

**Appendix IR2020-1.1-B**  
**RBT2 Offsetting Project Summary Table**

Table IR2020-1.1-B1: RBT2 offsetting project summary

Offsetting project	Areal habitat gain (~86 ha in total)	Description	Key benefits to estuarine-rearing juvenile salmon					Key investigative and design work completed (C) / ongoing (O) / underway (U) / planned (P) / not applicable (NA)						Current conditions (re: underlying habitat value)	Controls (re: site/setting suitability, self-sustainability, and reducing uncertainty/increasing performance confidence)	Land access	Long-term success/performance monitoring focus (comparison with suitable reference site/sites and georeferenced photography/videography)	
			Feeding/prey production	Detrital food web support	Nursery/rearing	Refuge/cover	Salinity acclimatization	Site field assessment	Archaeological assessment	Topographic/bathymetric survey	Geotechnical investigation	Physical processes assessment	FAA-level engineering design					
<b>Port authority habitat bank projects (<i>habitat bank credit</i>)</b>																		
Salt Marsh Restoration Projects (5 sites)	~6.3 ha	Sites were enhanced by removing accumulated logs and woody debris that was suppressing salt marsh growth.	✓	✓	✓	✓	✓									Well-established, functioning habitat bank sites with 6 years of post-construction performance monitoring. In collaboration with Fisheries and Oceans Canada (DFO), habitat will be subject to a confirmatory assessment during application review to confirm final habitat credit.		
Glenrose Tidal Marsh Project (3 sites)	~1.1 ha	Involved habitat enhancement through construction of brackish tidal marsh.						NA	NA	NA	NA	NA	NA	NA	NA	Well-established, functioning habitat bank sites with 5 years of post-construction performance monitoring. In collaboration with DFO, habitat will be subject to a confirmatory assessment during application review to confirm final habitat credit.		
Gladstone Park and Riverfront Park Tidal Marsh Projects	~0.5 ha		Well-established habitat bank sites, functioning for approximately 30 years, and with 7 years of post-construction performance monitoring. In collaboration with DFO, habitat will be subject to a confirmatory assessment during application review to confirm final habitat credit.															
Timberland Basin Habitat Project	~0.4 ha	Involved habitat enhancement through construction of freshwater tidal marsh.	✓	✓	✓	✓	X									Well-established habitat bank sites, functioning for approximately 30 years, and with 6 years of post-construction performance monitoring. In collaboration with DFO, habitat will be subject to a confirmatory assessment during application review to confirm final habitat credit.		
<b>Optimized onsite offsetting (<i>restoration and/or enhancement</i>)</b>																		
Native Eelgrass	9 ha to 10 ha	Shallow subtidal eelgrass bed and tidal marsh proposed to be located north of the perimeter of the proposed terminal.	✓	✓	✓	✓	✓	C	NA	C	C	C	C	C	Lower-productivity unvegetated subtidal mud/sand.	- Substantial investigative work completed by a range of technical experts (including updated 2019 habitat mapping, and wind-wave, current and salinity analysis), in consideration of biological design criteria and lessons learned.	Located on Federal Crown land under port authority management.	- SCUBA quadrat surveys to determine whether the transplanted eelgrass survives and multiplies to cover the intended area at a density comparable to a reference bed. - Identification of any areas greater than 25 m <sup>2</sup> within the transplanted bed that are devoid of eelgrass.

Offsetting project	Areal habitat gain (~86 ha in total)	Description	Key benefits to estuarine-rearing juvenile salmon					Key investigative and design work completed (C) / ongoing (O) / underway (U) / planned (P) / not applicable (NA)						Current conditions (re: underlying habitat value)	Controls (re: site/setting suitability, self-sustainability, and reducing uncertainty/increasing performance confidence)	Land access	Long-term success/performance monitoring focus (comparison with suitable reference site/sites and georeferenced photography/videography)
			Feeding/prey production	Detrital food web support	Nursery/rearing	Refuge/cover	Salinity acclimatization	Site field assessment	Archaeological assessment	Topographic/bathymetric survey	Geotechnical investigation	Physical processes assessment	FAA-level engineering design				
															<ul style="list-style-type: none"> <li>- Berm proposed to provide containment and scour protection.</li> <li>- Physical processes within acceptable range. Only very minor changes in surrounding bed shear stress.</li> </ul>		<ul style="list-style-type: none"> <li>- Leaf area index (mean shoot length x mean shoot width x mean shoot density) as a measure of productivity.</li> <li>- Bathymetric surveys to confirm physical stability of the transplanted bed and that elevations are within established design criteria.</li> <li>- Observations of motile fish, invertebrate and other wildlife use of the habitat will be documented.</li> <li>- Management as needed (e.g., additional transplanting, invasive vegetation removal).</li> <li>- Site-specific annual reports for each monitoring year will be submitted, typically including a description of the monitoring methodology, observations and data, photo documentation, and a summary with conclusions and recommendations.</li> </ul>
Intertidal Marsh	12.5 ha to 13.5 ha		✓	✓	✓	✓	✓	C	NA	C	C	C	C	<p>Lower-productivity unvegetated subtidal mud/sand + sparse sea pen.</p> <ul style="list-style-type: none"> <li>- Substantial investigative work completed by a range of technical experts (including updated 2019 habitat mapping, and wind-wave, current and salinity analysis), in consideration of biological design criteria and lessons learned.</li> <li>- Berm proposed to provide containment and scour protection.</li> <li>- Physical processes within acceptable range. Only very minor changes in</li> </ul>	<p>Located on Federal Crown land under port authority management.</p>	<ul style="list-style-type: none"> <li>- Survey stratified randomized sample plots to determine whether marsh plants survive and multiply to cover the intended area at a density comparable to a reference site based on areal coverage percentage range.</li> <li>- Data will also be collected on marsh plant stem density and length, and species diversity.</li> <li>- Topographic surveys to confirm physical stability of the marsh and that elevations are within established design criteria.</li> <li>- Observations of motile fish, invertebrate and other wildlife use of the habitat will be documented.</li> </ul>	

