

ECOLOGICAL CONDITIONS AT PROPOSED WESTHAM ISLAND TIDAL MARSH PROJECT

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TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
1.1	RATIONALE	1
2.0	PROJECT LOCATION	2
3.0	PROPOSED PROJECT.....	4
3.1	SITE HISTORY	4
3.2	PROPOSED WORKS.....	5
4.0	BIOPHYSICAL CONDITIONS.....	7
4.1	GENERAL SITE DESCRIPTION	7
4.2	PHYSICAL CHARACTERISTICS.....	8
4.2.1	Existing Conditions	8
4.3	HABITAT.....	10
4.3.1	Habitat Classification	10
4.3.2	Fish and Wildlife Habitats	11
4.3.3	Listed Plant Communities	13
4.4	FISH	16
4.4.1	Common Fish Species.....	16
4.4.2	Listed Fish Species	19
4.5	WILDLIFE	21
4.5.1	Common Wildlife.....	21
4.5.2	Listed Wildlife	22
5.0	CONCLUSION	26
6.0	REFERENCES.....	27

List of Tables

Table A	Proposed Marsh Transplant Species for Westham Island.....	12
Table B	Listed Wetland Ecosystems with the Potential to Occur at the Project Site (BC Ministry of Environment 2013).....	13
Table C	Listed Plant Species with Potential to Occur at the Project Site (BC Ministry of Environment 2013).....	15

Table D	Listed Fish Species with the Potential to Occur Near the Project Site (BC Ministry of Environment 2013).....	20
Table E	Common Wildlife Species with Potential to Occur at the Project Site (from Nuszdorfer et al. 1991)	21
Table F	Listed Wildlife Species with a Potential to Occur at the Westham Island Site (BC Ministry of Environment 2013).....	23

List of Figures

Figure 1	Westham Island Tidal Marsh Project Site – Regional Setting (Google Inc. 2013)	2
Figure 2	Westham Island Tidal Marsh – Site Location (Google Inc. 2009)	3
Figure 3	Proposed Habitat Enhancement Design for the Westham Island Tidal Marsh Project BC NTS (Moffatt & Nichol 2014)	5
Figure 4	A) Existing Site Conditions, B) Rendering of Proposed Post-Enhancement Conditions....	6
Figure 5	Biogeoclimatic Subzones of Metro Vancouver (Government of British Columbia 2012) ...	8
Figure 6	FREMP Habitat Classification at and Near Westham Island, Fraser River, Delta, BC (FREMP 2013)	11
Figure 7	Watersheds and Waterbodies Near the Project Site (Corporation of Delta 2003)	18
Figure 8	Watercourse Classification Close to the Project Site. Orange Streams are Endangered (FREMP 2013).	19
Figure 9	Known Occurrences of Listed Wildlife Species near Westham Island Site, BC (iMap BC 2013)	25

List of Photos

Photo 1	Upstream View of the Proposed Enhancement Area	9
Photo 2	Tidal Channel within the Existing Marsh Adjacent to Project Site	9
Photo 3	Existing Brackish Marsh with Spike Rush and Lyngby’s Sedge	12
Photo 4	Canada Geese Loafing at Proposed Enhancement site.....	22

List of Appendices

Appendix A	Coastal Douglas-fir Moist Maritime Biogeoclimatic Subzone - Common and Listed Species and Ecosystems	
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1.0 INTRODUCTION

The proposed Westham Island Tidal Marsh Creation Project (the Project) in the Corporation of Delta, B.C., is being considered as a potential project under PMV's Habitat Enhancement Program. Project planning is being undertaken in accordance with the "Working Agreement Concerning Procedures for Development and Operation of the Port Metro Vancouver Habitat Bank" (September 19, 2012) between Fisheries and Oceans Canada (DFO) and PMV.

1.1 RATIONALE

As part of the Habitat Enhancement Program, PMV is applying a landscape approach to identify locations where productive capacity of fish habitats can be increased (e.g., by conversion of unproductive upland to productive fish and wildlife habitat); existing habitat can be enhanced to increase its productivity, or degraded habitat can be restored to benefit fish and wildlife species utilizing the lower Fraser River estuary.

This project is located within the Habitat Enhancement Program's "Fraser Estuary, Boundary Bay, Burrard Inlet, Fraser and North Arms" Geographic Service Area (GSA). More than 70% of the original estuarine marsh habitat in this GSA has been impacted by diking and shoreline development over the last century. Marsh restoration in this GSA is considered a very high priority for PMV's Habitat Enhancement Program, wherever a substantial and meaningful improvement in habitat productivity can be provided. The final site selection for this Project was based on factors including need, habitat productivity, site location, feasibility and cost, sustainable habitat creation, ownership and tenure, and consideration towards First Nations and communities.

Conversion of an unvegetated intertidal flat to brackish marsh at the Project site will increase the productivity of Canoe Passage and provide high-quality habitat at a prime estuarine location for juvenile salmonids, other fish species, birds and wildlife utilizing the Fraser River estuary.

The primary sources of information considered during preparation of this report included:

- A review of current and historical aerial photographs.
- Field reconnaissance information collected in 2012 (Pers. Comm.GL Williams 2012)
- Desktop study and background research.

2.0 PROJECT LOCATION

The Project site is located in Canoe Passage in the Corporation of Delta (**Figure 1**), in the intertidal zone on the south-east shore of Westham Island less than 1 km downstream of the Wes-Del Marina (**Figure 2**).

Figure 1 Westham Island Tidal Marsh Project Site – Regional Setting (Google Inc. 2013)

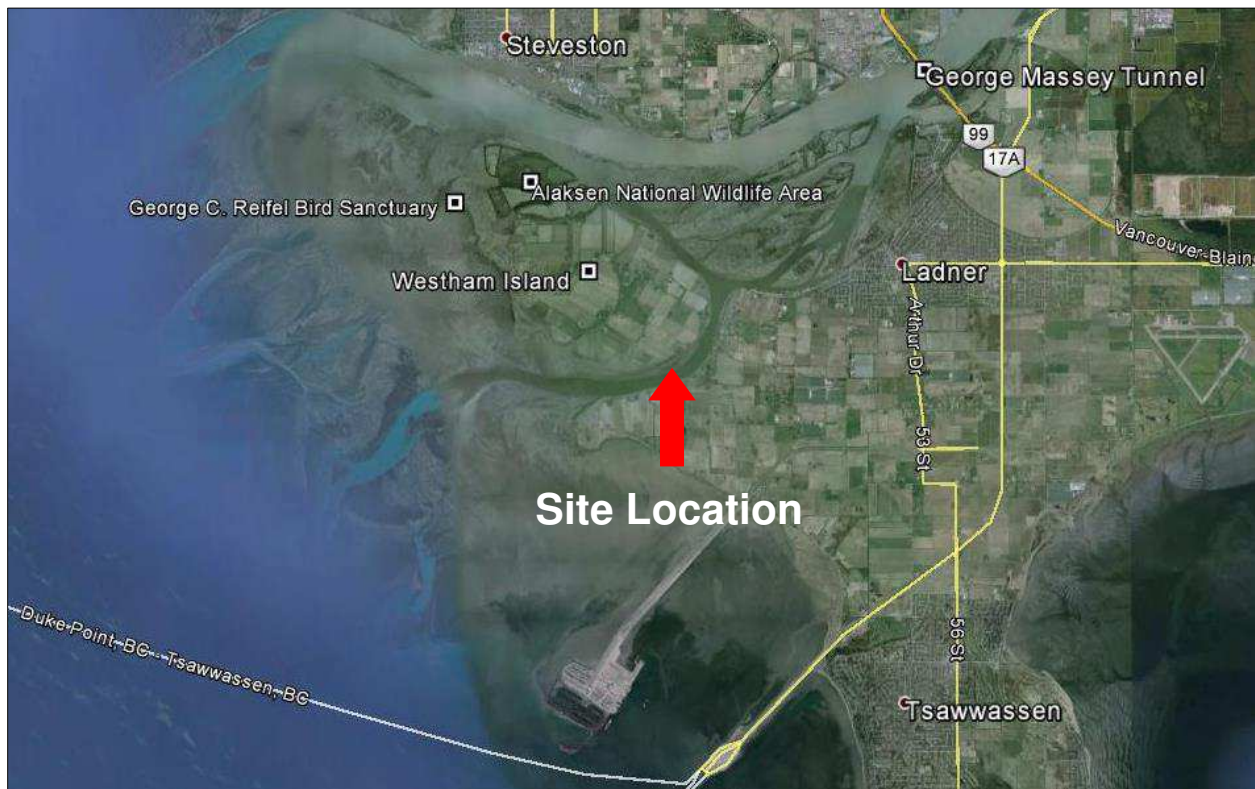


Figure 2 Westham Island Tidal Marsh – Site Location (Google Inc. 2009)



3.0 PROPOSED PROJECT

3.1 SITE HISTORY

Westham Island was settled by farmers and fishermen in the early 1870's (Corporation of Delta 2013a) shortly after settlers Thomas and William Ladner in 1868 began to cultivate land in what is now part of Ladner town centre (Delta Farmland & Wildlife Trust 2011). The island was used as agricultural lands, as a barge-loading site for horses sent to logging camps along the lower coast of BC (Delta Farmland & Wildlife Trust 2011), and was also the site of several canneries, including the ABC Cannery (est. 1988) (Strukoff 2013). Prior to the flourishing of Steveston's cannery industry, the 14 canneries surrounding Ladner formed the most important cannery centre in the region (Destination BC Corporation 2013).

By the late 1800's Ladner, and surrounding areas, was a centre of agriculture and related industries (Delta Farmland & Wildlife Trust 2011). In order to protect Ladner's industry, many dikes had been built along the Fraser River by the turn of the century. Nearby river islands either had minimal protection or were left to flood naturally. Many of these river islands were used as fishing camp sites supplying the local salmon canneries. Ewen Slough on Westham Island was the site of one of these fishing camps (British Columbia Waterfowl Society 2012).

The construction of the Westham Island Bridge in 1910 created a key transportation route for the canneries and farms on the Island; prior to its construction a small ferry connected island residents to the mainland (Strukoff 2013). To this day, Westham Island is an important agricultural component in the Fraser Delta (Google Inc. 2009).

