will increase light emissions for the area, appropriate mitigation will be employed to reduce potential effects • The LAA provides a large amount >3,500 ha of alternative habitat available away from the terminal • Illumination may provide benefits to some raptors (e.g., bald eagles) from increases in foraging opportunity and duration, based on scientific literature

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			• Where possible, using fixtures that emit light at wavelengths shown to minimise disorienting effects to birds • Establishing a centralised lighting control system to select lighting where required			
✓	✓	Biotic and abiotic interactions (e.g., effects to, and changes in, prey availability)	*Avoidance and Project Design Mitigation* The following measures were taken that directly reduced effects to or enhance habitat for raptor prey, or fauna on which raptor prey depend and thereby provided indirect benefits to raptors: • Rounding the northwest terminal corner to reduce bed scour post construction • Reducing footprint of causeway widening to minimise effects to prey and raptor habitat • Placing the terminal in subtidal waters to minimise effects within the intertidal zone used by raptors and their prey • Incorporating rocky shoreline in portions of the terminal and causeway perimeters that provide habitat for raptor prey (e.g., shorebirds) and species on which prey depend • Alignment of construction activities to avoid fisheries-sensitive windows for juvenile salmon (i.e., raptor prey) • Alignment of construction activities to avoid fisheries sensitive window for crab, benefitting marine fish life stages (i.e., raptor prey) that overlap spatially and temporally *Other Mitigation (including Offsetting)*: • Eelgrass – to promote productivity increases for juvenile salmon, juvenile rockfish, forage fish, small demersal fish, and bivalves consumed by raptors • Intertidal marsh – to promote productivity increases for juvenile salmon and bivalves	The intent of the avoidance mitigation measures employed as part of the proposed Project design is to minimise potential adverse effects to raptor populations. A primary mitigation measure employed early on in the Project, as part of the alternatives assessment, was the placement of the proposed Project in subtidal waters. This not only minimised the direct loss of intertidal habitat primarily used by raptors, but also minimised potential indirect abiotic effects, such as changes in geomorphology, which could affect raptor prey and impact raptor populations.	The mitigation is effective as intended. The avoidance mitigation employed is intended to be effective in minimising potential adverse effects to raptor populations and their prey through minimising potential geomorphic changes to the LAA (based on the analysis presented in EIS Section 5.0 and IR1-07 of CEAR Document #897). Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, changes to biotic and abiotic interactions is predicted to result in no measurable residual effect to raptor populations. This determination is based on the fact that raptors are apex predators within the LAA; therefore, they are influenced by bottom-up trophic interactions such as prey availability described within the EIS. Effects to raptor prey are considered negligible with the implementation of mitigation, and are as follows: • For shorebirds and waterfowl, no measurable residual effects were predicted to their productivity and population viability • For Pacific salmon, there is potential that the Project may affect juvenile salmon migration, which would decrease productivity. It is expected that increases in juvenile salmon productivity from increases in prey (e.g., macrofauna), predicted increases in tidal marsh habitat, and from onsite offsetting will counterbalance losses. Overall, predicted net changes in Pacific salmon productive potential from the Project are expected to be not measurable, with mitigation • For reef fish and small demersal fish, potential productivity loss from injury and mortality and changes in the acoustic environment (during construction if impact pile driving is used) will be minimised through mitigation, and the resulting residual effect is considered not measurable • For forage fish, potential effects of injury and mortality, acoustic harm, and changes in the light environment are anticipated to be reduced through mitigation • For small mammals, the terrestrial footprint is largely within a highly disturbed industrial environment that provides low quality habitat to small mammals, and the resulting residual effect resulting from habitat removal is considered not measurable

Phase		Potential Project-related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			• Mudflat – to promote productivity increase in benthic invertebrates, which are also food sources for fish consumed by raptors • Sandy gravel beach – to promote increase in forage fish and bivalves • Subtidal rock reef – to promote reef fish and bivalve shellfish productivity For mitigation measures benefiting raptor prey see EIS Sections 11.0, 12.0, 13.0, and 17.0, and the response to IR13-30 (CEAR Document #1331)			

Table IR9-05-A6 Effect Pathways for the Heron Sub-component, Mitigation Measures, Mitigation Effectiveness, and Predicted Residual Effects and Significance Determination