Offsetting project	Areal habitat gain (~86 ha in total)	Description	Key benefits to estuarine-rearing juvenile salmon					Key investigative and design work completed (C) / ongoing (O) / underway (U) / planned (P) / not applicable (NA)							Current conditions (re: underlying habitat value)	Controls (re: site/setting suitability, self-sustainability, and reducing uncertainty/increasing performance confidence)	Land access	Long-term success/performance monitoring focus (comparison with suitable reference site/sites and georeferenced photography/videography)
			Feeding/prey production	Detrital food web support	Nursery/rearing	Refuge/cover	Salinity acclimatization	Site field assessment	Archaeological assessment	Topographic/bathymetric survey	Geotechnical investigation	Physical processes assessment	FAA-level engineering design					
																surrounding bed shear stress.		<ul style="list-style-type: none"> <li>- Management as needed (e.g., additional planting, species substitution, invasive vegetation removal, debris removal, and herbivory management).</li> <li>- Site-specific annual reports for each monitoring year will be submitted, typically including a description of the monitoring methodology, observations and data, photo documentation, and a summary with conclusions and recommendations.</li> </ul>
Subtidal Rock Reef	3 ha to 4 ha	Proposed expansion of existing rocky reef habitat fronting Westshore Terminals. Note, the quantity of rock reef habitat is currently being re-evaluated based on feedback received from Indigenous groups and DFO.	X	✓	X	X	X	C	NA	C	C	C	C	C	Lower-productivity unvegetated subtidal mud/sand + sparse sea pen.	<ul style="list-style-type: none"> <li>- Substantial investigative work completed by a range of technical experts (including updated habitat mapping and current analysis) in consideration of biological design criteria and lessons learned.</li> <li>- Physical processes within acceptable range.</li> </ul>	Located on Federal Crown land under port authority management.	<ul style="list-style-type: none"> <li>- SCUBA transect-quadrat surveys to record substrate composition, macroalgal species and areal coverage percentage range, and encrusting invertebrate species and areal coverage percentage range.</li> <li>- Observations of motile fish, invertebrate and other wildlife use of the habitat will be documented.</li> <li>- Management as needed (e.g., invasive vegetation removal).</li> <li>- Site-specific annual reports for each monitoring year will be submitted, typically including a description of the monitoring methodology, observations and data, photo documentation, and a summary with conclusions and recommendations.</li> </ul>
<b>Offsite offsetting projects (restoration and/or enhancement)</b>																		
South Arm Jetty Tidal Marsh Project	30 ha to 40 ha	Proposed habitat enhancement through construction of brackish tidal	✓	✓	✓	✓	✓	C	C	C	C	C	C	C	Lower-productivity unvegetated tidal flat.	<ul style="list-style-type: none"> <li>- Substantial investigative work completed by a range of technical experts (including wind-wave, current and salinity</li> </ul>	Located on Provincial Crown land; land tenure application submitted and in	<ul style="list-style-type: none"> <li>- See previous entry for monitoring specific to tidal marsh habitat.</li> </ul>

Offsetting project	Areal habitat gain (~86 ha in total)	Description	Key benefits to estuarine-rearing juvenile salmon					Key investigative and design work completed (C) / ongoing (O) / underway (U) / planned (P) / not applicable (NA)						Current conditions (re: underlying habitat value)	Controls (re: site/setting suitability, self-sustainability, and reducing uncertainty/increasing performance confidence)	Land access	Long-term success/performance monitoring focus (comparison with suitable reference site/sites and georeferenced photography/videography)
			Feeding/prey production	Detrital food web support	Nursery/rearing	Refuge/cover	Salinity acclimatization	Site field assessment	Archaeological assessment	Topographic/bathymetric survey	Geotechnical investigation	Physical processes assessment	FAA-level engineering design				
		marsh and potential habitat restoration through removal of piles, logs and other debris.												analysis), in consideration of biological design criteria and lessons learned. <ul style="list-style-type: none"> <li>- Berm proposed to provide containment and scour protection.</li> <li>- Physical processes within acceptable range. Only very minor changes in surrounding bed shear stress.</li> <li>- Biophysical assessment completed in Summer 2020 to confirm current extent and species/community composition of existing marsh habitat to be retained.</li> </ul>	the advanced stages of review.		
Westham Island Canoe Pass Tidal Marsh Project	4.0 ha to 4.5 ha													<ul style="list-style-type: none"> <li>- Substantial investigative work completed by a range of technical experts, in consideration of biological design criteria and lessons learned.</li> <li>- Berm proposed to provide containment and scour protection.</li> <li>- Physical processes within acceptable range.</li> <li>- Biophysical assessment completed in Summer 2020 to confirm current extent and species/community composition of existing</li> </ul>			