The Project Site is adjacent to a 90.8 ha property that was acquired by the Nature Trust of British Columbia in 1995-1997. Most of the Nature Trust property sits on the landward side of the dike. Managed by Ducks Unlimited, the property provides feeding and overwintering habitat for waterfowl through its conservation of agricultural land (The Nature Trust of British Columbia 2012). Also located on Westham Island, the 300 ha George C. Reifel Migratory Bird Sanctuary is located about 4 km northwest of the Project Site. The Reifel Sanctuary was established in the 1960s to preserve the area's importance as a migration stop-over and a wintering area for large numbers of migratory birds.

The Project Site is located within a net sediment depositional zone on the inner bend of Canoe Passage (Moffatt & Nichol 2014). A review of existing aerial photographs (1996, 1979, 1984 and 2002) shows both a lengthening and narrowing of Canoe Passage over time (NHC-Triton 2004). This narrowing of Canoe Passage has resulted in a decrease in its hydraulic capacity. In 2004 Canoe Passage was estimated to be conveying 5% of the Fraser River's flow, compared to 14% in the 1980's (Moffatt & Nichol 2014).

The Project area is currently used by First Nations for fishing, hunting and harvesting of traditional plants. The Tsawwassen, Musqueam and Hwlitsum First Nations have indicated that Canoe Pass was once an important area for eulachon, sturgeon and other finfish but that siltation, creased vessel traffic and other factors have adversely affected fish and wildlife habitat. The Project area falls within the Tsawwassen First Nations migratory bird, wildlife and fishing areas that is currently accessed by members exercising treaty rights. Musqueam Indian Band currently uses Canoe Pass for salmon fishing and duck hunting. Members of Hwlitsum First Nation currently fish, hunt and harvest traditional plants in the Project area.

3.2 PROPOSED WORKS

Proposed fish habitat enhancement works in Canoe Passage involve the creation of productive intertidal brackish marsh on an area that is currently occupied by un-vegetated intertidal mud/sand flat. The creation of an intertidal brackish marsh on the site will be accomplished through the construction of a perimeter rock berm, followed by placement of clean fill material to specified elevations, and planting of marsh vegetation.

Unvegetated areas extend approximately 2.3 km along the Westham Island shoreline, with a total estimated area at low tide of approximately 11 to 12 ha. The design of this project consists of the construction of a low-elevation containment berm that will follow the existing channel and sandbar, creating an outline of an area that can be filled to create marsh (**Figure 3**). The maximum width of this created marsh will be approximately 100 m, and it will extend approximately 670 m downstream of the end of Trim Road (**Figure 4**). The total resulting tidal wetland habitat will be approximately 4.0 ha. The project is not expected to negatively affect river flow, sedimentation or erosion within Canoe Passage (GL Williams & Associates Ltd. 2012).

Figure 3 Proposed Habitat Enhancement Design for the Westham Island Tidal Marsh Project BC NTS (Moffatt & Nichol 2014)

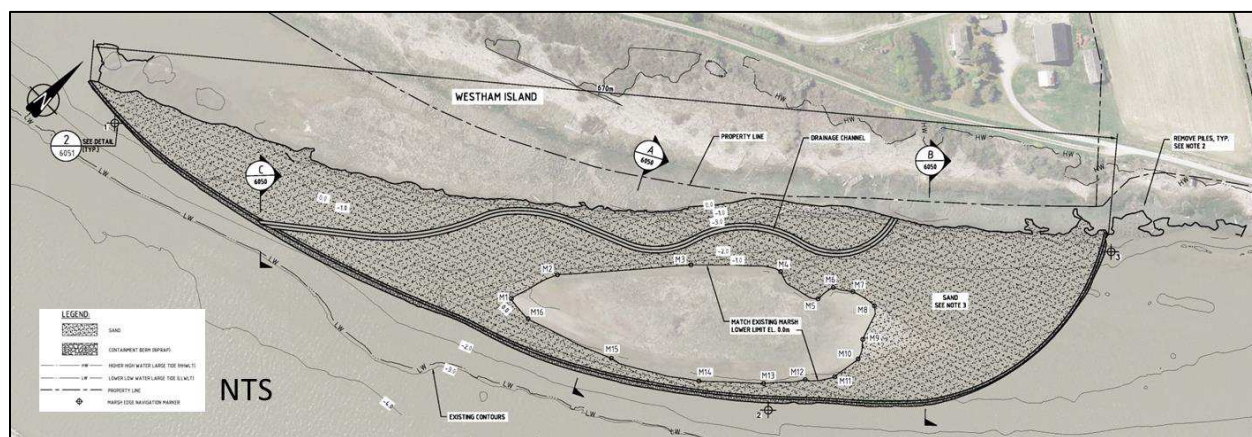


Figure 4 A) Existing Site Conditions, B) Rendering of Proposed Post-Enhancement Conditions



4.0 BIOPHYSICAL CONDITIONS

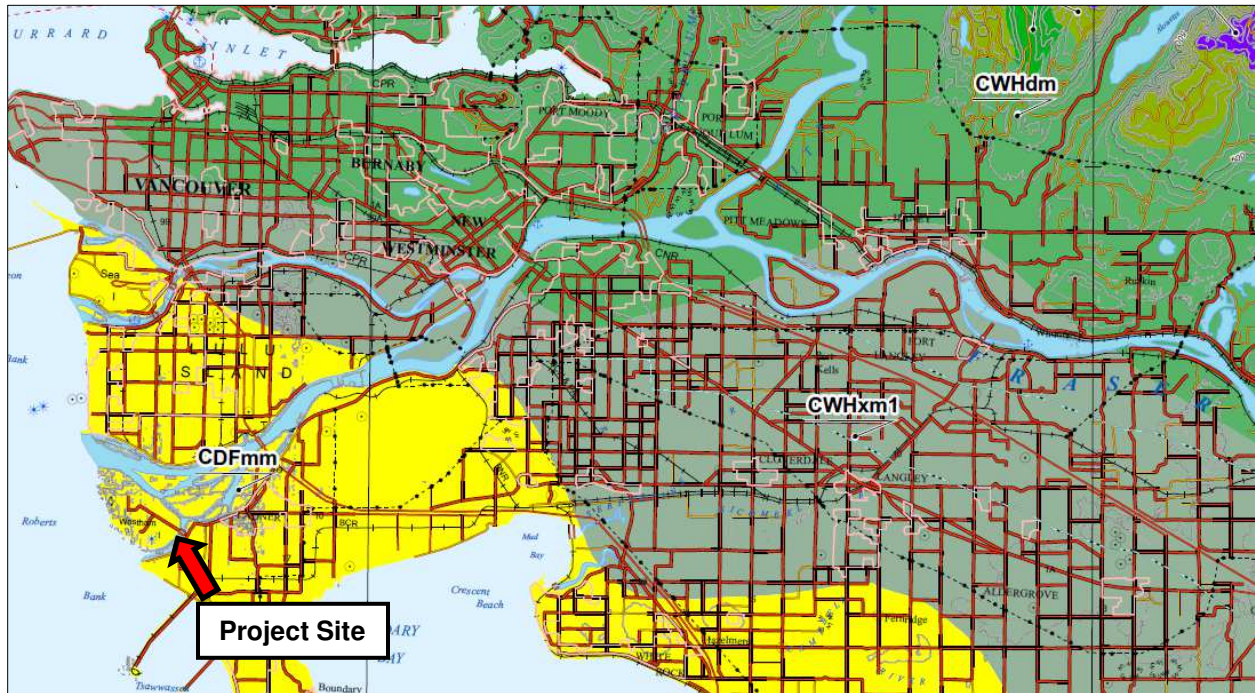
Information related to the biophysical conditions of the Project Site was obtained from the following sources:

- Online Sensitive Habitat Inventory and Mapping database (SHIM 2013).
- Online Fraser River Estuary Management Program and Burrard Inlet Environmental Action Program Habitat Atlas (FREMP 2013).
- Online BC Species and Ecosystems Explorer database (BC Ministry of Environment 2013).
- Online E-fauna BC database (Klinkenberg 2013).
- Online iMap BC database (iMap BC 2013).
- Online Deltamap database (Corporation of Delta 2013).
- Aerial photographs (W. Jans/PMV 2013).
- Delta Watersheds Fish and Amphibian Distributions map (Corporation of Delta 2003).
- Westham Island memo: GL Williams & Associates Ltd to Hemmera (GL Williams & Associates Ltd. 2012).

4.1 GENERAL SITE DESCRIPTION

The Project Site occurs within the Coastal Douglas-fir Moist Maritime (CDFmm) biogeoclimatic subzone (SHIM 2013; **Figure 5**). The CDFmm subzone is limited to the south coast of British Columbia, and includes several Strait of Georgia islands, a small portion of southeastern Vancouver Island, and a narrow strip of the Lower Mainland. The CDFmm occurs at elevations of less than 150 m above sea level and typically has warm, dry summers and mild, wet winters (Nuszdorfer et al. 1991). The mean annual temperature in the CDFmm is 9.2 to 10.5°C and the mean annual precipitation ranges from 647 to 1263 mm (Nuszdorfer et al. 1991).

Figure 5 Biogeoclimatic Subzones of Metro Vancouver (Government of British Columbia 2012)



4.2 PHYSICAL CHARACTERISTICS

4.2.1 Existing Conditions

The Project Site currently consists of an unvegetated intertidal point bar, ranging in width from 120 to 230 m, with substrates characterized by sand and mud (**Photo 1**). At low tide, the sand flat drains via several small surface channels. Adjacent to the Project Site, several larger drainage channels transect the existing marsh (**Photo 2**).