Phase: Construction	Phase: Operation	Potential Project related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
✓		Loss of 40.4 ha of intertidal habitat composed of sand-flat/mudflat, eelgrass, and intertidal marsh habitat used by herons; this comprises approximately 1.1% of the total suitable intertidal habitat within LAA. Additionally, the loss of 1 ha of upland habitat.	*Construction and Operation:* *Avoidance and Project Design Mitigation*: • Terminal placement in subtidal waters • Reducing the width of the causeway • Incorporation of rocky shoreline in portions of the terminal and causeway perimeters that provides habitat for heron prey (e.g., marine invertebrates and forage fish) and species on which prey depend *Other Mitigation (offsetting)*: • Creation of intertidal marsh • Creation of sandy-gravel beach • Creation of mudflat • Creation of subtidal rock reef • Creation of eelgrass The onsite habitats (i.e., Offsetting Measures) will be capable of supporting various prey species (e.g., marine invertebrates, herring, sand lance, small demersal fish, juvenile salmonids, etc.).	*Construction and Operation* • Placing the terminal in subtidal waters (~5 km offshore) minimises the direct effects (including habitat loss) to herons and their prey, which use intertidal habitats, so heron foraging habitat is protected and their productivity is not compromised. • Similarly, reducing the width of the causeway widening reduced effects to intertidal habitat used by herons and their prey, minimised habitat loss, and protected heron foraging habitat. • Changes in habitat quantity potentially affecting heron productivity are limited to causeway widening, which will affect approximately 40 ha of intertidal habitat, including intertidal marsh within the embayment area where the causeway meets the existing terminal. Rip-rap armouring the length of the north side of the causeway will also be temporarily removed and replaced with similar habitat as part of the Project. This rocky habitat supports small fish (e.g., sculpins, juvenile salmonids, forage fishes) and crustaceans. Collectively, these habitats provide foraging and roosting habitat to herons. • Incorporation of rocky shoreline into the terminal and causeway perimeter design creates habitat for some heron prey species. • Creation of onsite mudflat habitat facilitates productivity increases in marine invertebrates, which are food sources for herons and partially offsets habitat lost due to Project construction. • Creation of onsite intertidal marsh provides foraging and roosting habitat for herons, enhancing feeding opportunities and maintaining heron productivity.	The mitigation is effective as intended. Avoidance mitigation is the first measure in the mitigation hierarchy to minimise effects to VCs and is a proven effective technique. Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, the loss of intertidal and upland foraging habitat is predicted to result in no measurable residual effect to heron populations. This determination is based on numerous factors, including: • Terminal placement in subtidal waters minimised direct intertidal habitat loss used by herons and their prey • Reducing the footprint of causeway widening reduced effects to habitat used by herons and their prey • Empirical data demonstrates that changes in the areal extent of heron foraging and roosting habitat within the LAA comprise 1.1% of the existing similarly suitable intertidal habitat (>3,500 ha) within the LAA at Roberts Bank. Thus, herons will not to be habitat limited with the Project in place • The Roberts Bank ecosystem model predicted a negligible change in heron productivity (-1.5%) with the Project in place • The habitat affected by the causeway expansion will be replaced with similar habitat as part of the new terminal • The removal of approximately 1 ha of upland habitat will not affect to heron population as the existing habitat is highly modified, abuts the existing rail lines entering Roberts Bank terminals, and is currently not used by herons. Outside this area, small mammals will continue to be available • The removal of intertidal and upland habitat is not anticipated to affect heron populations using the LAA or the viability of heron populations within the LAA due to the factors cited above
✓	✓	Noise and other disturbance	*Avoidance and Project Design Mitigation*: • Placement of terminal in subtidal waters away from nearshore habitats used by species in the sub-component • Project optimisation associated with the PCU to reduce intensity of equipment use at the peak of construction *Other Mitigation*:	*Avoidance and Project Design Mitigation* • Placing the terminal in subtidal waters (~5 km offshore) minimises the potential for disturbance during construction and operation activities, as herons will be physically separated from activities associated with the terminal in the subtidal zone. • Project optimisation associated with the PCU reduces the intensity of equipment used during	Effective as intended. The mitigation measures that will be employed are proven approaches to reduce noise to acceptable levels and minimise the potential for adverse effects during construction activities that would reduce heron population. Temporarily disturbed herons are expected to relocate a short distance to access within the	Taking mitigation into account, noise and other disturbance during construction and operation is predicted to result in no measurable residual effect to heron populations. This determination is also based on a number of factors, including: • The placement of the terminal in subtidal waters reduced the potential for herons to interact with this effect pathway, as heron usage of the LAA (Roberts Bank) is restricted to the intertidal zone