Offsetting project	Areal habitat gain (~86 ha in total)	Description	Key benefits to estuarine-rearing juvenile salmon					Key investigative and design work completed (C) / ongoing (O) / underway (U) / planned (P) / not applicable (NA)							Current conditions (re: underlying habitat value)	Controls (re: site/setting suitability, self-sustainability, and reducing uncertainty/increasing performance confidence)	Land access	Long-term success/performance monitoring focus (comparison with suitable reference site/sites and georeferenced photography/videography)
			Feeding/prey production	Detrital food web support	Nursery/rearing	Refuge/cover	Salinity acclimatization	Site field assessment	Archaeological assessment	Topographic/bathymetric survey	Geotechnical investigation	Physical processes assessment	FAA-level engineering design					
															marsh habitat to be retained.			
South Causeway Eelgrass Project	3.5 ha to 4.5 ha	Proposed habitat enhancement through construction of shallow subtidal eelgrass beds.	✓	✓	✓	✓	✓	C	NA	C	C	C	C	Lower-productivity unvegetated subtidal sand.	<ul style="list-style-type: none"> <li>- Substantial investigative work completed by a range of technical experts (including current analysis) in consideration of biological design criteria and lessons learned.</li> <li>- Physical processes within acceptable range.</li> <li>- Negligible effect on currents in surrounding areas.</li> <li>- Biophysical assessment completed in Summer 2020 to confirm if there has been any substantial change from previous findings.</li> </ul>	The design being advanced based on Tsawwassen First Nation preference is located exclusively within the BC Ferries water lot. A tenure agreement with BC Ferries has been executed.	<ul style="list-style-type: none"> <li>- See previous entry for monitoring specific to eelgrass habitat.</li> </ul>	
<b>Offsite offsetting projects identified by Indigenous groups (creation and/or restoration and/or enhancement)</b>																		
Finn Slough Enhancement Project	0.5 ha to 1.0 ha	Proposed habitat enhancement through construction of brackish tidal marsh and potential habitat restoration through removal of piles, logs and other debris.	✓	✓	✓	✓	✓	O	U	O	NA	O	C	Accumulated, rafted logs and wood debris; grown in, ill-defined and poorly connected upstream slough section.	<ul style="list-style-type: none"> <li>- Substantial investigative work completed, underway, or ongoing, based on the work of a range of technical experts.</li> <li>- Where appropriate, investigative work will be completed prior to submission of the <i>Fisheries Act</i> Authorization (FAA) application (i.e., to the extent needed to confirm site/setting suitability,</li> </ul>	Located on Provincial Crown land; land tenure application underway. Ongoing discussions with the City of Richmond.	<ul style="list-style-type: none"> <li>- See previous entry for monitoring specific to tidal marsh habitat.</li> </ul>	
Semiahmoo Bay-Little Campbell River Enhancement Project	1 ha to 3 ha	Various opportunities are being advanced, including construction of	✓	✓	✓	✓	✓	C	U	O	NA	C	C	Various, ranging from potentially riparian habitat to		Partly located on Federal Crown land (Semiahmoo First Nation Reserve). The	<ul style="list-style-type: none"> <li>- See previous entry for monitoring specific to tidal marsh habitat.</li> <li>- For forage fish spawning habitat, assess sediment size, slope, elevations, debris (e.g., log)</li> </ul>	

Offsetting project	Areal habitat gain (~86 ha in total)	Description	Key benefits to estuarine-rearing juvenile salmon					Key investigative and design work completed (C) / ongoing (O) / underway (U) / planned (P) / not applicable (NA)						Current conditions (re: underlying habitat value)	Controls (re: site/setting suitability, self-sustainability, and reducing uncertainty/increasing performance confidence)	Land access	Long-term success/performance monitoring focus (comparison with suitable reference site/sites and georeferenced photography/videography)
			Feeding/prey production	Detrital food web support	Nursery/rearing	Refuge/cover	Salinity acclimatization	Site field assessment	Archaeological assessment	Topographic/bathymetric survey	Geotechnical investigation	Physical processes assessment	FAA-level engineering design				
		marsh bench tidal channels, large-woody debris complexes, tidal salt marsh habitat, and forage fish spawning habitat.												lower-productivity unvegetated tidal flat.	self-sustainability and performance confidence). - As with other offsetting projects described in this table, FAA-level engineering design materials have been developed and made available to DFO and Indigenous groups.	requirement for Provincial Crown land tenure is being evaluated and if applicable, an application will be submitted. Discussions underway with BNSF Railway regarding access and land use.	accumulation and potential off-site migration of sediment and/or on-site accretion of sediments. - Any observations of fish, wildlife (e.g., shorebird), and invertebrate use of the beach will be noted.
Tilbury Island Peninsula Enhancement Project	2 ha to 4 ha	Proposed creation of off-channel habitat and habitat enhancement through construction of brackish tidal marsh.	✓	✓	✓	✓	✓	C	U	C	P	C	C	Riparian and lower-productivity unvegetated tidal flat.		Located on Provincial Crown land; land tenure application underway. Ongoing discussions with the City of Delta.	- See previous entry for monitoring specific to tidal marsh habitat.