Photo 1 Upstream View of the Proposed Enhancement Area



Photo 2 Tidal Channel within the Existing Marsh Adjacent to Project Site

4.3 HABITAT

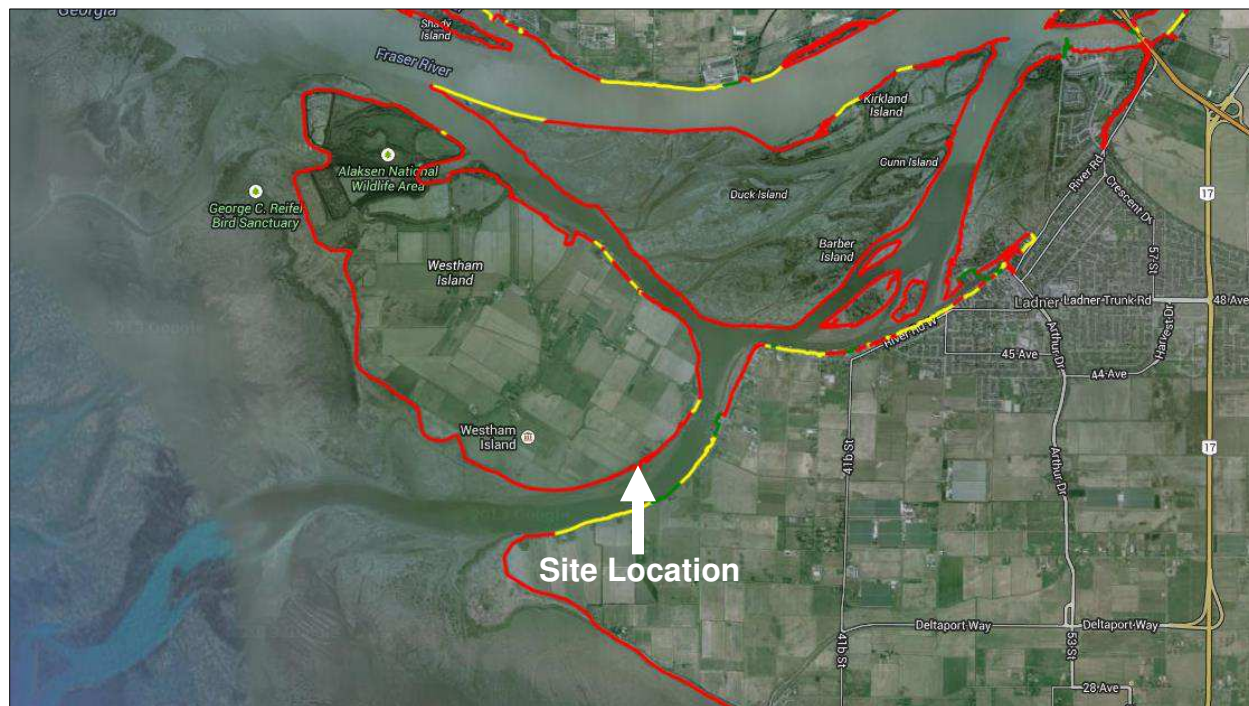
4.3.1 Habitat Classification

FREMP classifies shorelines within the Fraser River estuary on the basis of the relative values of their habitat features (FREMP 2002). The classification system was created from an inventory of habitat types in the estuary, including features such as mudflats, marshes, and riparian habitats. FREMP (2002) habitat classifications include:

- Red (High Productivity): includes productive and diverse habitat features that support critical fish and wildlife functions on-site or as part of a more regional context and/or areas where habitat compensation has been previously constructed to offset habitat losses.
- Yellow (Moderate Productivity): habitats include habitat features that are of moderate value in structure or diversity due to existing conditions (e.g., surrounding land uses or productivity) and support moderate fish and wildlife functions.
- Green (Low Productivity): habitats include areas where habitat features and functions are limited due to existing conditions (e.g., developed for port or other urbanized uses).

The Project Site is currently coded Red, indicating that this is a highly productive habitat (**Figure 6**). This classification is likely due to the existing narrow strip of marsh adjacent to the Project Site. The Project Site itself is not classified by FREMP. However, since the Project Site mainly consists of mudflat, which is low in productivity, it would likely be classified as Yellow. The proposed enhancement is intended to increase the productivity of habitats along the shoreline, and will therefore not affect the FREMP coding for the area.

Figure 6 FREMP Habitat Classification at and Near Westham Island, Fraser River, Delta, BC (FREMP 2013)



4.3.2 Fish and Wildlife Habitats

4.3.2.1 Existing Habitats

Intertidal Marsh and Mudflats

The Project Site is largely unvegetated intertidal sand/mudflat habitat (GL Williams & Associates Ltd. 2012). Intertidal brackish marsh is present along the toe of the dike and in patches on the sand/mudflat (GL Williams & Associates Ltd. 2012) (**Photo 3**). The dominant marsh vegetation species is Lyngby's sedge (*Carex lyngbyei*). Softstem bulrush (*Schoenoplectus tabernaemontani*), threesquare bulrush (*Schoenoplectus pungens*), and spike rush (*Eleocharis palustris*) are also present (GL Williams & Associates Ltd. 2012). The upper intertidal marsh contains invasive purple loosestrife (*Lythrum salicaria*) (GL Williams & Associates Ltd. 2012).



Photo 3 Existing Brackish Marsh with Spike Rush and Lyngby's Sedge

4.3.2.2 Post-Enhancement Conditions

Existing intertidal marsh habitat at The Project Site will not be negatively affected by proposed enhancements works. Existing tidal marshes along the dike and on the sandflat will connect with the enhanced marsh post construction. Four native marsh species will be transplanted to the enhanced area (**Table A**).

Local First Nations have used local plants, including cattail, for traditional purposes. Proposed marsh transplant species will potentially include traditional and medicinal plants. Final plant selection will be determined in consultation between PMV staff and interested First Nations groups.

Table A Proposed Marsh Transplant Species for Westham Island

Scientific Name	Common name
<i>Carex lyngbyei</i>	Lyngby's sedge
<i>Eleocharis palustris</i>	spikerush
<i>Schoenoplectus tabernaemontani</i>	softstem bulrush
<i>Schoenoplectus pungens</i>	threesquare bulrush

4.3.3 Listed Plant Communities

Provincial at-risk species and ecosystems are assigned by the B.C. Conservation Data Centre to either the Red or Blue lists. Red-listed species or ecosystems are considered Threatened, Endangered or Extirpated. Blue-listed species or ecosystems are considered to be of Special Concern, i.e., sensitive to activities which could lead to them becoming extinct or extirpated. The rankings highlight species and ecological communities that have particular threats, declining population trends, or restricted distributions that indicate that they require special attention.

4.3.3.1 Existing Conditions

A number of listed estuarine and wetland ecosystems occur in the CDFmm subzone (**Table A1, Appendix A**). **Table B** indicates only those species from **Table A1** that have been identified as having a potential of occurring at the site, based upon their known geographic distributions and habitat associations (BC Ministry of Environment 2013).

Table B Listed Wetland Ecosystems with the Potential to Occur at the Project Site (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial Listing ¹	Potential to Occur ²	Effects of Enhancement
<i>Carex lyngbyei</i> Herbaceous Vegetation	Lyngbye's sedge herbaceous vegetation	Red	May occur at the site; this ecosystem is classified as an Estuary Marsh	Benefit: possible creation of habitat
<i>Deschampsia cespitosa</i> ssp. <i>Beringensis</i> - <i>Hordeum</i> <i>brachyantherum</i>	tufted hairgrass - meadow barley	Red	May occur at the site; this ecosystem is classified as an Estuary Meadow	Benefit: possible creation of habitat
<i>Deschampsia cespitosa</i> ssp. <i>beringensis</i> - <i>Symphotrichum</i> <i>subspicatum</i>	tufted hairgrass - Douglas's aster	Red	May occur at the site; this ecosystem is classified as an Estuary Meadow	Benefit: possible creation of habitat
<i>Distichlis spicata</i> var. <i>spicata</i> Herbaceous Vegetation	seashore saltgrass Herbaceous Vegetation	Red	May occur at the site; this ecosystem is classified as an Estuary Meadow	Benefit: possible creation of habitat
<i>Juncus arcticus</i> - <i>Plantago macrocarpa</i>	arctic rush - Alaska plantain	Red	May occur at the site; this ecosystem is classified as an Estuary Meadow	Benefit: possible creation of habitat
<i>Ruppia maritima</i> Herbaceous Vegetation	beaked ditch-grass Herbaceous Vegetation	Red	May occur at the site; this ecosystem is classified as an Estuary Meadow	Benefit: possible creation of habitat
<i>Sarcocornia pacifica</i> - <i>Glaux maritima</i>	American glasswort - sea-milkwort	Red	May occur at the site; this ecosystem is classified as an Estuary Marsh	Benefit: possible creation of habitat

Notes: ¹ Red = includes any ecological community that is Extirpated, Endangered, or Threatened in BC,
Blue = includes any ecological community considered to be of Special Concern (formerly Vulnerable) in BC
² Ecosystem information cited from B.C. Conservation Data Centre (2013)

Nineteen listed wetland vegetation species occur in the CDFmm subzone (BC Ministry of Environment 2013; **Table A2 Appendix A**). **Table C** lists only the species from **Table A2** that have the potential of occurring at the Project site or that will likely be affected by the proposed enhancement works. Three of these species have been recorded near the Project site (iMap BC 2013) (**Table C**). A detailed vegetation inventory was not undertaken at the site, however, a series of site visits were conducted to describe existing plant species, plant communities, and fish and wildlife habitats at the site. The blue-listed Henderson's checker-mallow (*Sidalcea hendersoni*) was identified in the brackish marsh, adjacent to the dike on Westham Island (GL Williams & Associates Ltd. 2012).