Phase		Potential Project related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			• Shutdown of equipment and vehicles when not in use • Utilisation of equipment that produces less noise where feasible • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing) • Awareness and training for construction crew • Using barriers (e.g., acoustic blankets) to shield wildlife from abrupt loud noise where feasible • Increasing or ramping-up sound levels slowly to allow birds to habituate or temporarily leave the area where feasible • Where possible, implementing measures to minimise impulsive noise • During piling, use of vibratory hammer instead of impact pile driving when practical • Implementation of sound reduction or dampening methods or technologies (e.g., bubble curtains) to manage pile-driving sound levels, if required, to lower sound levels below thresholds • Compliance checking for above-ground and underwater noise *Operation* *Noise Management Plan* • Optimised tonality of equipment alarms to limit audibility on shore while meeting safety requirements • Operator awareness and training • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing)	the peak of construction, reducing the potential for activities to disturb herons. *Construction and Operation:* The intent of these mitigation measures is to minimise the potential for disturbance effects that could affect heron population by conducting activities under sound levels that may elicit flight behaviours or harm (injury or mortality) to the birds or their prey (e.g., fish) and thereby maintaining habitat quality. • Mitigation that will be implemented during construction and operation are proven techniques to reduce the overall amount and levels of noise that will be produced, and potential for the generation of excessive noise. • Turning equipment and vehicles off when not in use, using equipment that produces less noise, and performing regular maintenance activities reduces the overall noise in the surrounding environment. • Awareness training informs construction workers of the importance of the implementation of noise reduction measures and works to modify behaviours by ensuring staff understand the intent of mitigation measures and their responsibility to meet compliance. Results of this measure benefit the surrounding environment and subsequently avian health. • The use of noise barriers, such as acoustic blankets and bubble curtains, are a proven method to shield surroundings from abrupt noise and reduce the ambient noise within the surrounding environment. Some of these technologies can also act as visual barriers, further reducing disturbance. • The use of ramp-up periods (soft start) is a proven technique that allows birds to gradually habituate to noise or temporarily position themselves away from potentially disruptive noise, thereby remaining within the LAA. • Vibratory hammers produce less noise (~15 dB) compared to impact hammers, and will be used when possible to reduce the incidence of impulsive noise that could disturb herons. • The physical separation of herons using the mud-sandflats from the causeway and terminal where construction activities will occur, along with noise reduction mitigation, minimises the potential for disturbance and the disruption of	large quantity of alternative suitable habitat in the LAA, or habituate. Should mitigation be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account the fact that herons have habituated to current noise levels from the existing terminals, and previous construction activities (e.g., Deltaport Third Birth) and are likely to habituate to any Project-related noise increases.	• Apparent habituation of herons to existing disturbance associated with the operating Deltaport, Westshore, and BC Ferries terminals indicates likely future habituation to RBT2 • Documented behavioural responses and habituation to activities by herons associated with the Deltaport Third Berth construction that would likely be similar to RBT2 construction. Effects were limited to a temporary shift by herons away from construction activities to other suitable habitats within the LAA on Roberts Bank • The determination that based on anticipated noise levels, herons would have to be within 100 to 140 m of pile driving or 60 to 100 m of other construction activities to encounter noise levels anticipated to initiate a flight response (i.e., ~85 dBA). Construction activities emitting such levels within the habitats most frequently used by herons will be very limited and localised (i.e., many of the loud impulsive events will occur on the terminal footprint in the subtidal zone; heron foraging and general habitat use is restricted to the intertidal zone. This separation should further reduce the likelihood of herons encountering above-ground noise that would elicit a flight response) • The determination that there is a large amount of suitable alternative foraging and roosting habitat available to herons in the LAA (>3,500 ha), and herons are anticipated to move to areas away from construction activities, if disturbed • Herons periodically submerge their head when striking to capture aquatic prey and therefore can be exposed to underwater noise. Because of the heron's hunting technique (i.e., foraging in shallow water with their head only very briefly submerged when attempting to catch prey) and because anticipated underwater noise levels from construction and operation will be below levels known to cause harm to coastal waterbirds

Phase		Potential Project related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
				heron activities, ensuring heron populations can continue to occupy the LAA and habitat quality within the LAA is maintained. The combination of measures described herein reduces the overall levels of noise in the environment, as well as minimise the level and potential generation of impulsive noise to maintain habitat quality for herons.		
✓	✓	Direct mortality from vehicles	*Construction and Operation:* As described in the EIS, there are a number of proven effective mitigation measures to reduce barn owl collisions and other coastal birds, which will also mitigate collision risk to herons. These measures were expanded upon in IR9-01 (CEAR Document #1322). • Connect and collaborate with local authorities to support speed management within the LAA to reduce the likelihood of bird-vehicle mortalities.	*Construction and Operation:* The intent of the mitigation is to support the management of vehicular speed limits along the causeway to reduce the incidence and likelihood of bird-vehicle collisions, thereby maintaining heron population viability.	Effective as intended. Reducing the speed at which vehicles travel is a proven technique in reducing the potential for bird-vehicle collisions.	Taking mitigation into account, the direct mortality of herons resulting from collisions with vehicles in the LAA is predicted to result in no measurable residual effect to heron populations based on the anticipated low frequency of heron-vehicle collisions. This was determined by taking the following factors into account: • No heron mortalities attributable to collisions with vehicles were documented during an 18-month collision baseline study • Based on site-specific data, collisions with vehicles are considered unlikely as ~99% (770/773 crossings) of documented heron crossings occurred above the height of vehicles (cars/trucks/trains) using the existing Roberts Bank terminals
✓	✓	Disturbance and disorientation from artificial lighting	*Construction* • Orienting lights downward and away from known bird-occupied areas, where possible • Using shielding to minimise light trespass and skyglow • Controlling light levels and limiting light use to areas where activities are occurring, where possible • Where possible, using fixtures that emit light at specific wavelengths shown to minimise disorienting effects to birds • Ensuring dredge lighting system shields light from spilling outside the basic working footprint of the dredge • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of navigational obstruction avoidance lighting on tall structures *Operation* • Minimising the number of light installations	*Construction and Operation* To minimise the potential for disturbance and disorienting effects to birds from artificial light, thereby maintaining habitat quality and the continued use of an area by herons. Orienting lights downward, using shielding, and ensuring dredge lighting systems shield light from spilling outside the basic working footprint are methods intended to minimise light trespass and skyglow and maintain coastal bird population (including heron) health. The proposed terminal will be semi-automated. As part of design mitigation, the Light Management Plan will ensure areas not occupied by humans stay dark or minimally lit, which will further reduce the likelihood of adverse effects from artificial light. Similarly, the Project design purposefully minimises the number of light installations and avoids the use of exterior decorative lights, that have the potential to draw birds from distance. As proven collision avoidance measures, the proposed Project will avoid the use of solid burning or slow pulsing warning lights, use the minimum amount of on-terminal navigational obstruction	Effective as intended. The mitigation measures that will be implemented as part of the Project are a suite of measures that are proven to reduce light trespass and sky glow. Should mitigation measures be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account potential habituation by herons and the (bright) light levels from the existing terminals and the associated incremental increase with the Project. Even if herons are temporarily disturbed, they would likely relocate a short distance away within the large quantity of alternative suitable habitat in the LAA on Robert Bank.	Taking mitigation into account, changes to artificial light is predicted to result in no measurable residual effect to heron populations. This determination is also based on a number of factors, including: • The existing Roberts Bank terminals being a well-lit industrial site • Existing data indicate herons are habituated to existing lighting conditions within the intertidal zone and onshore • The majority (94%) of new lighting will be on the terminal in subtidal waters, away from habitats intensively used by herons for roosting and foraging. Light levels within the intertidal zone used by herons are not predicted to differ from existing conditions • Herons have been shown to increase their nocturnal foraging in association with increasing light levels. Existing data collected within the LAA indicates herons will forage at the tideline and within tidal channels at night within relatively close proximity of the existing terminal. As herons are visual foragers, illumination from the existing terminals may increase the foraging time available to herons in intertidal habitats adjacent to terminal infrastructure