**Appendix IR2020-1.1-C**  
**Key Offsetting Habitat Types**



## Appendix IR2020-1.1-C: Key Offsetting Habitat Types

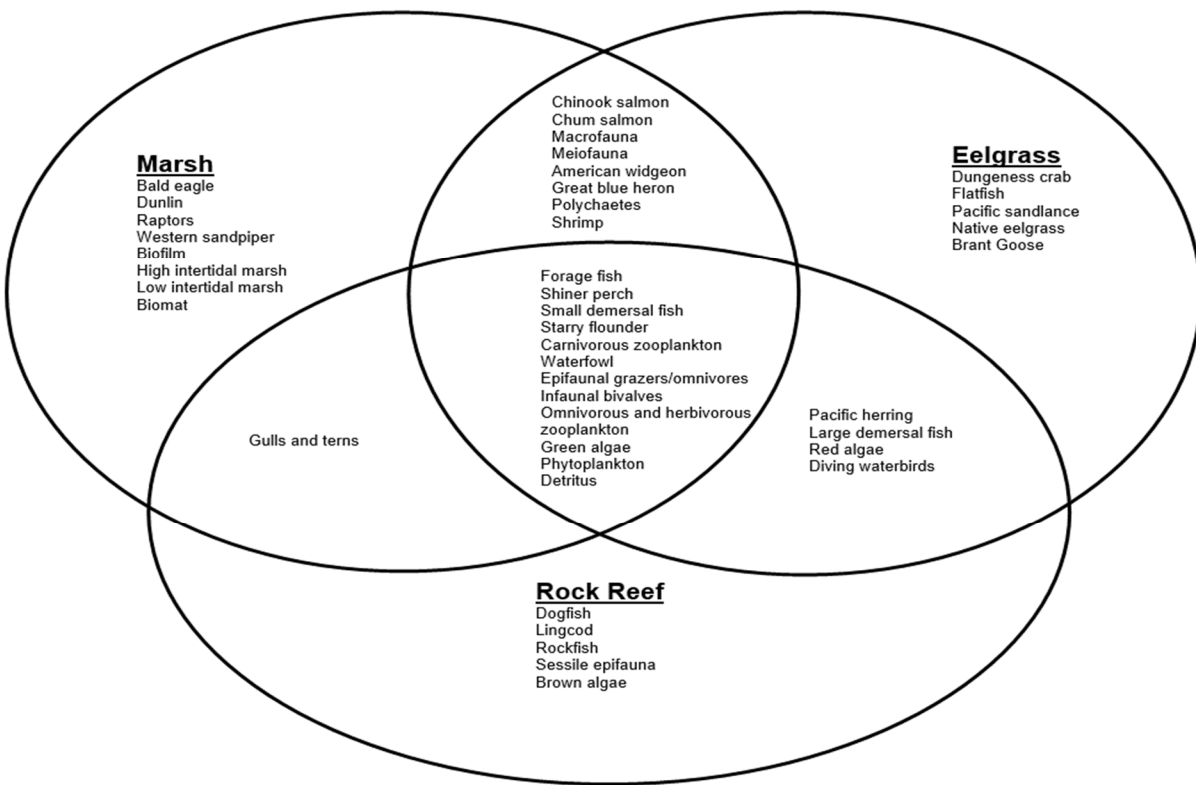
The key offset habitat types being advanced (i.e., intertidal marsh, native eelgrass, and subtidal rock reef) will provide a wide range of important ecosystem benefits that are summarized in **Table IR2020-1.1-C1** in comparison with the key habitats underlying the offsetting being advanced (i.e., unvegetated intertidal and subtidal soft sediment areas).

**Table IR2020-1.1-C1: Ecosystem services benefits of principal offsetting habitat types proposed**

Key functions	Value	Key offsetting habitat types			Underlying habitats	
		Intertidal marsh	Native eelgrass	Subtidal rock reef	Intertidal soft sediment	Subtidal soft sediment
Canopy structure	Habitat, refuge, nursery, settlement, and fisheries support	✓	✓	✓	X	X
Primary production	Food for herbivores and support for fisheries and wildlife	✓	✓	✓	X	X
Epibenthic and benthic production	Food web and fishery support	✓	✓	✓	✓	✓
Nutrient and contaminant filtration	Improved water quality and fishery support	✓	✓	✓	X	X
Sediment filtration and trapping	Improved water quality, countering sea-level rise and fishery support	✓	✓	X	X	X
Epiphyte and epifaunal substratum	Secondary production and fishery support	✓	✓	✓	X	X
Oxygen production	Improved water quality and fishery support	✓	✓	✓	X	X
Organic production and export	Support of estuarine, offshore food webs, and fisheries	✓	✓	✓	X	X
Nutrient regeneration and recycling	Support of primary production and fisheries	✓	✓	✓	✓	✓
Organic matter accumulation	Food web support and countering sea-level rise	✓	✓	X	X	X
Wave and current energy dampening	Reduced erosion and sediment accretion	✓	✓	✓	X	X
Seed production and vegetative expansion	Self-maintenance of habitat and fishery support	✓	✓	✓	X	X
Self-sustaining ecosystem	Provision of recreation and education opportunities, and landscape level biodiversity	✓	✓	✓	X	X