Table C Listed Plant Species with Potential to Occur at the Project Site (BC Ministry of Environment 2013)

Scientific Name	Common Name	Provincial Listing ¹	SARA ²	COSEWIC ³	Potential to Occur ⁴	Effects of Enhancement
<i>Anagallis minima</i>	Chaffweed	Blue			May occur at the site; this species utilizes wet river banks and salt marshes in the lowland zone.	Benefit: creation of additional habitat
<i>Bidens amplissima</i>	Vancouver Island beggarticks	Blue	1-SC (2003)	SC (2001)	May occur at the site; this species utilizes estuary environments such as intertidal mudflats and salt marshes. Known to occur on nearby Reifel Island (iMap BC 2013).	Benefit: creation of additional habitat
<i>Caltha palustris</i> var. <i>radicans</i>	Yellow marsh-marigold	Blue			May occur at the site; this species utilizes wet habitats such as brackish marshes.	Benefit: creation of additional habitat
<i>Carex scoparia</i>	Pointed broom sedge	Blue			May occur at the site; this species utilizes brackish tidal marshes.	Benefit: creation of additional habitat
<i>Elatine rubella</i>	Three-flowered waterwort	Blue			May occur at the site; this species utilizes estuarine tidal marsh environments.	Benefit: creation of additional habitat
<i>Eleocharis parvula</i>	Small spike-rush	Blue			May occur at the site; this species utilizes intertidal brackish wetlands.	Benefit: creation of additional habitat
<i>Eleocharis rostellata</i>	Beaked spike-rush	Blue			May occur at the site; this species may utilize salt marshes.	Benefit: creation of additional habitat
<i>Glyceria leptostachya</i>	Slender-spiked mannagrass	Blue			May occur at the site; this species may utilize brackish tidal marshes.	Benefit: creation of additional habitat
<i>Lilaea scilloides</i>	Flowering quillwort	Blue			May occur at the site; this species utilizes intertidal mudflats and marshes. Known to occur on nearby Reifel Island and north side of Westham Island (iMap BC 2013).	Benefit: creation of additional habitat
<i>Sidalcea hendersonii</i>	Henderson's checker-mallow	Blue			May occur at the site; this species utilizes wet coastal areas including mudflats and high marshes. Known to occur on nearby Duck Island, Woodward Island and Ladner marsh (iMap BC 2013). Recorded adjacent to proposed enhancement site (GL Williams & Associates Ltd. 2012).	Benefit: creation of additional habitat

Notes: ¹ Red = endangered or threatened, Blue = special concern

² Schedule 1 = federal species at risk

³ E = Endangered, SC = Special Concern

⁴ Species Information from BC Conservation Data Centre (2013) and E-Flora BC (2013)

4.3.3.2 Post-Enhancement Conditions

Proposed enhancement works will result in the addition of approximately 4.02 ha of brackish tidal marsh habitat. Marsh creation may create physical conditions that are suitable for some of the listed species presented in **Table C**, particularly those that are tolerant of brackish tidal conditions. None of the listed species are included in the list of potential transplant species for the project. Therefore, their occurrence in the enhanced area would be the result of natural dispersal or vegetative growth from nearby occurrences.

Henderson's checker-mallow was observed adjacent to the proposed enhancement site and it occurs in wet meadows, estuaries and tidal wetlands. Flowering quillwort (*Lilaea scilloides*) is an annual herb that occurs as an understory species in the tidal marshes of the lower Fraser estuary. Both of these species have the potential to occur in the enhanced area once physical works are complete and vegetation becomes established. Post-construction monitoring focussed on the identification of plants species will confirm the presence of these species.

4.4 FISH

4.4.1 Common Fish Species

4.4.1.1 Existing Conditions

The south arm of the Fraser River is an important migratory, rearing and spawning area for fishes, including ecologically and economically important salmonids. For example, the valuable Harrison-run chinook salmon (*Oncorhynchus tshawytscha*) rear in the lower Fraser River (DFO 1999). Coho salmon (*O. kisutch*), cutthroat trout (*O. clarkii*), chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*), Dolly Varden char (*Salvelinus malma*) and steelhead trout (*O. mykiss*) all occur in the Fraser River (SHIM 2013).

The Project Site would be accessible, via Canoe Passage, to freshwater tolerant marine fish species that occur in the Strait of Georgia. An inventory at nearby Roberts Bank shows the area is used by a wide range of fishes, including: flatfish, salmonids, rockfish, lingcod (*Ophiodon elongatus*), spiny dogfish (*Squalus acanthius*), gobbies, sculpins, perch, and forage fish such as Pacific herring (*Clupea pallasii*) and Pacific sandlance (*Ammodytes hexapterus*) (Precision Identification Consultants 2007). The most common fish species found in sand/mudflat habitats were flatfish such as English sole (*Parophrys vetulus*), Pacific sanddab (*Citharichthys sordidus*), rock sole (*Lepidopsetta petraborealis*), starry flounder (*Platichthys stellatus*) (Pers. Comm. Pam Thuringer 2013). These sand/mudflat species have potential to occur at the Project Site, particularly starry flounder, which is freshwater-tolerant, and Pacific sandlance, a burrowing forage fish that is an important prey item for a number of locally valued species (Taylor and Perrin 2005).

The Project Site is within the Corporation of Delta's FA-1 watershed and near to the FA-2 watershed (**Figure 7**). Several agricultural ditches and three sloughs (London, Ewen and Tamboline) occur north of the site. Delta sloughs are generally highly impacted by channelization and riparian removal and suffer from low water quality, likely due to agricultural inputs that influence water temperature and primary productivity (Fraser River Action Plan 1999). The natural flow regime of the Delta sloughs has been modified and most act as storm drainage channels with pump houses or flap gates that cut off direct connection to the Fraser River. Flood control structures prevent access by anadromous fishes, except during periods of high flow (Fraser River Action Plan 1999). The west arm of London Slough runs into the Reifel Bird Sanctuary, where it is protected from development (British Columbia Waterfowl Society 2012). Neither London nor Tamboline slough are known support salmonids year-round. Juvenile salmonids are known to access portions of these areas during high flows, such as in the summer when the areas are flooded for agriculture (Fraser River Action Plan 1999). The following fish species have been observed in Watershed FA-1: brassy minnow (*Hydognathus hankinsoni*), redbelt shiner (*Richardsonius balteatus*), carp (*Cyprinus carpio*), brown catfish (*Ameiurus nebulosus*), and threespine stickleback (*Gasterosteus aculeatus*) (Corporation of Delta 2008; **Figure 8**).

First Nations have harvested fish from the Fraser Estuary since their colonization of the area. First Nations currently exercise the Aboriginal Right to Fish in Canoe Pass and have indicated that Canoe Pass is an important area for salmon and was previously important for eulachon.

Figure 7 Watersheds and Waterbodies Near the Project Site (Corporation of Delta 2003)

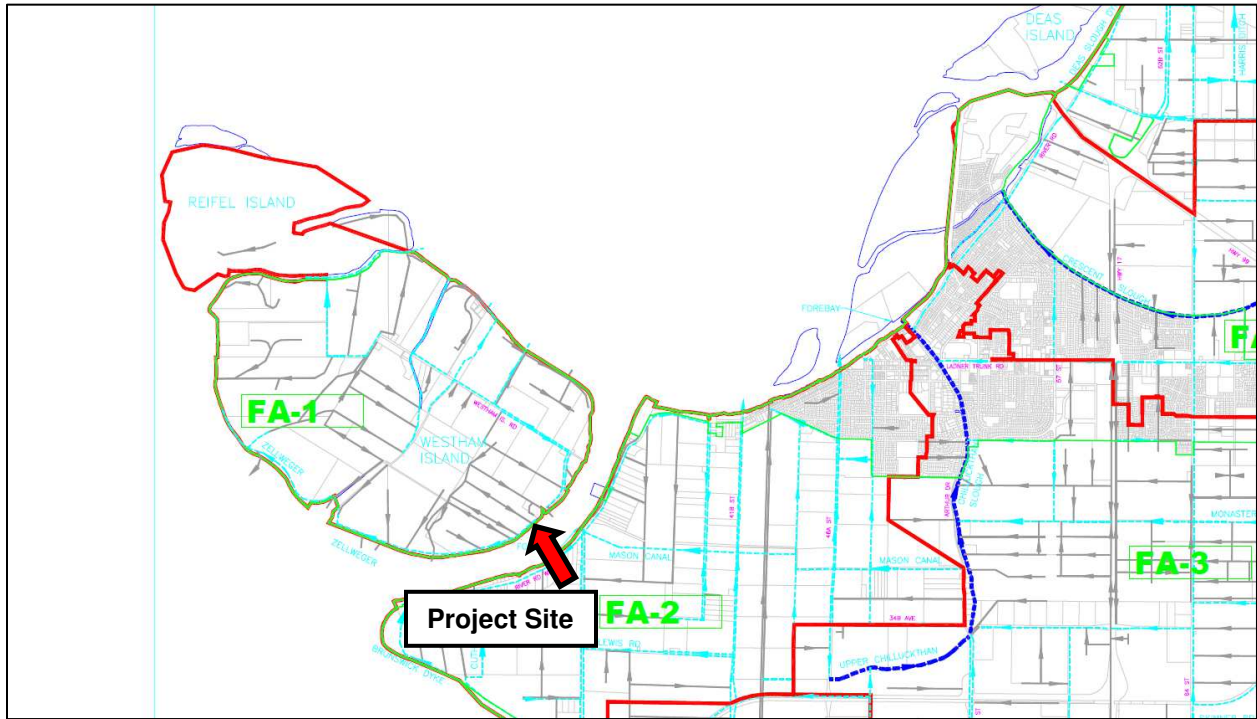
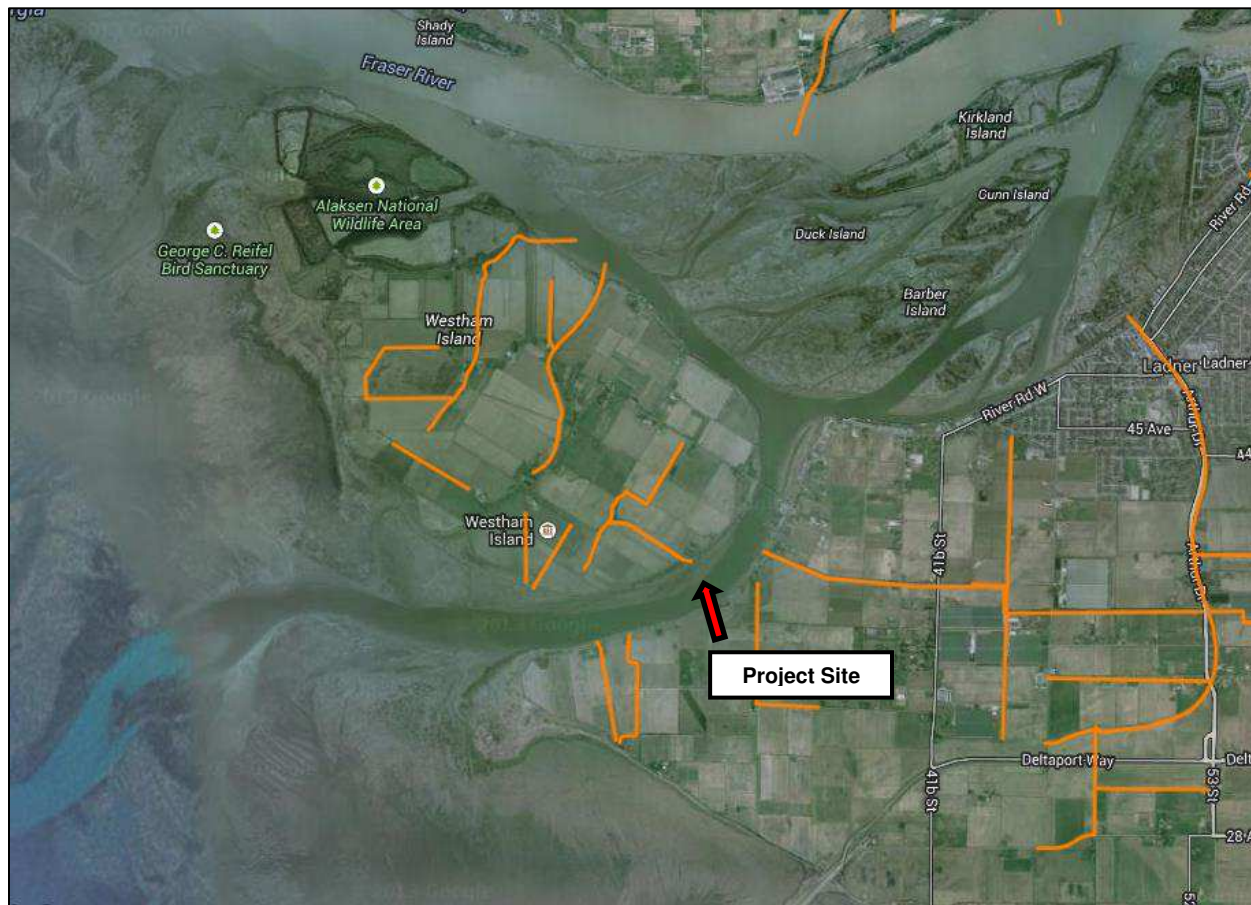