Phase		Potential Project related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			• Orienting lights downwards and away from known bird-occupied areas where possible • Using down-shielded lighting fixtures to minimise light pollution • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of navigational obstruction avoidance lighting on tall structures • Using of only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada • Avoiding the use of exterior decorative lights, especially on humid, foggy, or rainy nights, when illumination glow can draw birds from distance • Controlling light levels and limiting light use to areas where activities are occurring • Where possible, using fixtures that emit light at wavelengths shown to minimise disorienting effects to birds • Establishing a centralised lighting control system to select lighting where required	avoidance lighting on tall structures, and use only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada.		• If herons are affected by Project illumination there is >3,500 ha of alternative habitat available away from the terminal • Potential adverse effects to herons from Project-related lighting are not expected, including for the heron colony located at the eastern end of the BC Ferries Terminal causeway in Tsawwassen, as illuminance levels are predicted to increase only slightly (i.e., 0.005 lux) in the vicinity of the colony
✓	✓	Biotic and abiotic interactions (e.g., changes in prey availability)	*Avoidance and Project Design Mitigation* The following measures were taken that directly reduced effects to or enhanced habitat for heron prey, or fauna on which heron prey depend, and thereby provided indirect benefits to herons: • Rounding the northwest terminal corner to reduce bed scour post construction • Reducing the footprint of causeway widening to minimise effects to prey and heron habitat • Placing the terminal in subtidal waters to minimise effects within the intertidal zone used by herons and their prey • Incorporating rocky shoreline in portions of the terminal and causeway perimeters that provides habitat for heron prey (e.g., marine	The intent of the avoidance mitigation measures employed as part of the proposed Project design is to minimise potential adverse effects to heron populations. A primary mitigation measure employed early on in the Project, as part of the alternatives assessment, was the placement of the proposed Project in subtidal waters. This not only minimised the direct loss of intertidal habitat used by herons, but was also determined to minimise potential indirect abiotic effects, such as changes in geomorphology, which could affect heron prey and impact heron populations. Modelling indicates the design modification to round the northwest corner of the terminal will reduce the projected scour area and minimise the potential for tidal channel formation that could affect heron habitat.	The avoidance mitigation employed is intended to be effective in minimising potential adverse effects to heron populations and their prey through minimising potential geomorphic changes to the LAA (based on the analysis presented in EIS Section 5.0 and IR1-07 of CEAR Document #897). Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, changes to biotic and abiotic interactions is predicted to result in no measurable residual effect to heron populations. This determination is based on the fact that herons are higher trophic level predators that are well adapted to the marine environment. Abiotic effects (e.g., changes in salinity, TSS, and sedimentation) to foraging habitat productivity within the LAA are predicted to be negligible. • The ability of the LAA to support heron populations is predicted to remain unchanged with the Project, based on the multiple lines of evidence relied upon in the EIS including the results of Roberts Bank ecosystem model: ○ For Pacific salmon, there is potential that the Project may affect juvenile salmon migration, which would decrease productivity prior to mitigation. It is expected that increases in juvenile salmon productivity from increases in prey (e.g., macrofauna), predicted increases in