It is expected that both onsite and offsite habitat created as part of the project's offsetting plan will benefit a variety of species (or groups of species) and life stages (**Figure IR2020-1.1-C1**). Juvenile stages of salmon, forage fish, small demersal fish, flatfish, and a range of other wildlife species (e.g., raptors, waterfowl, great blue heron) are expected to benefit from the construction of intertidal marsh. Native eelgrass will provide spawning habitat for Pacific herring, as well as feeding, rearing, and refuge opportunities for juvenile salmon, Dungeness crab, and forage fish, and benefits to other wildlife (e.g., diving birds, waterfowl, great blue heron). Subtidal rock reef will provide habitat opportunities for a range of fish species, including lingcod, rockfish, shiner perch, and forage fish, as well as a range of other wildlife species (e.g., diving birds, waterfowl, gulls and terns), plus indirect benefits to scavengers occupying surrounding areas like Dungeness crab. Intertidal marsh and native eelgrass habitat will particularly benefit estuarine-rearing juvenile salmon through food web support, provision of prey, and opportunities for feeding, rearing, refuge, and salinity acclimatization.

**Figure IR2020-1.1-C1: Key species/groups benefited by principal offsetting habitat types**



Based on empirical results from effectiveness monitoring of constructed habitats in the Fraser River estuary and results reported in the literature from elsewhere in B.C., detailed food webs for the species (or groups of species) and life stages that are expected to benefit from offsetting habitat types has been provided to Fisheries and Oceans Canada (DFO) (VFPA 2020).

## 1. Intertidal marsh

Empirical results from effectiveness monitoring programs of constructed marshes in the lower Fraser River and estuary combined with literature from further afield indicate that constructed intertidal marshes function similarly to naturally occurring marshes. Empirical results from effectiveness monitoring associated with the creation of intertidal marsh offset habitats in the main arm and estuary of the Fraser

River are presented in the response to IR7-28 (CIAR Document #934<sup>1</sup>) and main findings are summarized herein.

In summary, intertidal marshes perform important ecological functions, including shoreline stabilization, gas and nutrient regulation, contaminant filtering, and nutrient supply (e.g., Ellings et al. 2016, Flitcroft et al. 2016, McNatt et al. 2016, Chalifour et al. 2019). They contribute to increasing biological diversity by providing complex, structural habitat that is used for shelter and food by organisms at multiple trophic levels (Callaway et al. 2012). In the Fraser River estuary, constructed intertidal marshes have been documented to provide food (through direct grazing or provision of juvenile and adult stages of macroinvertebrates) to juvenile and adult stages of fish and birds (e.g., Levings and Nishimura 1996, 1997, Levings 1998, Archipelago and Williams 2016). For example, species that were caught consistently during effectiveness monitoring of intertidal marsh habitats constructed for the Deltaport Third Berth (DP3) Project included juvenile chum (*Oncorhynchus keta*) and Chinook salmon (*O. tshawytscha*), juvenile pink salmon (*O. gorbuscha*) in even years, Pacific staghorn sculpin (*Leptocottus armatus*), threespine stickleback (*Gasterosteus aculeatus*), shiner perch (*Cymatogaster aggregata*), surf smelt (*Hypomesus pretiosus*), and starry flounder (*Platichthys stellatus*) (Archipelago and Williams 2016).

## 2. Native eelgrass

Native eelgrass beds constructed within and outside Roberts Bank to offset effects on marine fish are considered as effective in providing productive foraging, rearing, and refuge opportunities for marine fish as natural eelgrass beds. This is supported by empirical results collected as part of the effectiveness monitoring programs for constructed eelgrass habitats. Empirical results from effectiveness monitoring associated with the creation of native eelgrass offset habitats in the Fraser River estuary and elsewhere in the southern Strait of Georgia are presented in the response to IR7-29 (CIAR Document #934) and main findings are summarized herein.

In summary, native eelgrass beds (either natural or constructed) provide important ecological services to estuarine environments by providing spatial complexity, stable sediment and water flow regimes, improved water quality, and important direct and indirect food sources (e.g., Costanza et al. 1997, Hasegawa et al. 2008, DFO 2009, Fourqurean et al. 2012, Lamb et al. 2017). Specifically, the habitat structure and complexity provided by eelgrass beds attracts diverse assemblages of marine invertebrates (e.g., Sogard and Able 1991, Knight et al. 2015, Kennedy et al. 2018), including important prey for juvenile salmon (MacDonald 1984, Thom et al. 1989, Webb 1991, Bottom et al. 2005, Semmens 2008, Knight et al. 2015, Kennedy 2016, Kennedy et al. 2018). The structure also provides valuable refuge habitat for outmigrating juvenile salmon (e.g., Semmens 2008, Levings 2016). Other fish species that associate or rely on eelgrass beds for spawning, rearing, and/or migration include juvenile and adult stages of surf smelt, Pacific sand lance (*Ammodytes hexapterus*), Pacific herring (*Clupea pallasii*) (Penttila 2007, response to IR4-18 (CIAR Document #934)), and shiner perch (TDR MF-7 in Appendix AIR10-C of CIAR Document #388<sup>2</sup>).

