Appendix F.3
Terrestrial Wildlife and Marine Birds
Information Request #3 and 5

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Dear Ms. Ponsford:

Reference: Assessment of Effects to Migratory Birds Information Request # 3 and #5

This letter responds to the request for Outstanding Information received from the Canadian Environmental Assessment (CEA) Agency on August 14, 2014.

Information Request #3

Government of Canada –Outstanding Information:

EC: *The Project falls within Bird Conservation Region 5: Northern Pacific Rainforest. The proponent assessed effects to birds (covered under the MBCA and others) through a general assessment using ecological community modelling and through a more detailed assessment for three threatened species, two of which are migratory birds (Olive-sided Flycatcher and Marbled Murrelet). The Indicator species chosen by the proponent do not represent all bird guilds/groups and the ecological community modelling is too general. Further, the use of species at risk is problematic, as the reasons for listing can be specific, including in relation to habitat requirements and identified threats. In some instances, the reasons for a particular species decline is not well understood, including in relation to habitat needs and threats, suggesting again that caution be applied in using a listed species as an Indicator Species. Also, use of any species, whether listed or non-listed species, as an Indicator Species should be supported by a clear, robust, scientific rationale indicating how the life requisites of one species accounts for the many species of a species group. Provide a detailed assessment of effects to migratory birds and update the cumulative effect assessment accordingly.*

The proponent could refer, for example, to the Bird Conservation Strategy for Bird Conservation Region 5 (BCR 5): Northern Pacific Rainforest for guidance on the selection of appropriate indicator species to assess the effects of the Project on the species identified on Lelu Island. The document is available at http://nabci.net/Canada/English/pdf/BCR%205%20PYR%20FINAL%20Feb%202013.pdf. Priority species in BCR 5 include species that are vulnerable due to population size, distribution, population trend, abundance and threats. Some widely distributed and abundant 'stewardship' species are included because they typify the national or regional avifauna and/or because they have a large proportion of their range and/or continental population in the sub-region. Finally, species of management concern (i.e., listed under schedule 1 of SARA) are also included as priority species in BCR 5. The proponent could consider grouping priority species together by their habitat niches (i.e., shorebird community, songbird community, waterfowl community, etc.) in order to conduct an effects assessment on these groups Alternatively, the proponent could provide a science-based rationale for how the chosen indicator species have addressed likely effects to the species/groups identified in and around the Project area.

Information Request #5

See Terrestrial Wildlife and Marine Birds IR # 3 regarding cumulative effects assessment for migratory birds.

Pacific NorthWest LNG (PNW LNG) – Response:
Scientific Rationale for the Assessment of Migratory Birds

The Environmental Impact Statement (EIS) applied a two-tiered approach to assess potential effects of change in habitat for migratory birds from the Pacific NorthWest LNG Project (the Project) that included habitat suitability modelling and ecological community modelling. Modelling methods were completed in accordance with guidance from:

- Field Manual for Describing Terrestrial Ecosystems (BC MOFR and MOE 2010)
- British Columbia Wildlife Habitat Rating Standards (RIC 1999)
- A framework for the scientific assessment of potential project impacts on birds, Canadian Wildlife Service Technical Report Series No. 508 (Hanson et al. 2009)
- Bird Conservation Strategy for Bird Conservation Region 5: Northern Pacific Rainforest (EC 2013)
- North Coast Land and Resource Management Plan: Final Recommendations (BC MSRM 2005)
- Ecosystem-based Management Planning Handbook (CIT 2004).

Application of each modelling approach also considered habitats available on or near Lelu Island with potential to be effected by project activities, in combination with seasonal abundance, diversity, and habitat use of migratory bird species obtained through a review of regional occurrence data combined with baseline field surveys.

The methods for each approach are summarized below. Please refer to Section 11.3.2 of the EIS, Section 4 of Appendix H, and in the technical memo submitted on June 22, 2014 entitled “Wildlife Habitat Modelling” for a detailed description.

Wildlife Habitat Suitability Modelling

Wildlife habitat assessments followed methods outlined in the *Field Manual for Describing Terrestrial Ecosystems* (BC MOFR and BC MOE 2010) and the *British Columbia Wildlife Habitat Rating Standards* (RIC 1999a). Prior to field work, plots were selected to proportionately represent the variety of habitat types that exist within the study area. A total of 71 habitat assessment plots were completed on or near Lelu Island.