Phase		Potential Project related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			invertebrates) and species on which prey depend • Alignment of construction activities to avoid fisheries-sensitive windows for juvenile salmon (i.e., heron prey) • Alignment of construction activities to avoid fisheries sensitive window for crab, benefitting marine fish life stages (i.e., heron prey) that overlap spatially and temporally. *Other Mitigation (Offsetting)*: Creation of the following onsite habitats to benefit heron prey: • Eelgrass – to promote productivity increases for juvenile salmon, juvenile rockfish, forage fish, and marine invertebrates • Intertidal marsh – to promote productivity increases for juvenile salmon • Mudflat – to promote productivity increase in benthic invertebrates, which are also food sources for fish • Sandy-gravel beach – to promote increase in forage fish For mitigation measures benefiting heron prey, see EIS Sections 11.0, 12.0, 13.0, and 17.0, and the response to IR13-30 (CEAR Document #1331).	For herons, abiotic effects (e.g., changes in salinity, TSS, and sedimentation) to heron foraging habitat productivity within the LAA are predicted to be negligible. Increases in TSS levels associated with Project construction will be temporary and are not anticipated to affect herons. Concentrations of TSS from dredging and marine works are within the natural variation of ambient TSS concentrations within the Fraser River estuary to which these birds and their prey are already accustomed. Similarly, changes to salinity levels with the proposed Project in place are anticipated to be within the natural variability currently experienced in the estuary and will not adversely affect herons or their prey. The intent of onsite habitat creation is to provide habitat to herons and increase the productivity of the prey they consume.		intertidal marsh habitat, and from onsite offsetting will counterbalance losses. Overall, predicted net changes in Pacific salmon productive potential from the Project are expected to be not measurable, with mitigation ○ For forage fish, potential effects of injury and mortality, acoustic harm, and changes in the light environment are anticipated to be reduced through mitigation ○ For Pacific herring, a not significant residual effect from behaviour disturbance is predicted due to exposure to underwater sound during construction ○ Pacific sand lance are anticipated to experience reduced productivity due to reduction in suitable subtidal burying habitat ○ For infaunal and epifaunal invertebrates (prey of heron prey), short-term productivity losses associated with construction activities (direct mortality, changes in water quality) will be offset by gains from improved habitat suitability shoreward of the terminal. Overall, a minor increase in productive potential is predicted for the sub-component with the Project in place, prior to mitigation

Table IR9-05-A7 Effect Pathways for the Passerine Sub-component, Mitigation Measures, Mitigation Effectiveness, and Predicted Residual Effects and Significance Determination

Phase: Construction	Phase: Operation	Potential Project related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
✓		Loss of 21.9 ha of nearshore intertidal habitat composed of mudflat, rock, grass and intertidal marsh habitat used by passerines; this comprises approximately 2.6% of the total suitable intertidal habitat within LAA. Additionally, the loss of 1 ha of upland habitat.	*Construction and Operation:* *Avoidance and Project Design Mitigation* • Terminal placement in subtidal waters • Reducing the width of the causeway • Incorporation of rocky shoreline in portions of the terminal and causeway perimeters that provides habitat for passerine prey (e.g., terrestrial invertebrates, vegetation) *Other Mitigation (Offsetting):* • Creation of intertidal marsh • Creation of sandy gravel beach • Creation of mudflat, and rocky shoreline The onsite habitats (i.e., Offsetting Measures) capable of supporting various passerine prey species (e.g., small invertebrates)	*Construction and Operation* • Placing the terminal in subtidal waters (~5 km offshore) minimises the direct effects (including habitat loss) to passerines and their prey (e.g., invertebrates), which use intertidal habitats, so passerine foraging habitat is protected and their productivity is not compromised. • Similarly, reducing the width of the causeway widening reduced effects to intertidal habitat used by passerines and their prey, minimised habitat loss, and protected passerine foraging habitat. • Incorporation of rocky shoreline into the terminal and causeway perimeter design creates habitat for some passerine prey species. • Creation of onsite mudflat habitat facilitates productivity increases in marine invertebrates, which are food sources for some species of passerine (e.g., northwestern crow) and partially offsets habitat lost due to Project construction. • Creation of onsite intertidal marsh provides foraging and roosting habitat for some passerines (e.g., barn swallows), enhancing feeding opportunities and maintaining passerine productivity.	The mitigation is effective as intended. Avoidance mitigation is the first measure in the mitigation hierarchy to minimise effects to VCs and is a proven effective technique. Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, the loss of intertidal and upland foraging habitat is predicted to result in no measurable residual effect to passerine populations. This determination is based on numerous factors, including: • Terminal placement in subtidal waters minimised direct intertidal habitat loss potentially used by passerines • Reducing the footprint of causeway widening reduced effects to habitat used by passerines and their prey • Approximately 1 ha of terrestrial habitat abutting the east end of the Roberts Bank causeway will be affected by the Project. This habitat consists of previously disturbed areas within a railroad right-of-way, and grassy roadside verge, and comprises a very small portion of similar habitat in the local area. Due to the small size of the affected habitat, passerine populations are not anticipated to be affected • Existing anthropogenic habitat used by passerines at the terminals will not be affected by the Project and will not affect passerine productivity • Only a small portion of the intertidal and intertidal marsh habitats used by some species (e.g., barn swallow) for foraging will be affected by the Project; therefore, the ability of the LAA to support passerines and the population viability of passerines within the LAA is not anticipated to change • An abundance of alternate comparable habitat existing within the LAA to support passerine populations
✓	✓	Noise and other disturbance	*Avoidance and Project Design Mitigation*: • Placement of terminal in subtidal waters away from nearshore habitats primarily used by species in the sub-component • Project optimisation associated with the PCU reduced intensity of equipment use at the peak of construction *Other Mitigation*: • Shutdown of equipment and vehicles when not in use • Utilisation of equipment that produces less noise where feasible	*Avoidance and Project Design Mitigation* • Placing the terminal in subtidal waters (~5 km offshore) minimises the potential for disturbance during construction and operation activities, as passerines will be physically separated from activities associated with the terminal in the subtidal zone. • Project optimisation associated with the PCU reduces the intensity of equipment used during the peak of construction, reducing the potential for activities to disturb passerines. *Construction and Operation:* The intent of these mitigation measures is to minimise the potential for disturbance effects that	Effective as intended. The mitigation measures that will be employed are proven approaches to reduce noise to acceptable levels and minimise the potential for adverse effects during construction activities that would reduce passerine productivity. The likely potential effect if passerines are disturbed is temporary, short distance, relocation within the large quantity of alternative suitable habitat in the LAA, or habituation.	Taking mitigation into account, noise and other disturbance during construction and operation is predicted to result in no measurable residual effect to passerine populations. This determination is also based on a number of factors, including: • As passerines do not utilise submerged habitats, constant or impulsive underwater noise will not affect this sub-component. Potential effects from underwater noise on passerines are therefore considered negligible • Terminal placement in subtidal waters reduced the potential for disturbance to passerines by locating the terminal in an area minimally used by the sub-