## 3. Subtidal rock reef

Artificial subtidal rock reef habitat promotes high productivity and was first successfully used for habitat compensation at Roberts Bank in 1983, which led to further rock reef placement in 1993 and 2005 for the Deltaport Terminal projects. Empirical results from effectiveness monitoring associated with the creation

---

<sup>1</sup> CIAR Document #934 From the Vancouver Fraser Port Authority to the Review Panel re: Compilation of the Review Panel's Information Requests and the Vancouver Fraser Port Authority's Responses (Note: Updated February 15, 2019). <https://iaac-aeic.gc.ca/050/evaluations/document/128131>

<sup>2</sup> CIAR 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. <https://iaac-aeic.gc.ca/050/evaluations/document/115188>

of subtidal rock reef offset habitats at Roberts Bank are presented in the response to IR11-18 (CIAR Document #934) and main findings are summarized herein.

In summary, the subtidal rock reef offsetting habitat proposed for Roberts Bank Terminal 2 is expected to be like that constructed as compensation for DP3, including the fish species community that would benefit (TDR MF-5 in Appendix AIR10-C of CIAR Document #388, CIAR Document #1360<sup>3</sup>). The existing artificial reefs provide habitat for kelp greenling (*Hexagrammos decagrammus*), lingcod (*Ophiodon elongatus*), and copper rockfish (*Sebastes caurinus*), which were observed in every season, and striped perch (*Embiotoca lateralis*) and quillback rockfish (*Sebastes maliger*), which were only observed in fall and winter.<sup>4</sup> Field survey data (collected by the port authority in 2012, 2013, and 2020) indicate that the structure of the fish community observed at the existing artificial reefs at Roberts Bank is likely stable and fully developed and comparable to communities on natural and constructed artificial reefs elsewhere in the Pacific Northwest (TDR MF-5 in Appendix AIR10-C of CIAR Document #388). Moreover, based on previous (2012–2013) and recent (2020) survey data, the reef fish community is similar in diversity and density to other naturally occurring reef communities that have been surveyed (Naito 2001, McPhie and King 2011). Over the long term, artificial reefs will also contribute to juvenile recruitment, adult survival, and ultimately enhance fish productivity. For example, lingcod egg masses have been consistently recorded on artificial reefs at Roberts Bank during past compensation monitoring surveys (Brickhill et al. 2005, see TDR MF-5 in Appendix AIR10-C of CIAR Document #388 and references therein).

## References

- Archipelago Marine Research Ltd. and GL Williams and Associates Ltd. 2016. Deltaport Third Berth Habitat Compensation Monitoring: East Causeway – Year 5 and Summary Post-Construction Report. Prepared for Port Metro Vancouver. 213 pp.
- Bottom, D. L., C. A. Simenstad, J. Burke, A. M. Baptista, D. A. Jay, K. K. Jones, E. Casillas, and M. H. Schiewe. 2005. Salmon at River's End: The Role of the Estuary in the Decline and Recovery of Columbia River Salmon. NOAA Technical Memorandum NMFS-NWFSC68. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Seattle, WA. Available at [https://www.nwfsc.noaa.gov/assets/26/5575\\_07072014\\_133858\\_SARE-2001draft.pdf](https://www.nwfsc.noaa.gov/assets/26/5575_07072014_133858_SARE-2001draft.pdf).
- Brickhill, M. J., S. Y. Lee, and R. M. Connolly. 2005. Fishes Associated with Artificial Reefs: Attributing Changes to Attraction or Production Using Novel Approaches. *Journal of Fish Biology* 67(Supplement B):53–71.
- Callaway, J. C., A. B. Borde, H. L. Diefenderfer, V. T. Parker, J. M. Rybczyk, and R. M. Thom. 2012. Pacific Coast Tidal Wetlands. Pages 103–116 in Batzer, D. P., and A. H. Baldwin, Editors, *Wetland Habitats of North America: Ecology and Conservation Concerns*. University of California Press, Berkeley, CA.
- Chalifour, L., D. C. Scott, M. MacDuffee, J. C. Iacarella, T. G. Martin, and J. K. Baum. 2019. Habitat Use by Juvenile Salmon, Other Migratory Fish, and Resident Fish Species Underscores the Importance of Estuarine Habitat Mosaics. *Marine Ecology Progress Series* 625:145–162.

---

<sup>3</sup> CIAR Document #1360 From the Vancouver Fraser Port Authority to the Review Panel re: Responses to Information Requests: IR7-24, IR7-25, IR7-26, IR7-27, IR7-30, IR9-05, IR10-10, IR11-13, IR11-14, IR11-15, IR11-16, IR11-17, IR11-18, IR11-19, IR11-21, IR12-10, and IR13-17 (See Reference Documents #1000, 1122, 1130, 1179, 1206 and 1228). <https://iaac-aeic.gc.ca/050/documents/p80054/126250E.pdf>

<sup>4</sup> Fish species that do not commonly associate with reef habitats, such as Pacific sand lance, were seen at the existing reefs during the summer survey only, but were not included in the total fish counts, as their abundance could not be accurately estimated