Figure 8 Watercourse Classification Close to the Project Site. Orange Streams are Endangered (FREMP 2013).



4.4.1.2 Post-Enhancement Conditions

Establishment of brackish tidal marsh habitat will increase the productivity of fish and wildlife habitat in Canoe Passage and provide important rearing habitat for juvenile Pacific salmon, particularly chum and chinook salmon. The benefits of increased productivity will also extend to other fish species.

The enhanced productivity of the proposed project will contribute to the estuarine detritus-based food web and result in increased production of important forage and prey items in adjacent unvegetated flats. The restoration of tidal marshes, which have been subject to up to 70% losses due to human development, is a desirable management outcome for the lower Fraser River estuary.

4.4.2 Listed Fish Species

4.4.2.1 Existing Conditions

Three listed marine and freshwater fish species occur in the CDF biogeoclimatic zone within Metro Vancouver (BC Ministry of Environment 2013; **Table D**). The potential of these species to occur at or near the Project Site and the effect the proposed works will have on these species is given in **Table D**.

Table D Listed Fish Species with the Potential to Occur Near the Project Site (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial Listing ¹	SARA ²	COSEWIC ³	Comments	Effects Enhancement
<i>Acipenser medirostris</i>	Green sturgeon	Red	1-SC (2006)	SC (1987)	Habitat preferences are poorly understood. Green sturgeons have only been observed in marine waters off the BC coast.	n/a
<i>Acipenser transmontanus</i> (Lower Fraser River population)	White sturgeon	Red	Not listed	T (2012)	Have been observed near Project Site and juveniles, which prefer shallow water depths, could potentially use the mudflat or marsh habitats at the Project Site. Known to occur in the south arm of the Fraser River (iMap BC 2013).	Unlikely to be affected by creation of marsh habitat.
<i>Oncorhynchus clarkii clarkii</i>	Cutthroat trout, <i>clarkii</i> subspecies	Blue	Not listed	Not listed	May use marsh habitat and habitat edges near the project site.	Additional marsh and marsh edge may provide foraging and cover opportunities during periods of high tide.

Notes: ¹ Red = endangered or threatened, Blue = special concern

² Schedule 1 = federal species at risk

³ E = Endangered, T = Threatened, SC = Special Concern

4.4.2.2 Post-Enhancement Conditions

The project site is proposed for an accreting mud/sand bar on the inside bend of Canoe Passage. The Project will essentially accelerate the rate of deposition, with the goal of creating a tidal brackish marsh along the bar. The replacement of tidal sand/mudflat with tidal marsh will result in the loss of habitat that may be utilized by some fish species, particularly at high tide (e.g., flatfish such as starry flounder (*Platichthys stellatus*)). The proposed enhancements will create more complex, productive habitat with high value to juvenile salmonids rearing in the lower Fraser River estuary.

4.5 WILDLIFE

4.5.1 Common Wildlife

4.5.1.1 Existing Conditions

Species representative of the CDFmm subzone that occur in estuaries, shallow bays, intertidal and sub-tidal marine ecosystems are listed in **Table E** (Nuszdorfer et al. 1991).

Table E Common Wildlife Species with Potential to Occur at the Project Site (from Nuszdorfer et al. 1991)

Taxa	Species
Mammals	raccoon (<i>Procyon lotor</i>) mink (<i>Neovison vison</i>) river otter (<i>Lontra canadensis</i>) harbour seal (<i>Phoca vitulina</i>) American beaver (<i>Castor canadensis</i>) coyote (<i>Canis latrans</i>) muskrat (<i>Ondatra zibethicus</i>)
Birds	Pacific loon (<i>Gavia pacifica</i>) horned grebe (<i>Podiceps auritus</i>) Canada goose (<i>Branta canadensis</i>) snow goose (<i>Chen caerulescens</i>) Barrow's goldeneye (<i>Bucephala islandica</i>) bufflehead (<i>B. albeola</i>) mallard (<i>Anas platyrhynchos</i>) American wigeon (<i>A. americana</i>) green-winged teal (<i>A. carolinensis</i>) glaucous-winged gull (<i>Larus glaucescens</i>) northwestern crow (<i>Corvus caurinus</i>) Pacific dunlin (<i>Calidris alpina</i>)

The Fraser River Estuary, including Westham Island, is globally recognized as a key migratory stop-over and wintering area for millions of waterfowl and shorebirds (Butler and Campbell 1987; WHSRN 2005). The area is also home to countless resident bird species. A list of bird species that have been observed at the Reifel Migratory Bird Sanctuary is presented in **Appendix A (Table A3)**. American beaver (*Castor canadensis*), coyote (*Canis latrans*) and muskrat (*Ondatra zibethicus*) all occur on Westham Island (BC Ministry of Environment 2003). Reptiles and amphibians including common garter snake (*Thamnophis sirtalis*) and the northern Pacific treefrog (*Pseudacris regilla*) have all been observed in the area (Delta Corporation 2003; iMap BC 2013).

In addition to native species found at Westham Island, non-native species recorded near the site include green frog (*Lithobates clamintans*), American bullfrog (*Lithobates catesbeiana*), and red-eared slider turtle (*Trachemys scripta*) (Delta Corporation 2003; iMap BC 2013).

During reconnaissance of the Project Site, a flock of Canada geese (*Branta canadensis*) were observed loafing on the tidal flats as well as a pair of mute swans (*Cygnus olor*) with seven cygnets swimming and feeding near shore (GL Williams & Associates Ltd. 2012; **Photo 4**).



Photo 4 Canada Geese Loafing at Proposed Enhancement site

4.5.1.2 Post-Enhancement Conditions

The intertidal sand/mud flat at the Project Site will be converted to intertidal brackish marsh. Converting this habitat to intertidal marsh will result in the loss of some intertidal flats habitat that is currently used as a loafing site for waterfowl (e.g., Canada geese and mute swans) and as a potential foraging area for shorebirds, although use of the less-productive sand flat is likely limited compared to more highly utilized mudflats in the outer estuary. Tidal flats at and immediately downstream of the Project Site are extensive, and include Roberts Bank, Sturgeon Bank and Boundary Bay. The benefits of the intertidal marsh will extend to a wide range of birds and wildlife that utilize the lower Fraser River (Moffatt & Nichol 2014). For example, productive marsh habitat provides foraging and protective roosting grounds for waterfowl such as the American widgeon (*Anas americana*).

4.5.2 Listed Wildlife

4.5.2.1 Existing Conditions

Thirty-two wildlife species occur in the CDFmm biogeoclimatic subzone within Metro Vancouver Regional District (**Table A4 Appendix A**). **Table F** indicates only those species from **Table A4** that have been identified as having a potential of occurring at the site.