Phase: Construction	Phase: Operation	Potential Project related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
			• Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing) • Awareness and training for construction crew • Using barriers (e.g., acoustic blankets) to shield wildlife from abrupt loud noise where feasible • Increasing or ramping-up sound levels slowly to allow birds to habituate or temporarily leave the area where feasible • Where possible, implementing measures to minimise impulsive noise • During, piling, use of vibratory hammer instead of impact pile driving when practical • Implementation of sound reduction or dampening methods or technologies to manage pile-driving sound levels, if required, to lower sound levels below thresholds • Compliance checking for above-ground and underwater noise *Operation* *Noise Management Plan* • Optimised tonality of equipment alarms to limit audibility on shore while meeting safety requirements • Operator awareness and training • Regular maintenance of equipment (e.g., lubrication of pulleys and other moving parts, replacement of deteriorated exhaust mufflers, maintaining efficiencies of engines through servicing)	could affect passerine populations by conducting activities under sound levels that may elicit flight behaviours or harm (injury or mortality) to the birds and thereby maintaining habitat quality. • Mitigation that will be implemented during construction and operation are proven techniques to reduce the overall amount and levels of noise that will be produced, and potential for the generation of excessive noise. • Turning equipment and vehicles off when not in use, using equipment that produces less noise, and performing regular maintenance activities reduces the overall noise in the surrounding environment. • Awareness training informs construction workers of the importance of the implementation of noise reduction measures and works to modify behaviours by ensuring staff understand the intent of mitigation measures and their responsibility to meet compliance. Results of this measure benefit the surrounding environment and subsequently avian health. • The use of noise barriers, such as acoustic blankets and/or bubble curtains, are a proven method to shield surroundings from abrupt noise and reduce the ambient noise within the surrounding environment. These types of technologies also act as visual barriers, and further reduce disturbance. • The use of ramp-up periods (soft start) is a proven technique that allows birds to gradually habituate to noise or temporarily position themselves away from potentially disruptive noise, thereby remaining within the LAA. • Vibratory hammers produce less noise (~15 dB) compared to impact hammers, and will be used when possible to reduce the incidence of impulsive noise that could disturb raptors. • The combination of measures described herein reduce the overall levels of noise in the environment, as well as minimise the level and potential generation of impulsive noise to maintain habitat quality for passerines.	Should mitigation be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account the fact that passerines have habituated to current noise levels from the existing terminals, and previous construction activities (e.g., Deltaport Third Birth) and are likely to habituate to any Project-related noise increases.	component and reducing the amount of dredging required to construct the Project • Observations of passerine distribution, abundance, and flight patterns at Roberts Bank terminals indicate that passerines are likely habituated to existing port activities and associated noise. It is likely that similar habituation to the presence of RBT2 will occur • Studies monitoring passerine distribution, abundance, and habitat use during the construction and operation of the DP3 terminal indicate negligible effects resulting from the Project to this sub-component • The determination that based on anticipated noise levels, passerines would have to be within 100 to 140 m of pile driving or 60 to 100 m of other construction activities to encounter noise levels anticipated to initiate a flight response (i.e., ~85 dBA). Construction activities emitting such levels within the intertidal zone used by passerines will be very limited and localised • The determination that there is a large amount of suitable alternative foraging habitat available to passerines in the LAA (>830 ha), and passerines are anticipated to move to areas away from construction activities if disturbed
✓	✓	Direct mortality from vehicles	*Construction and Operation* As described in the EIS, there are a number of proven effective mitigation measures to reduce barn owl collisions and other coastal birds, which will also mitigate collision risk to passerines.	*Construction and Operation* The intent of the mitigation is to support the management of vehicular speed limits along the causeway to reduce the incidence and likelihood of bird-vehicle collisions, thereby maintaining passerine population viability.	Effective as intended. Reducing the speed at which vehicles travel is a proven technique in reducing the potential for bird-vehicle collisions.	Taking mitigation into account, the direct mortality of passerines resulting from collisions with vehicles in the LAA is predicted to result in no measurable residual effect to passerine populations based on the anticipated low frequency of passerine-vehicle collisions by species