- Costanza, R. R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R. V. O'Neill, J. Paruelo, R. G. Raskin, P. Sutton, M. van de Belt. 1997. The Value of the World's Ecosystem Services and Natural Capital. *Nature* 387:253–260.
- Ellings, C. S., M. J. Davis, E. E. Grossman, I. Woo, S. Hodgson, K. L. Turner, G. Nakai, J. E. Takekawa, and J. Y. Takekawa. 2016. Changes in Habitat Availability for Outmigrating Juvenile Salmon (*Oncorhynchus* spp.) Following Estuary Restoration. *Restoration Ecology* 24(3):415-427.
- Fisheries and Oceans Canada (DFO). 2009. Does Eelgrass (*Zostera marina*) Meet the Criteria as an Ecologically Significant Species? Canadian Science Advisory Secretariat, Science Advisory Report 2009/018, Fisheries and Oceans Canada, Gulf Region. Available at <https://waves-vagues.dfo-mpo.gc.ca/Library/337549.pdf>.
- Flitcroft, R. L., D. L. Bottom, K. L. Haberman, K. F. Bierly, K. K. Jones, C. A. Simenstad, A. Gray, K. S. Ellingson, E. Baumgartner, T. J. Cornwell, and L. A. Campbell. 2016. Expect the Unexpected: Place-Based Protections Can Lead to Unforeseen Benefits. *Aquatic Conservation: Marine and Freshwater Ecosystems* 26(Supplement 1):39-59.
- Fourqurean, J. W., C. M. Duarte, H. Kennedy, N. Marbá, M. Holmer, M. A. Mateo, E. T. Apostolaki, G. A. Kendrick, D. Krause-Jensen, K. J. McGlathery, and O. Serrano. 2012. Seagrass Ecosystems as a Globally Significant Carbon Stock. *Nature Geoscience* 5:505–509.
- Hasegawa, N., M. Hori, and H. Mukai. 2008. Seasonal Changes in Eelgrass Functions: Current Velocity Reduction, Prevention of Sediment Resuspension, and Control of Sediment–Water Column Nutrient Flux in Relation to Eelgrass Dynamics. *Hydrobiologia* 596:387–399.
- Kennedy, L. 2016. Eelgrass Habitat as Nearshore Foraging Grounds for Juvenile Pacific Salmon. M.Sc. Thesis. Department of Biology, University of Victoria, Victoria, B.C.
- Kennedy, L. A., F. Juanes, and R. El-Sabaawi. 2018. Eelgrass as Valuable Nearshore Foraging Habitat for Juvenile Pacific Salmon in the Early Marine Period. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science* 10:190–203.
- Knight, N. S., C. Prentice, M. Tseng, and M. I. O'Connor. 2015. A Comparison of Epifaunal Invertebrate Communities in Native Eelgrass *Zostera marina* and Non-Native *Zostera japonica* at Tsawwassen, B.C. *Marine Biology Research* 11(6):564–571.
- Lamb, J. B., J. A. J. M. van de Water, D. G. Bourne, C. Altier, M. Y. Hein, E. A. Fiorenza, N. Abu, J. Jompa, and C. D. Harvell. 2017. Seagrass Ecosystems Reduce Exposure to Bacterial Pathogens of Humans, Fishes, and Invertebrates. *Science* 355:731–733.
- Levings, C. D. 1998. Functional Assessment of Created, Restored, and Replaced Fish Habitat in the Fraser River Estuary. Pages 451-457 in *Proceedings of Puget Sound Research '98*, Volume 1, 12-13 March 1998, Seattle, WA. Published by the Puget Sound Water Quality Action Team, Olympia, WA. Available at [https://www.eopugetsound.org/sites/default/files/features/resources/PugetSoundResearch1998Vol1Optimized\\_0.pdf](https://www.eopugetsound.org/sites/default/files/features/resources/PugetSoundResearch1998Vol1Optimized_0.pdf).
- Levings, C. D. 2016. *Ecology of Salmonids in Estuaries Around the World: Adaptations, Habitats, and Conservation*. UBC Press, Vancouver, B.C.
- Levings, C. D., and D. J. H. Nishimura. 1996. Created and Restored Sedge Marshes in the Lower Fraser River and Estuary: An Evaluation of Their Functioning as Fish Habitat. Canadian Technical Report of Fisheries and Aquatic Sciences 2126. Fisheries and Oceans Canada. Available at <http://www.dfo-mpo.gc.ca/Library/209017.pdf>.