Wildlife habitat suitability modelling was completed to characterize abundance and availability of suitable habitat for species designated as Threatened or Endangered on Schedule 1 of the Species at Risk Act (SARA). Species selected for modelling were limited to those that have been previously recorded in the regional assessment area (RAA) and have habitat requirements that are met by ecological communities present in the local assessment area (LAA) (JWA 2008; Stantec 2010, 2011, 2012, 2013; Bird Studies Canada 2013). Based on these criteria, wildlife habitat assessments were completed for the following species and associated life requisites:

- **Northern goshawk, *laingi* subspecies (BC Red List; SARA Threatened)—**Reproduction requirements (breeding) during spring and summer
- **Olive-sided flycatcher (BC Blue List; SARA Threatened)—**Reproduction requirements (breeding) during spring and summer
- **Marbled murrelet (BC Blue List; SARA Threatened)—**Reproduction requirements (breeding) during spring and summer.

Assessment of Indicator Species

PNW LNG agrees that indicator species can be a useful method to characterize potential project effects for wildlife with shared life requisites (e.g., habitat requirements, life history traits). While marbled murrelet (BC Blue List; SARA Threatened), northern goshawk, *laingi* subspecies (BC Red List; SARA Threatened), and olive-sided flycatcher (BC Blue List; SARA Threatened) may share habitat requirements with other species, they were not modelled as indicators of other species, guilds or groups. Please refer to Section 11.3 of the EIS for further details.

Species on Schedule 1 of SARA were considered for habitat suitability modelling and chosen based on their potential to occur within the project area, as determined by:

1. Regional occurrence records and/or detections during baseline surveys
2. The availability of suitable identified habitat within the modelling limits as determined through a literature review of species habitat requirements combined with data collected during vegetation assessments in the LAA.

Marbled murrelet, northern goshawk, and olive-sided flycatcher are the only species with potential to occur within the project development area (PDA) that are listed as Threatened or Endangered on Schedule 1 of SARA. To facilitate compliance with SARA, habitat suitability modelling was conducted for species listed as Threatened or Endangered on Schedule 1 of SARA to quantify potential changes in habitat availability during project construction or operations.

Assessment of Migratory Birds

Potential effects from change in availability of habitat for other migratory birds are addressed using ecological community modelling. Please see Section 11.3.2 in the EIS and Section 4 in Appendix H for a full description of these methods. Ecological community modelling considers species of traditional use, birds protected under the *Migratory Bird Convention Act* (MBCA), other SARA-listed species (i.e., Schedule 1 Special Concern, Schedule 2, and Schedule 3 species), and those listed by COSEWIC.

Baseline Conditions for Migratory Birds

Ecological Community Modeling
Ecological community modelling provides a means to assess potential project effects on migratory birds and other wildlife that share similar habitat requirements and ecological traits (i.e., breeding, foraging, and migration requirements). In Hanson et al. (2009), the authors recommend an ecosystem-based approach that considers species and/or species groups by integrating habitat requirements. Combined with habitat suitability modelling, ecological community modelling is a useful tool to assess potential project effects to migratory birds of traditional use, species protected under the *Migratory Bird Convention Act* (MBCA), and those species listed on Schedule 1 Special Concern, Schedule 2, Schedule 3 and Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated species. Information used to identify habitat requirements was identified from a combination of scientific literature, regional occurrence records, and baseline survey data. Please refer to Appendix H of the EIS for further information.

Results of ecological community modelling presents both a quantitative and qualitative estimate of the extent of ecological communities available at baseline, characterizes the migratory bird assemblages that use each community, and predicts the change in each ecological community due to the Project (Section 11.5.2 of the EIS). These methods are consistent with the approach recommended in the following guidance documents:

- A framework for the scientific assessment of potential project impacts on birds, Canadian Wildlife Service Technical Report Series No. 508 (Hanson et al. 2009)
- Bird Conservation Strategy for Bird Conservation Region 5: Northern Pacific Rainforest (EC 2013)

- North Coast Land and Resource Management Plan: Final Recommendations (BC MSRM 2005)
- Ecosystem-based Management Planning Handbook (CIT 2004).

Ecological community modelling was completed within habitat modelling limits that included Lelu Island and extended 1.5 km from the shoreline to include the mainland and adjacent nearshore marine habitats. Results of the ecological modelling are presented in Table 1 and Figure 1. The spatial area modelled includes eleven ecological community types that provide unique habitat attributes expected to support differing assemblages of migratory birds and other wildlife. Under baseline conditions, the majority of habitat within the modelling limits is comprised of ocean habitat, followed by estuarine tidal flat, shrub-dominated bog, old coniferous forest, and seral coniferous forest (Table 1).