Table F Listed Wildlife Species with a Potential to Occur at the Westham Island Site (BC Ministry of Environment 2013)

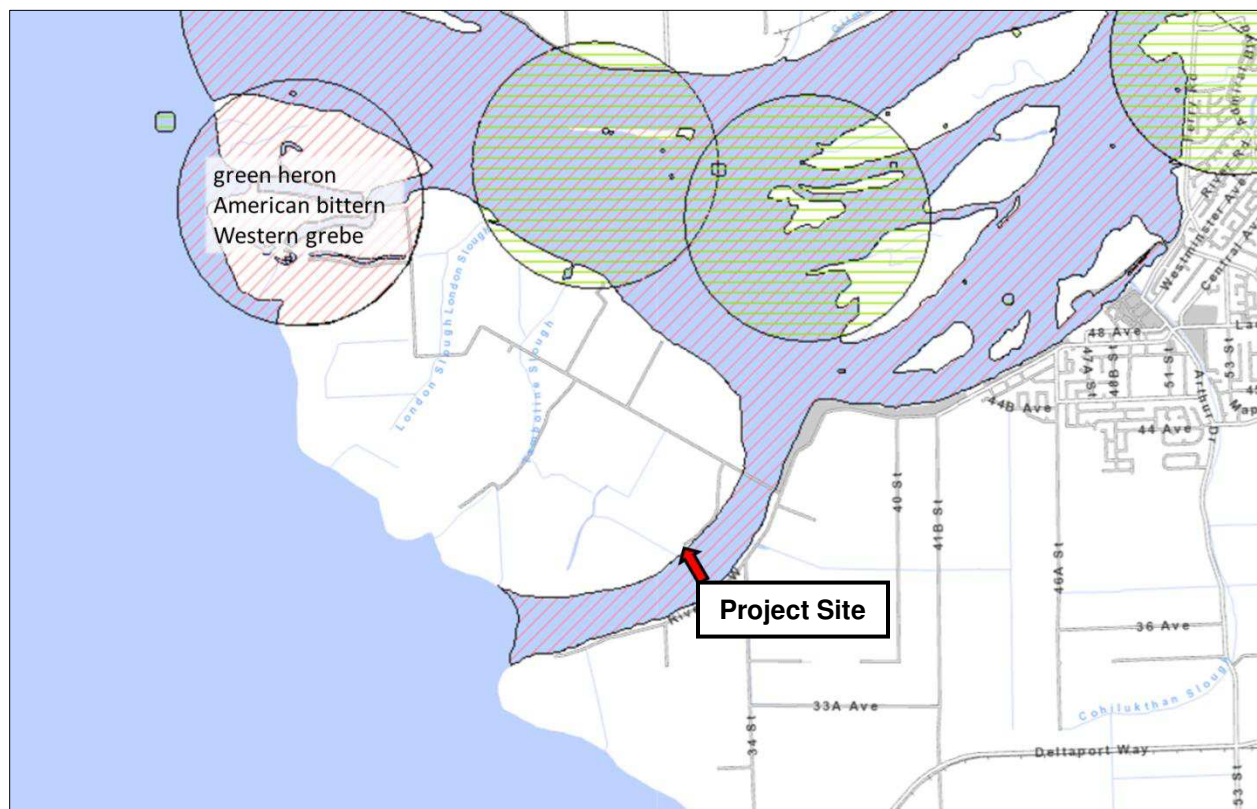
Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴	Effects of Enhancement
Birds						
<i>Ardea herodias fannini</i>	Great blue heron, <i>fannini</i> subspecies	Blue	1-SC (Feb 2010)	SC (Mar 2008)	Forages for fish near and/or at the site; roosts nearby at Reifel Bird Sanctuary; nearest nesting colony is ~10km away at Point Roberts.	Benefit: possible increase in prey abundance
<i>Botaurus lentiginosus</i>	American bittern	Blue	Not listed	Not listed	Not likely found at the site currently; this species is tied to wetlands with tall emergent vegetation (e.g., cattails) year-round.	Benefit: creation of habitat
<i>Butorides virescens</i>	Green heron	Blue	Not listed	Not listed	May forage for fish at the site, although it is unlikely.	Benefit: possible increase in prey abundance
<i>Nycticorax nycticorax</i>	Black-crowned night-heron	Red	Not listed	Not listed	Not likely found at the site currently; this species may forage for fish in marshes.	Benefit: creation of foraging habitat
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	Blue	Not listed	NAR (May 1978)	May forage for fish at site during high tide; between fishing it often spends time perched on man-made structures over or near water.	Benefit: possible increase in prey abundance
<i>Buteo lagopus</i>	Rough-legged hawk	Blue	Not listed	NAR (May 1995)	Not Likely found at this site currently; this species may forage for rodents over marshes.	Benefit: creation of foraging habitat
<i>Hydroprogne caspia</i>	Caspian tern	Blue	Not listed	NAR (May 1999)	May forage for fish at the site during high tide.	Benefit: possible increase in prey abundance
<i>Tyto alba</i>	Barn owl	Blue	1-SC (Jun 2003)	T (Nov 2010)	Not likely found at the site currently; may forage for rodents over marsh habitat.	Benefit: creation of foraging habitat
<i>Asio flammeus</i>	Short-eared owl	Blue	1-SC (Jul 2012)	SC (Mar 2008)	Not likely found at the site currently; this species is an open grassland and marshland specialist.	Benefit: creation of habitat
<i>Falco peregrinus anatum</i>	Peregrine falcon, <i>anatum</i> subspecies	Red	1-SC (Jun 2012)	SC (Apr 2007)	May forage for birds over the site.	No effect
<i>Hirundo rustica</i>	Barn swallow	Blue	Not listed	T (May 2011)	May forage for flying insects over the site; nest under man made coverings close to a source of mud which is used to construct their nests.	Benefit: possible increase in prey abundance

Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴	Effects of Enhancement
Mammals						
<i>Myotis keenii</i>	Keen's myotis	Blue	3 (Mar 2005)	DD (Nov 2003)	May be found foraging insects over the site.	Benefit: possible increase in prey abundance
<i>Myotis lucifugus</i>	Little brown myotis	Yellow	Not listed	E (Nov 2012)	May be found foraging insects over the site.	Benefit: possible increase in prey abundance
<i>Mustela frenata altifrontalis</i>	Long-tailed weasel, <i>altifrontalis</i> subspecies	Red	Not listed	Not listed	Not likely found at site; open habitats near marshes and riparian areas; can tolerate close proximity to humans.	Benefit: creation of habitat

- Notes:
- ¹ Red = endangered or threatened, Blue = special concern, Yellow = not at risk
 - ² Schedule 1 = federal species at risk, Schedule 3 = Species under consideration for Schedule 1
 - ³ E = Endangered, T = Threatened, SC = Special Concern, NAR = Not at Risk, C = Candidate for upcoming assessment
 - ⁴ Species information was taken from The Birds of North American Online 2013 and E-Fauna BC 2013

American bittern (*Botaurus lentiginosus*) and green heron (*Butorides virescens*), listed in **Table F**, have been recorded at nearby Reifel Migratory Bird Sanctuary (Raffan 2013). The provincially red listed western grebe (*Aechmophorus occidentalis*) has been sighted at Westham Island (iMap BC 2013; **Figure 9**), however it is not one of the species listed by the BC Species and Ecosystem Explorer within the Metro Vancouver CDF zone (BC Ministry of Environment 2013; **Table F**). Another species not listed on the BC Species and Ecosystem Explorer within the Metro Vancouver CDFmm subzone, the Steller sea lion (*Eumetopias jubatus*) is the only listed pinniped species that have been seen within the Fraser River Estuary. When not in the water, Steller sea lions prefer to haul-out on secluded rocky islands and rocky ledges, so it is unlikely that they occur at the proposed Project Site (COSEWIC 2003). The painted turtle (*Chrysemys picta*) is a red listed species with recorded sighting(s) near the site (BC Ministry of Environment 2003).

Figure 9 Known Occurrences of Listed Wildlife Species near Westham Island Site, BC (iMap BC 2013)



4.5.2.2 Post-Enhancement Conditions

Listed wildlife species occurrences and use of the Westham Island area will not likely be negatively affected by proposed tidal marsh enhancement projects. Listed species are not likely to occupy the study area for critical life history functions. Species that forage for insects may benefit from additional insect production resulting from increased marsh area and productivity. Fish eating species, such as great blue heron and double-crested cormorant may benefit during spring salmon rearing.

5.0 CONCLUSION

DFO's Fisheries Protection Program has supported the enhancement of intertidal marsh habitat to create higher value fish habitat in the Fraser River Estuary. As one of the primary management efforts conducted to support Pacific Salmon, this activity creates or improves productive rearing habitat. It has also been shown to increase marine survival and improve fitness of returning adult salmon, in turn, providing benefits to marine mammals as well as First Nations commercial and recreational fisheries. Construction of productive intertidal brackish marsh will also benefit other fish species, birds, and wildlife utilizing the lower Fraser River.

Construction of intertidal marsh habitat at the Project Site aims to restore or improve the following specific ecological functions:

- Increasing primary productivity.
- Supplementing the detritus food web.
- Creating intertidal habitat for the benthic and drift invertebrates (e.g., chironomids, amphipods) that are important prey items for juvenile salmonids and other fishes.
- Providing intertidal vegetation cover and refuge for juvenile salmonids as they utilize shoreline habitats in the lower Fraser River rearing corridor prior to out-migrating to the Strait of Georgia and the Pacific Ocean (Moffatt & Nichol 2014).
- Providing shoreline protection from storm waves (wave dampening), promoting sediment accretion and reducing erosion.
- Increasing prey availability for avian species.

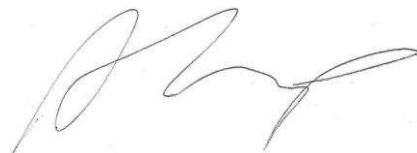
We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned by phone at 604.669.0424.

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APPENDIX A

Coastal Douglas-Fir Moist Maritime Biogeoclimatic Subzone – Common and Listed Species and Ecosystems

Table A1 At-risk Wetland Ecosystems within the Metro Vancouver CDFmm Subzone (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial Listing ¹	Potential to Occur Comment ²
<i>Alnus rubra</i> / <i>Carex obnupta</i> [<i>Populus trichocarpa</i>]	red alder / slough sedge [black cottonwood]	Red	Not likely to occur at the site; this ecosystem is classified as a Wetland Swamp
<i>Alnus rubra</i> / <i>Lysichiton americanus</i>	red alder / skunk cabbage	Red	Not likely to occur at the site; this ecosystem is classified as a Wetland Swamp
<i>Carex lasiocarpa</i> - <i>Rhynchospora alba</i>	slender sedge - white beak-rush	Red	Not likely to occur at the site; this ecosystem is classified as a Wetland Fen
<i>Carex lyngbyei</i> Herbaceous Vegetation	Lyngbye's sedge herbaceous vegetation	Red	May occur at the site; this ecosystem is classified as an Estuary Marsh
<i>Deschampsia cespitosa</i> ssp. <i>Beringensis</i> - <i>Hordeum brachyantherum</i>	tufted hairgrass - meadow barley	Red	May occur at or near the site; this ecosystem is classified as an Estuary Meadow
<i>Deschampsia cespitosa</i> ssp. <i>beringensis</i> - <i>Symphotrichum subspicatum</i>	tufted hairgrass - Douglas' aster	Red	May occur at or near the site; this ecosystem is classified as an Estuary Meadow
<i>Distichlis spicata</i> var. <i>spicata</i> Herbaceous Vegetation	seashore saltgrass Herbaceous Vegetation	Red	May occur at the site; this ecosystem is classified as an Estuary Meadow
<i>Dulichium arundinaceum</i> Herbaceous Vegetation	three-way sedge Herbaceous Vegetation	Red	Not likely found at the site; this ecosystem is classified as an Wetland Marsh
<i>Eleocharis palustris</i> Herbaceous Vegetation	common spike-rush Herbaceous Vegetation	Blue	Not likely to occur at the site; this ecosystem is classified as a Wetland Marsh
<i>Juncus arcticus</i> - <i>Plantago macrocarpa</i>	arctic rush - Alaska plantain	Red	May occur at or near the site; this ecosystem is classified as an Estuary Meadow
<i>Menyanthes trifoliata</i> - <i>Carex lasiocarpa</i>	buckbean - slender sedge	Blue	Not likely to occur at the site; this ecosystem is classified as a Wetland Fen
<i>Myrica gale</i> / <i>Carex sitchensis</i>	sweet gale / Sitka sedge	Red	Not likely to occur at the site; this ecosystem is classified as a Wetland Bog
<i>Pinus contorta</i> / <i>Sphagnum</i> spp.	lodgepole pine / peat-mosses CDFmm	Red	Not likely to occur at the site; this ecosystem is classified as a Wetland Bog