- Levings, C. D., and D. J. H. Nishimura. 1997. Created and Restored Marshes in the Lower Fraser River, British Columbia: Summary of Their Functioning as Fish Habitat. *Water Quality Research Journal of Canada* 32(3):599-618.
- MacDonald, A. L. 1984. Seasonal Use of Nearshore Intertidal Habitats by Juvenile Pacific Salmon on the Delta Front of the Fraser River Estuary, British Columbia. M.Sc. Thesis, University of Victoria, Department of Biology, Victoria, B.C.
- Naito, B. 2001. An Overview of Artificial Reefs Constructed in Southern British Columbia Prior to 1994. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2583. Fisheries and Oceans Canada, New Westminster, BC. Available at [http://publications.gc.ca/collections/collection\\_2014/mpo-dfo/Fs97-4-2583-eng.pdf](http://publications.gc.ca/collections/collection_2014/mpo-dfo/Fs97-4-2583-eng.pdf).
- McNatt, R. A., D. L. Bottom, and S. A. Hinton. 2016. Residency and Movement of Juvenile Chinook Salmon at Multiple Spatial Scales in a Tidal Marsh of the Columbia River Estuary. *Transactions of the American Fisheries Society* 145:774-785.
- McPhie, R. P. and J. R. King. 2011. Lingcod (*Ophiodon elongatus*) Egg Mass and Reef Fish Density SCUBA Survey in the Strait of Georgia, February 15-22, 2012. Canadian Technical Report of Fisheries and Aquatic Sciences 2987. Fisheries and Oceans Canada, Nanaimo, B.C. Available at [http://publications.gc.ca/collections/collection\\_2014/mpodfo/Fs97-6-2987-eng.pdf](http://publications.gc.ca/collections/collection_2014/mpodfo/Fs97-6-2987-eng.pdf).
- Semmens, B. X. 2008. Acoustically Derived Fine-Scale Behaviors of Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) Associated with Intertidal Benthic Habitats in an Estuary. *Canadian Journal of Fisheries and Aquatic Sciences* 65:2053–2062.
- Sogard, S. M. and K. W. Able. 1991. A Comparison of Eelgrass, Sea Lettuce Macroalgae, and Marsh Creeks as Habitats for Epibenthic Fishes and Decapods. *Estuarine, Coastal and Shelf Science* 33(5):501–519. Stantec. 2013. Preliminary Field Reconnaissance of the Proposed Canoe Pass/Westham Island Habitat Banking Development. 2 pp.
- Thom, R. M., C. A. Simenstad, J. R. Cordell, and E. O. Salo. 1989. Fish and Their Epibenthic Prey in a Marina and Adjacent Mudflats and Eelgrass Meadow in a Small Estuarine Bay. FRI-UW-8901. Prepared for the Port of Bellingham, Prepared by the Fisheries Research Institute, Seattle, WA. Available at <https://digital.lib.washington.edu/researchworks/bitstream/handle/1773/4104/8901.pdf?sequence=1>.
- Vancouver Fraser Port Authority (VFPA). 2020. Roberts Bank Terminal 2 Project – Ecological context for proposed offsetting habitats. Prepared for DFO. 75 pp.
- Webb, D. G. 1991. Effect of Predation by Juvenile Pacific Salmon on Marine Harpacticoid Copepods. I. Comparisons of Patterns of Copepod Mortality with Patterns of Salmon Consumption. *Marine Ecology Progress Series* 72:25–36.

## **Appendix IR2020-1.1-D**

# **Ministry of Forests, Lands, Natural Resource Operations, and Rural Development Letter Regarding Status of Land Tenure Applications**





July 30, 2021

Robin Silvester, President and CEO  
Vancouver Fraser Port Authority  
100 The Pointe, 999 Canada Place  
Vancouver, BC V6C 3T4

Dear Robin Silvester:

The Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) acknowledges that there are currently six *Land Act* applications submitted by the Vancouver Fraser Port Authority (VFPA) for the purpose of habitat enhancement projects to offset potential impacts of the Roberts Bank Terminal 2 Project.

In the interest of providing a level of comfort to Fisheries and Oceans Canada and other agencies as they participate in the Environmental Assessment process on the Roberts Bank Terminal 2 Project, FLNRORD can confirm the following information regarding our review and pending decisions on these *Land Act* applications:

- Applications for the South Arm Jetty (~38.4 ha), Roberts Bank Eelgrass Project and Westham Island Canoe Pass (~4.0 ha) tidal marsh projects are well advanced, and the land within the application areas is available, and not currently designated or granted in any way that would preclude approval of these applications. There are no outstanding concerns from First Nations on the applications.
- Applications for more recently submitted projects (Tilbury, Finn, Semiahmoo, totalling ~3.5 ha) have yet to undergo referral and public advertisement; however, we understand that the proponent has been engaging with Indigenous groups on the selection of these sites.
- The VFPA has requested variances from standard Land Policy. The VFPA and FLNRORD are working on this matter in consideration of resolving these requests. Additional time is required to process these requests at the appropriate levels. In addition to this, coordinated efforts to develop mutually agreeable contract language are still underway.

While this letter does not convey tenure approval, or obligate FLNRORD to issue tenures; it does confirm that FLNRORD and VFPA are working to advance tenure decisions in a timely manner. In addition, we would like to note that a current backlog of applications within FLNRORD

is impacting the internal turnaround times for documentation and decision on Crown land applications. Processing times do not directly relate to any outstanding issues or concerns.

If you have any questions or require clarification with regards to the contents of this letter, please contact me at (778)572-2175 or [Allan.Johnsrude@gov.bc.ca](mailto:Allan.Johnsrude@gov.bc.ca).

Sincerely,



Allan Johnsrude, RPF  
Regional Executive Director  
South Coast Region

cc: Rick Manwaring, Deputy Minister  
Ministry of Forests, Lands, Natural Resource Operations and Rural Development  
Craig Sutherland, Assistant Deputy Minister  
Ministry of Forests, Lands, Natural Resource Operations and Rural Development  
Kevin Haberl, Director of Authorizations  
Ministry of Forests, Lands, Natural Resource Operations and Rural Development  
Greg Mouchian, Resource Authorizations Manager  
Ministry of Forests, Lands, Natural Resource Operations and Rural Development  
Catherine Allard, Senior Authorizations Specialist  
Ministry of Forests, Lands, Natural Resource Operations and Rural Development  
David Guest, Manager, Infrastructure Real Estate  
Vancouver Fraser Port Authority  
Jennifer Natland, Vice President, Real Estate  
Vancouver Fraser Port Authority