Table1: Total Area of each Ecological Community Removed by Clearing and Construction within the Project Development Area

Ecological Community	Area (ha) of each Ecological Community at Baseline[a]	Ecological Community Removed	
		Area Removed in by the Project Development Area (ha)	% Change in Baseline
Anthropogenic	51	0	0
Forest – Old Coniferous	201	44	22
Forest – Seral Coniferous	199	0	0
Forest – Seral Deciduous	40	0	0
Marine – Ocean	1,290	5	<1
Wetland – Aquatic	16	1	6
Wetland – Estuarine Marsh	5	0	0
Wetland – Estuarine Meadow	< 1	0	0
Wetland – Estuarine Tidal Flat	540	3	<1
Wetland – Shrub Dominated Bog	211	76	36
Wetland – Treed Swamp or Bog	151	43	29
Total	**2,704**	**172**	**–**

NOTE

[a] Area (ha) of each ecological community is the total available at baseline within the habitat modelling limits.

The Bird Conservation Strategy For The Northern Pacific Coast

The ecological community modelling approach enables assessment of potential project effects on a variety of migratory bird species. This method is consistent with the *Bird Conservation Strategy for Bird Conservation Region 5: Northern Pacific Rainforest*, which bases an assessment on priority species and the corresponding habitat niches they represent (EC 2013). Ecological communities modelled in the assessment are consistent with broader habitat types that define habitat niches in the Bird Conservation Strategy for BCR5 (Table 2). For example, wetland habitat is one of the broad habitat types in BCR5 that encompasses estuarine marsh, estuarine meadow, and estuarine tidal flat wetland ecological communities modelled in the EIS. The following habitat types identified for BCR5 were excluded from the EIS because they are not present in the modellng limit: mixed wood, herbaceous, waterbodies – freshwater, riparian, and alpine (Figure 1).

Table 2 provides a list of each broad habitat type defined for BCR5 that is located on or near Lelu Island, and the corresponding ecological community modelled in the EIS, as well as the corresponding priority species and migratory bird communities represented by each community type.

Table 2: Migratory Bird Species Represented by Ecological Communities Modelled

Broad Habitat Type for BCR5	Ecological Communities in the EIS	Priority Species found in each BCR5 Broad Habitat Type	Migratory Birds Recorded from Regional Records or Baseline Surveys	Scientific Rationale
Urban	Anthropogenic	Barn swallow Northwestern crow	Barn swallow Band-tailed pigeon	• Supports species of management concern
Coniferous	Forest—Old Coniferous	Band-tailed pigeon Townsend's warbler Varied thrush	Pacific wren Townsend's warbler Varied thrush Chestnut-backed chickadee Western screech-owl, kennicottii	• Supports species of management concern • Coniferous forests are the dominant land cover in BCR5 (EC 2013) • Abundant snags found in old and mature coniferous forests support cavity-nesting and insectivorous birds • Large trees support raptor nests
Shrub or Early Successional	Forest—Seral Coniferous	Orange-crowned warbler	Pacific wren Pacific-slope flycatcher	• Supports species of management concern • Forests produce large seed banks foraged by a variety of birds • Comprise a relatively high proportion of land cover in the RAA
	Forest—Seral Deciduous	Orange-crowned warbler	Orange-crowned warbler American robin Pacific-slope flycatcher Western tanager	• Supports species of management concern • From baseline studies, seral deciduous forests have the highest breeding bird abundance and species richness • Variable canopy structure which provides breeding habitat for ground, shrub and tree nesting species
Waterbodies—Marine	Marine—Ocean	Red-necked phalarope	Black turnstone Glaucous-winged gull Bald eagle California gull Surf scoter Western grebe	• Dominant habitat type in the LAA • Marine environments provide seasonal staging, stopover, and foraging habitat for migratory birds • 42 priority species in BCR5 rely on the marine environment (56% of which are considered at risk; EC 2013)