Scientific Name	English Name	Provincial Listing ¹	Potential to Occur Comment ²
<i>Ruppia maritima</i> Herbaceous Vegetation	beaked ditch-grass Herbaceous Vegetation	Red	May occur at or near the site; this ecosystem is classified as an Estuary Meadow
<i>Rhododendron groenlandicum</i> / <i>Kalmia microphylla</i> / <i>Sphagnum</i> spp.	Labrador tea / western bog-laurel / peat-mosses	Blue	Not likely to occur at the site; this ecosystem is classified as a Wetland Bog
<i>Salix sitchensis</i> - <i>Salix lasiandra</i> var. <i>lasiandra</i> / <i>Lysichiton americanus</i>	Sitka willow - Pacific willow / skunk cabbage	Red	Not likely to occur at the site; this ecosystem is classified as a Wetland Swamp
<i>Sarcocornia pacifica</i> - <i>Glaux maritima</i>	American glasswort - sea-milkwort	Red	May occur at the site; this ecosystem is classified as an Estuary Marsh
<i>Schoenoplectus acutus</i> Deep Marsh	hard-stemmed bulrush Deep Marsh	Blue	Not likely to occur at the site; this ecosystem is classified as a Wetland Swamp
<i>Typha latifolia</i> Marsh	common cattail Marsh	Blue	Not likely to occur at the site; this ecosystem is classified as a Wetland Marsh

Notes: ¹ Red = endangered or threatened, Blue = special concern
² Ecosystem information cited from BC Conservation Data Centre (2013)

Table A2 At-risk Plant Species within the Metro Vancouver CDFmm Subzone (BC Ministry of Environment 2013)

Scientific Name	Common Name	Provincial Listing ¹	SARA ²	COSEWIC ³	Potential to Occur Comments ⁴
<i>Alopecurus carolinianus</i>	Carolina meadow-foxtail	Red	--	--	Not likely to occur at the site; this species does not generally occur in intertidal estuary environments.
<i>Anagallis minima</i>	Chaffweed	Blue	--	--	May occur at the site; this species utilizes wet river banks and salt marshes in the lowland zone.
<i>Bidens amplissima</i>	Vancouver Island beggarticks	Blue	1-SC (2003)	SC (2001)	May occur at the site; this species utilizes estuary environments such as intertidal mudflats and salt marshes.
<i>Callitriche heterophylla</i> var. <i>heterophylla</i>	Two-edged water-starwort	Blue	--	--	Not likely to occur at the site; this is an aquatic species typically found in lakes or pond.
<i>Caltha palustris</i> var. <i>radicans</i>	Yellow marsh-marigold	Blue	--	--	May occur at the site; this species utilizes wet habitats such as brackish marshes.
<i>Carex interrupta</i>	Green-fruited sedge	Red	--	--	Not likely to occur at the site; this species does not generally occur in intertidal estuary environments.
<i>Carex scoparia</i>	Pointed broom sedge	Blue	--	--	May occur at the site; this species utilizes brackish tidal marshes.
<i>Claytonia washingtoniana</i>	Washington springbeauty	Red	--	--	Not likely to occur at the site; this species does not occur in intertidal estuary environments.
<i>Cuscuta campestris</i>	Field dodder	Blue	--	--	Not likely to occur at the site; this species does not occur in intertidal estuary environments.
<i>Elatine rubella</i>	Three-flowered waterwort	Blue	--	--	May occur at the site; this species utilizes estuarine tidal marsh environments.
<i>Eleocharis parvula</i>	Small spike-rush	Blue	--	--	May occur at the site; this species utilizes intertidal brackish wetlands.
<i>Eleocharis rostellata</i>	Beaked spike-rush	Blue	--	--	May occur at the site; this species may utilize salt marshes.
<i>Erigeron philadelphicus</i> var. <i>glaber</i>	Salt marsh Philadelphia fleabane	Red	--	--	Not likely to occur at the site; this species occurs in moist mesic grassland, shrubland and open forests.
<i>Eutrochium maculatum</i> var. <i>bruneri</i>	Joe-pye weed	Red	--	--	Not likely to occur at the site; this species primarily occurs in swamps, pond margins and forest openings.

Scientific Name	Common Name	Provincial Listing ¹	SARA ²	COSEWIC ³	Potential to Occur Comments ⁴
<i>Glyceria leptostachya</i>	Slender-spiked mannagrass	Blue	--	--	May occur at the site; this species may utilize brackish tidal marshes.
<i>Helenium autumnale</i> <i>var. grandiflorum</i>	Mountain sneezeweed	Blue	--	--	Not likely to occur at the site; this species utilizes mesic streambanks, meadows and forest openings.
<i>Isoetes nuttallii</i>	Nuttall's quillwort	Blue	--	--	Not likely to occur at the site; this species does not generally occur in intertidal estuary environments.
<i>Juncus oxymeris</i>	Pointed rush	Blue	--	--	Not likely to occur at the site; this species does not generally occur in intertidal estuary environments.
<i>Lilaea scilloides</i>	Flowering quillwort	Blue	--	--	May occur at the site; this species utilizes intertidal mudflats and marshes.
<i>Lupinus rivularis</i>	Streambank lupine	Red	1-E (2005)	E (2002)	Not likely to occur at the site; this species primarily occurs in wet/moist meadows and riverbanks.
<i>Myriophyllum ussuriense</i>	Ussurian water-milfoil	Blue	--	--	Not likely to occur at the site; this species does not generally occur in intertidal estuary environments.
<i>Navarretia intertexta</i>	Needle-leaved navarretia	Red	--	--	Not likely to occur at the site; this species does not generally occur in intertidal estuary environments.
<i>Pleuropogon refractus</i>	Nodding semaphoregrass	Blue	--	--	Not likely to occur at the site; this species does not generally occur in intertidal estuary environments.
<i>Rubus nivalis</i>	Snow bramble	Blue	--	--	Not likely to occur at the site; this species does not occur in intertidal estuary environments.
<i>Rupertia physodes</i>	California-tea	Blue	--	--	Not likely to occur at the site; this species does not occur in intertidal estuary environments.
<i>Sidalcea hendersonii</i>	Henderson's checker-mallow	Blue	--	--	May occur at the site; this species utilizes wet coastal areas including mudflats and high marshes.

Table A3 Bird Species Observed at the George C. Reifel Migratory Bird Sanctuary from 1963 to 2013 (Raffan 2013)

Red-throated Loon	Peregrine Falcon	Barn Owl	Bohemian Waxwing
Pacific Loon	Gyrfalcon	Western Screech Owl*	Cedar Waxwing
Common Loon	Prairie Falcon*	Great Horned Owl	Northern Shrike
Pied-billed Grebe	Ring-necked	Snowy Owl	European Starling
Horned Grebe	Pheasant	Boreal Owl*	Crested Myna*
Red-necked Grebe	California Quail*	Barred Owl	Cassin's Vireo
Eared Grebe	Virginia Rail	Long-eared Owl	Hutton's Vireo
Western Grebe	Sora	Short-eared Owl	Warbling Vireo
Double-crested	American Coot	Northern Saw-whet Owl	Philadelphia Vireo*
Cormorant	Sandhill Crane	Common Nighthawk	Red-eyed Vireo
Brandt's Cormorant	Black-Bellied Plover	Black Swift	Orange-crowned Warbler
Pelagic Cormorant	American Golden	Vaux's Swift	Nashville Warbler
American Bittern	Plover	Anna's Hummingbird	Tennessee Warbler*
American White	Semipalmated Plover	Calliope Hummingbird*	Magnolia Warbler*
Pelican*	Killdeer	Rufous Hummingbird	Yellow Warbler
Brown Pelican*	Black Oystercatcher*	Belted Kingfisher	Chestnut-sided Warbler*
Great Blue Heron	Black-necked Stilt*	Lewis's Woodpecker*	Yellow-rumped Warbler
Great Egret*	Red-necked Stint*	Red-naped Sapsucker*	Black-throated Gray Warbler
Cattle Egret*	American Avocet	Red-breasted Sapsucker	Townsend's Warbler
Green Heron	Greater Yellowlegs	Downy Woodpecker	Hermit Warbler*
Black-crowned Night-	Lesser Yellowlegs	Hairy Woodpecker	Black-throated Green Warbler*
Heron	Willet	Three-toed Woodpecker*	Palm Warbler*
Trumpeter Swan	Spotted Redshank*	Northern Flicker	Black-and-white Warbler
Tundra Swan	Solitary Sandpiper	Pileated Woodpecker	American Redstart*
Mute Swan	Wood Sandpiper*	Olive-sided Flycatcher	Northern Waterthrush
Greater White-fronted	Spotted Sandpiper	Western Wood-Pewee	MacGillivray's Warbler
Goose	Upland Sandpiper*	Willow Flycatcher	Common Yellowthroat
Lesser Snow Goose	Whimbrel	Hammond's Flycatcher	Wilson's Warbler
Ross' Goose	Long-billed Curlew	Pacific-slope Flycatcher	Prothonotary Warbler*
Emperor Goose*	Hudsonian Godwit	Ash-throated Flycatcher*	Yellow-breasted Chat*
Brant	Bar-tailed Godwit	Dusky Flycatcher*	Western Tanager
Canada Goose	Marbled Godwit	Eastern Phoebe	Black-headed Grosbeak
Cackling Goose	Ruddy Turnstone	Say's Phoebe	Evening Grosbeak
Wood Duck	Black Turnstone	Western Kingbird	Pine Grosbeak
Mandarin Duck*	Rock Sandpiper*	Eastern Kingbird	Spotted Towhee
Green-winged Teal	Red Knot	Tropical Kingbird*	Green-tailed Towhee*
Eurasian Green-winged	Sanderling	Blue-gray Gnatcatcher*	American Tree Sparrow
Teal*	Semipalmated	Horned Lark	Chipping Sparrow
Mallard	Sandpiper	Purple Martin	Clay-coloured Sparrow*
American Black Duck*	Western Sandpiper	Tree Swallow	Vesper Sparrow*
Northern Pintail	Temminck's Stint*	Violet-green Swallow	Savannah Sparrow
Blue-Winged Teal	Least Sandpiper	Northern Rough-winged	Fox Sparrow
Cinnamon Teal	Baird's Sandpiper	Swallow	Song Sparrow
Northern Shoveler	Pectoral Sandpiper	Bank Swallow	Lincoln's Sparrow
Gadwall	Sharp-tailed	Cliff Swallow	Swamp Sparrow
Eurasian Wigeon	Sandpiper	Barn Swallow	White-throated Sparrow
American Wigeon	Dunlin	Steller's Jay	Golden-crowned Sparrow
Canvasback	Stilt Sandpiper	Blue Jay*	White-crowned Sparrow