Phase		Potential Project related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
Construction	Operation					
			These measures were expanded upon in IR9-01 (CEAR Document #1322). • Connect and collaborate with local authorities to support speed management within the LAA to reduce the likelihood of bird-vehicle mortalities.			protected under the *Migratory Birds Convention Act* (MBCA). No species of conservation concern, including barn swallow, were documented suffering bird-vehicle mortalities, despite barn swallow being one of the most numerous passerines documented in the LAA.
✓	✓	Disturbance and disorientation from artificial lighting	*Construction* • Orienting lights downward and away from known bird-occupied areas, where possible • Using shielding to minimise light trespass and skyglow • Controlling light levels and limiting light use to areas where activities are occurring, where possible • Where possible, using fixtures that emit light at specific wavelengths shown to minimise disorienting effects to birds • Ensuring dredge lighting system shields light from spilling outside the basic working footprint of the dredge • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of navigational obstruction avoidance lighting on tall structures *Operation* • Minimising the number of light installations • Orienting lights downwards and away from known bird-occupied areas, where possible • Using down-shielded lighting fixtures to minimise light pollution • Avoiding the use of solid burning or slow pulsing warning lights • Using the minimum amount of navigational obstruction avoidance lighting on tall structures • Using of only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada • Avoiding the use of exterior decorative lights, especially on	*Construction and Operation* To minimise the potential for disturbance and disorienting effects to birds from artificial light, thereby maintaining habitat quality and the continued use of an area by passerines. Orienting lights downward, using shielding, and ensuring dredge lighting systems shield light from spilling outside the basic working footprint are methods intended to minimise light trespass and skyglow and maintain coastal bird population (including passerine) health. The proposed terminal will be semi-automated. As part of design mitigation, the Light Management Plan will ensure areas not occupied by humans stay dark or minimally lit, which will further reduce the likelihood of adverse effects from artificial light. Similarly, the Project design purposefully minimises the number of light installations and avoids the use of exterior decorative lights that have the potential to draw birds from distance. As proven collision avoidance measures, the proposed Project will avoid the use of solid burning or slow pulsing warning lights, use the minimum amount of on-terminal navigational obstruction avoidance lighting on tall structures, and use only strobe lights at night, at the minimum intensity and minimum number of flashes per minute allowable by Transport Canada.	Effective as intended. The mitigation measures that will be implemented as part of the Project are a suite of measures that are proven to reduce light trespass and sky glow. Should mitigation measures be ineffective, a change in the residual effect prediction is not anticipated, as the determination took into account potential habituation by passerines and the (bright) light levels from the existing terminals and the associated incremental increase with the Project. The likely potential effect if passerines are disturbance is temporary, short distance, relocation within the large quantity of alternative suitable habitat in the LAA on Robert Bank.	Taking mitigation into account, changes to artificial light is predicted to result in no measurable residual effect to passerine populations. This determination is also based on a number of factors, including: • The existing Roberts Bank terminals being a well-lit industrial site • Existing data indicate passerines are habituated to existing lighting conditions within the intertidal zone and onshore • The majority (94%) of new lighting will be on the terminal in subtidal waters, away from habitats intensively used by passerines. Light levels within the intertidal zone used by passerines are not predicted to differ from existing conditions • Effects to birds using the existing port infrastructure (e.g., the causeway) are expected to be negligible, as future illuminance levels are anticipated to not differ substantially from existing conditions • If a passerine is adversely affected by additional artificial illumination from the Project, it is anticipated that it will move to use the >830 ha of alternate suitable habitats that are abundant in the area away from the terminal