Broad Habitat Type for BCR5	Ecological Communities in the EIS	Priority Species found in each BCR5 Broad Habitat Type	Migratory Birds Recorded from Regional Records or Baseline Surveys	Scientific Rationale
Wetland	Wetland—Aquatic	Great blue heron, fannini	Lesser yellowlegs	• Insectivorous birds may use these habitats for foraging. Wetland habitats are disproportionately important due to their high productivity (EC 2013)
	Wetland—Shrub Dominated Bog		Dark-eyed junco Hermit thrush Purple finch	• Shrub dominated areas provide breeding habitat for a number of songbirds
	Wetland—Treed Swamp or Bog		Wilson's warbler Orange-crowned warbler Red-eyed vireo	• Abundant snags provide cavity nesting and roosting for birds
	Wetland—Estuarine Marsh		Great blue heron, fannini Dark-eyed junco	• Estuaries may provide staging habitat for migratory shorebirds and waterfowl • Coastal habitat provides nesting habitat for seabirds in BCR5 (EC 2013)
	Wetland—Estuarine Meadow		Great blue heron, fannini Dark-eyed junco	• Small area (0.1 ha), expected to support similar species to other estuarine habitats
	Wetland—Estuarine Tidal Flat		American wigeon Canada goose Sanderling Western sandpiper	• Tidal mudflats provide foraging for waterfowl, shorebirds, gulls, eagles, etc. • Mudflats, sand flats and beaches provide are important stopover habitat for migrating shorebirds (EC 2013)

Field Surveys

Baseline surveys to characterize the abundance, diversity, and distribution of migratory bird species in the LAA were centred primarily breeding bird surveys for terrestrial bird species, and shore and vessel-based surveys in nearshore waters around Lelu Island to target marine bird species.

Breeding bird surveys were conducted in mid June and repeated in late June/early July, 2013 following methods for conducting point counts outlined in *Inventory Methods for Forest and Grassland Songbirds* (RIC 1999a, 1999b) (see Appendix H of the EIS for full details). Consistent with Hanson et al. (2009) and Coast Information Team (2004), each survey station was placed to the extent possible, in contiguous patches of habitat to examine similarities or differences in abundance and species richness across ecological communities.

Marine bird surveys were conducted following protocols for stationary counts and fixed-width vessel-transects outlined *in Inventory Methods for Seabirds: cormorants, gulls, murres, storm-petrels, Ancient Murrelet, auks, puffins, and Pigeon Guillemot* (RIC 1997a) *and Standardized Inventory Methodologies for Components of British Columbia's Biodiversity. Shorebirds: plovers, oystercatchers, stilts, avocets, sandpipers, phalaropes and allies* (RIC 1997b). A combination of shore and vessel-based surveys were completed in August and November, 2012 and January, April, and June, 2013 (see Appendix H of the EIS for full details).

Overall, a total of 1,775 individuals across 72 migratory bird species were detected during baseline surveys. Across all surveys and seasons, the greatest number of individuals and species were detected in estuarine tidal flats (885 birds of 37 species). Across terrestrial ecological communities, the migratory bird community was generally uniform (i.e., similar numbers of individuals and species observed across multiple community types). The majority of individuals were detected in shrub-dominated bog; similar numbers of species were detected across each terrestrial ecological community. There were no detections of terrestrial migratory bird species of management concern during baseline surveys. Federally or provincially listed migratory bird species observed during marine bird surveys include California gull, common murre, great blue heron *fannini* subspecies, long-tailed duck, marbled murrelet, surf scoter, and western grebe (Table 3). Please see Appendix H of the EIS for details of the number of individuals and species summarized by survey period. The number of individuals of each migratory bird species observed in each ecological community during baseline breeding bird and marine bird surveys is summarized in Table 3.

Table 3: Number of Individuals of Each Migratory Bird Species detected within each Ecological Community during Breeding Bird and Marine Bird Baseline Surveys

Species Name	Conservation Status			Forest – Old coniferous forest	Forest - Seral deciduous forest	Wetland - Shrub-dominated bog	Wetland - Treed swamp or bog	Wetland – Estuarine tidal flat	Marine - ocean	Total Individuals by Species
	BC	SARA	COSEWIC							
Alcid species	-	-	-					1		1
American Robin	Yellow	-	-	3	11	4	11			29
American Wigeon	Yellow	-	-					8	4	12
Barrow's Goldeneye	Yellow	-	-						2	2
Black Oystercatcher	Yellow	-	-					6		6
Black Turnstone	Yellow	-	-					82	7	89
Black-legged Kittiwake	No Status	-	-					4	49	53
Bonaparte's Gull	Yellow	-	-					2	3	5
Bufflehead	Yellow	-	-					20	10	30
California Gull	Blue	-	-					57	27	84
Canada Goose	Yellow	-	-	2				9	3	14
Chestnut-backed Chickadee	Yellow	-	-	10	4	4	3			21
Common Goldeneye	Yellow	-	-					1		1
Common Loon	Yellow	-	Not at Risk					7	15	22
Common Merganser	Yellow	-	-					23	26	49
Common Murre	Red	-	-					2		2
Dark-eyed Junco	Yellow	-	-	6	6	22	5			39
Downey Woodpecker	Yellow	-	-			1				1
Dunlin	Yellow	-	-					14		14
Glaucous Gull	No Status	-	-					2		2
Glaucous-Winged Gull	Yellow	-	-					77	22	99
Golden-crown Kinglet	Yellow	-	-		10		1			11