Redhead Ring-necked Duck Tufted Duck* Greater Scaup Lesser Scaup Long-tailed Duck Black Scoter Surf Scoter White-winged Scoter Common Goldeneye Barrow's Goldeneye* Bufflehead Smew* Hooded Merganser Common Merganser Red-breasted Merganser Ruddy Duck Turkey Vulture Osprey Black-shouldered Kite* Bald Eagle Northern Harrier Sharp-shinned Hawk Cooper's Hawk Northern Goshawk Red-tailed Hawk Rough-legged Hawk Golden Eagle* American Kestrel American Pipit	Buff-breasted Sandpiper* Ruff* Short-billed Dowitcher Long-billed Dowitcher Common Snipe Wilson's Phalarope Red-necked Phalarope Red Phalarope* Parasitic Jaeger Franklin's Gull Heermann's Gull* Bonaparte's Gull Mew Gull Ring-Billed Gull California Gull Herring Gull Thayer's Gull Western Gull* Glaucous-winged Gull Glaucous Gull Caspian Tern Common Tern Black Tern* Marbled Murrelet Common Murre* Eurasian Collared Dove Rock Pigeon Band-tailed Pigeon	Black-billed Magpie* Northwestern Crow Common Raven Black-capped Chickadee Mountain Chickadee Chestnut-backed Chickadee Bushtit Red-breasted Nuthatch Brown Creeper Bewick's Wren House Wren Pacific Wren Marsh Wren Golden-crowned Kinglet Ruby-crowned Kinglet Mountain Bluebird* Townsend's Solitaire Veery* Swainson's Thrush Hermit Thrush American Robin Varied Thrush Grey Catbird* American Dipper* Northern Mockingbird*	Harris' Sparrow* Dark-eyed Junco Lapland Longspur* Snow Bunting* Bobolink* Red-winged Blackbird Western Meadowlark Yellow-headed Blackbird Rusty Blackbird* Brewer's Blackbird Common Grackle* Brown-headed Cowbird Bullock's Oriole Brambling* Purple Finch House Finch Cassin's Finch* Red Crossbill Common Redpoll Pine Siskin American Goldfinch House Sparrow Merlin Mourning Dove
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*species observed but rare, or uncommon

Table A4 Species-at-risk within the Metro Vancouver CDFmm Subzone (BC Ministry of Environment 2013)

Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴
Birds					
<i>Dendragapus fuliginosus</i>	Sooty grouse	Blue	Not listed	Not listed	Site is not within species range
<i>Ardea herodias fannini</i>	Great blue heron, <i>fannini</i> subspecies	Blue	1-SC (Feb 2010)	SC (Mar 2008)	Species forage for fish near and/or at the site; roost nearby at Reifel Bird Sanctuary; nearest nesting colony is ~10km away at Point Roberts
<i>Botaurus lentiginosus</i>	American bittern	Blue	Not listed	Not listed	Not likely found at the site currently; this species is tied to wetlands with tall emergent vegetation (e.g. cattails) year-round
<i>Butorides virescens</i>	Green heron	Blue	Not listed	Not listed	May forage fish at the site, although it is unlikely
<i>Nycticorax nycticorax</i>	Black-crowned night-heron	Red	Not listed	Not listed	Not likely found at the site currently; this species may forage for fish in marshes
<i>Phalacrocorax auritus</i>	Double-crested cormorant	Blue	Not listed	NAR (May 1978)	May forage for fish at site during high tide; between fishing it often spends time perched on man-made structures over or near water
<i>Accipiter gentilis laingi</i>	Northern goshawk, <i>laingi</i> subspecies	Red	1-T (Jun 2003)	T (Apr 2013)	Not likely found at this site; this species prefers mature forests and old growth
<i>Buteo lagopus</i>	Rough-legged hawk	Blue	Not listed	NAR (May 1995)	Not Likely found at this site currently; this species may forage for rodents over marshes
<i>Hydroprogne caspia</i>	Caspian tern	Blue	Not listed	NAR (May 1999)	May forage for fish at the site during high tide
<i>Brachyramphus marmoratus</i>	Marbled murrelet	Blue	1-T (Jun 2003)	T (May 2012)	May forage for fish at the site during high tide
<i>Patagioenas fasciata</i>	Band-tailed pigeon	Blue	1-SC (Feb 2011)	SC (Nov 2008)	Not likely found at the site; this species typically breeds and feeds in open areas within forests or in suburban gardens and parks
<i>Tyto alba</i>	Barn owl	Blue	1-SC (Jun 2003)	T (Nov 2010)	Not likely found at the site currently; may forage for rodents over marsh habitat
<i>Asio flammeus</i>	Short-eared owl	Blue	1-SC (Jul 2012)	SC (Mar 2008)	Not likely found at the site currently; this species is an open grassland and marshland specialist

Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴
<i>Megascops kennicottii kennicottii</i>	Western screech-owl, <i>kennicottii</i> subspecies	Blue	1-SC (Jan 2005)	T (May 2012)	Not likely found at this site; this species is primarily associated with riparian or low elevation forests
<i>Chordeiles minor</i>	Common nighthawk	Yellow	1-T (Feb 2010)	T (Apr 2007)	Not likely to utilize the site
<i>Cypseloides niger</i>	Black swift	Yellow	Not listed	C (Jul 2011)	Not likely to utilize the site
<i>Falco peregrinus anatum</i>	Peregrine falcon, <i>anatum</i> subspecies	Red	1-SC (Jun 2012)	SC (Apr 2007)	May forage for birds over the site
<i>Contopus cooperi</i>	Olive-sided flycatcher	Blue	1-T (Feb 2010)	T (Nov 2007)	Not likely found at the site; this species forages and breeds in forest openings
<i>Hirundo rustica</i>	Barn swallow	Blue	Not listed	T (May 2011)	May forage for flying insects over the site; nest under man made coverings close to a source of mud which is used to construct their nests
<i>Progne subis</i>	Purple martin	Blue	Not listed	Not listed	Not likely to occur (foraging)
Mammals					
<i>Aplodontia rufa</i>	Mountain beaver	No Status	1-SC (Jun 2003)	SC (May 2012)	Site not within species range
<i>Myodes gapperi occidentalis</i>	Southern red-backed vole, <i>occidentalis</i> subspecies	Red	Not listed	Not listed	Not likely found at the site; this species is generally associated with mature forest cover with high levels of structural diversity and large woody debris
<i>Lepus americanus washingtonii</i>	Snowshoe hare, <i>washingtonii</i> subspecies	Red	Not listed	Not listed	Not likely found at the site; habitat generally includes non-fragmented adequately sized riparian woodlands
<i>Sorex rohweri</i>	Olympic shrew	Red	Not listed	Not listed	Not likely found at the site; this species is associated with dry riparian habitat around streams and wetlands with high levels of structural diversity and deep organic soil layers
<i>Sorex trowbridgii</i>	Trowbridge's shrew	Blue	Not listed	Not listed	Not likely found at the site; this species prefer upland areas away from water
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	Blue	Not listed	Not listed	Not likely found at the site; this species forages over forests, grasslands, shrub thickets and riparian areas with limited human disturbances

Scientific Name	English Name	Provincial Listing ¹	SARA Schedule ²	COSEWIC ³	Potential to Occur Comments ⁴
<i>Myotis keenii</i>	Keen's myotis	Blue	3 (Mar 2005)	DD (Nov 2003)	May be found foraging insects over the site
<i>Myotis lucifugus</i>	Little brown myotis	Yellow	Not listed	E (Nov 2012)	May be found foraging insects over the site
<i>Mustela frenata altifrontalis</i>	Long-tailed weasel, <i>altifrontalis</i> subspecies	Red	Not listed	Not listed	Not likely found at the site currently; this species may be found in open habitats often near marshes and riparian areas and can tolerate close proximity to humans
Amphibians					
<i>Anaxyrus boreas</i>	Western toad	Blue	1-SC (Jan 2005)	SC (2012)	Site not within species range
<i>Rana aurora</i>	Northern red-legged frog	Blue	1-SC (Jan 2005)	SC (Nov 2004)	Not likely found at the site; this species is associated with structurally complex wetlands with slow moving waters relatively free of urban and agricultural runoff
Reptiles and turtles					
<i>Chrysemys picta pop. 1</i>	Painted turtle - Pacific coast population	Red	1-E (Dec 2007)	E (Apr 2006)	Not likely found at the site; this species is associated with slow-moving, permanent water bodies