Phase: Construction	Phase: Operation	Potential Project related Effect	Applicable Mitigation Measures	Intent of Mitigation to Reduce Effect	Anticipated Effectiveness and Supporting Rationale	Residual Effect and Significance
			humid, foggy, or rainy nights, when illumination glow can draw birds from distance • Controlling light levels and limiting light use to areas where activities are occurring • Where possible, using fixtures that emit light at wavelengths shown to minimise disorienting effects to birds • Establishing a centralised lighting control system to select lighting where required			
✓	✓	Biotic and abiotic interactions (e.g., changes in prey availability)	*Avoidance and Project Design Mitigation:* The following measures were taken that directly reduced effects to or enhance habitat for passerine prey, or flora and fauna on which passerine prey depend and thereby provided indirect benefits to passerines: • Rounding the northwest terminal corner to reduce bed scour post construction • Placing the terminal in subtidal waters to minimise effects within the intertidal zone used by passerines and their prey • Incorporating rocky shoreline in portions of the terminal and causeway perimeters that provides habitat for some passerine prey *Other Mitigation*: • Creation of mudflat habitat (capable of supporting biofilm) providing invertebrate prey to passerines • Creation of intertidal marsh used by roosting and foraging passerines For mitigation measures benefiting passerine prey see EIS Sections 11.0, 12.0, 13.0, and 17.0, and the response to IR13-30 (CEAR Document #1331).	The intent of the avoidance mitigation measures employed as part of the proposed project design is to minimise potential adverse effects to passerine populations. A primary mitigation measure employed early on in the Project, as part of the alternatives assessment, was the placement of the proposed Project in subtidal waters. This not only minimised the direct loss of intertidal habitat used by passerines, but was also determined to minimise potential indirect abiotic effects, such as changes in geomorphology, which could affect passerine prey and impact passerine populations. The intent of onsite habitat creation is to provide habitat to passerines and increase the productivity of the prey they consume.	The avoidance mitigation employed is intended to be effective in minimising potential adverse effects to passerine populations and their prey through minimising potential geomorphic changes to the LAA (based on the analysis presented in EIS Section 5.0 and IR1-07 of CEAR Document #897). Onsite habitats (i.e., Offsetting Measures) have been proposed as mitigation based on the proven success of previous habitat creation projects, or based on ecological knowledge pertaining to conditions necessary to create functioning habitats and are anticipated to be fully effective.	Taking mitigation into account, changes to biotic and abiotic interactions is predicted to result in no measurable residual effect to passerine populations. This determination is based on the understanding that passerines are evolutionarily adapted to thrive in a dynamic environment, with species within the sub-component occupying terrestrial habitat more commonly than aquatic habitat. • Passerines documented in association with the existing Roberts Bank terminals are habituated to living in a highly modified industrial environment. Species found in high abundance included European starling and rock pigeon, which were ~2400% and 200% more abundant than the next most abundant passerine, barn swallow, respectively. The Project will be developed in this industrialised setting. It is anticipated that the species currently using the existing Roberts Bank terminal will also be adapted to conditions with the project in place • Biotic and abiotic factors influencing passerine population usage and abundance within the LAA are predicted to be minimal with the proposed Project and not affect passerine populations within the LAA

APPENDIX IR9-05-B

AERIAL EXTENT OF HABITATS WITHIN THE LOCAL ASSESSMENT AREA, HABITATS AFFECTED BY THE PROJECT FOOTPRINT, AND HABITATS USED BY COASTAL BIRD SUB-COMPONENTS

Table IR9-05-B1 Aerial Extent Of Habitats within the Local Assessment Area, Habitats Affected by the Project Footprint, and Habitats Used by Coastal Bird Sub-components[a]

Habitat	Outside Footprint (ha)	Within Footprint (ha)	Total in Local Assessment Area (ha)	Shorebirds	Diving Birds	Waterfowl	Gulls and Terns	Raptors	Herons	Passerines
Intertidal Zone										
Mud	557.9	0.2	558.1	✓		✓	✓	✓	✓	✓
Biomat	63.5	0.0	63.5	✓	✓	✓	✓	✓	✓	✓
Grass	8.9	3.6	12.5					✓		✓
Intertidal marsh	191.2	12.3	203.5	✓		✓	✓	✓	✓	✓
Kelp	0.4	0.02	0.4		✓					
Rock	10.1	5.8	15.8	✓	✓		✓	✓		✓
Sand	1,570.1	10.6	1,580.7	✓	✓		✓	✓	✓	
Non-native eelgrass	417.9	12.3	430.2	✓	✓	✓	✓	✓	✓	
Native Eelgrass	791.6	5.0	796.5	✓	✓	✓	✓	✓	✓	
Subtotal (ha)	*3,611.4*	*49.8*	*3,661.2*	*3,648.4*	*2,887.2*	*2,051.9*	*3,648.4*	*3,660.8*	*3,632.5*	*853.4*
Subtidal Zone										
Kelp	2.4	0.01	2.4		✓	✓				
Rock	0.0	0.1	0.1		✓		✓			
Sand	1,618.7	126.0	1,744.7		✓	✓	✓			
Native Eelgrass	55.3	1.0	56.3		✓	✓	✓			
Subtotal (ha)	*1,676.5*	*127.0*	*1,803.5*	*0*	*1,803.5*	*1,803.4*	*1,801.0*	*0*	*0*	*0*
Total (ha)	**5,287.9**	**176.7**	**5,464.7**	**3,648.4**	**4,690.7**	**3,855.3**	**5,449.4**	**3,660.8**	**3,632.5**	**853.4**

Note: a. Additionally, 1.2 ha of previously modified railroad and municipal infrastructure terrestrial habitat will be affected by the Project.