Species Name	Conservation Status			Forest – Old coniferous forest	Forest - Seral deciduous forest	Wetland - Shrub-dominated bog	Wetland - Treed swamp or bog	Wetland – Estuarine tidal flat	Marine - ocean	Total Individuals by Species
	BC	SARA	COSEWIC							
Great Blue Heron, *fannini* subspecies	Blue	Special Concern (Schedule 1)	Special Concern						6	6
Greater Yellowlegs	Yellow	-	-					2		2
Green-winged Teal	Yellow	-	-					128		128
Gull species	-	-	-					21	9	30
Hairy Woodpecker	Yellow	-	-			1				1
Harlequin Duck	Yellow	-	-						2	2
Hermit Thrush	Yellow	-	-	21	8	43	25			97
Herring Gull	Yellow	-	-					8	13	21
House Finch	Yellow	-	-			4	1			5
Least Sandpiper	Yellow	-	-					16		16
Lesser Scaup	Yellow	-	-					2	41	43
Lesser Yellowlegs	Yellow	-	-			3	1			4
Lincoln's Sparrow	Yellow	-	-			6				6
Long-tailed Duck	Blue	-	-					2	4	6
Loon species	-	-	-						1	1
Mallard	Yellow	-	-					70	38	108
Marbled Murrelet	Blue	Threatened (Schedule 1)	Threatened					48	29	77
Mew Gull	Yellow	-	-	1				60	20	81
Mourning Dove	Yellow	-	-				1			1
Northern Pintail	Yellow	-	-					2	5	7
Northern Waterthrush	Yellow	-	-		1					1
Orange-crowned Warbler	Yellow	-	-	14	1	26	14			55
Pacific Loon	Yellow	-	-					1	2	3
Pacific Wren	Yellow	-	-	24	15	13	19			71
Pacific-slope Flycatcher	Yellow	-	-	17	9	11	16			53
Pigeon Guillemot	Yellow	-	-					5	7	12
Purple Finch	Yellow	-	-			1				1

Species Name	Conservation Status			Forest – Old coniferous forest	Forest - Seral deciduous forest	Wetland - Shrub-dominated bog	Wetland - Treed swamp or bog	Wetland – Estuarine tidal flat	Marine - ocean	Total Individuals by Species
	BC	SARA	COSEWIC							
Red-breasted Merganser	Yellow	-	-					1	6	7
Red-breasted Sapsucker	Yellow	-	-				3	1		4
Red-eyed Vireo	Yellow	-	-				2			2
Red-necked Grebe	Yellow	-	Not at Risk						4	4
Red-throated Loon	Yellow	-	-						1	1
Rhinoceros Auklet	Yellow	-	-					35	19	54
Ring-billed Gull	Yellow	-	-					1	1	2
Ruby-crowned Kinglet	Yellow	-	-		3					3
Rufous Hummingbird	Yellow	-	-	3	1		2			6
Sanderling	Yellow	-	-					50		50
Shorebird species	-	-	-					6	4	10
Song Sparrow	Yellow	-	-	2	3	1				6
Spotted Sandpiper	Yellow	-	-					7		7
Surf Scoter	Blue	-	-					14	22	36
Swainson's Thrush	Yellow	-	-	2	2	5	3			12
Thayer's Gull	Yellow	-	-					10	15	25
Townsend's Solitaire	Yellow	-	-				1			1
Townsend's Warbler	Yellow	-	-	2		3	4			9
Varied Thrush	Yellow	-	-	5	4	1	5			15
Western Grebe	Red	-	Special Concern					4	22	26
Western Gull	Yellow	-	-						7	7
Western Sandpiper	Yellow	-	-					46		46
Western Tanager	Yellow	-	-		1					1

Species Name	Conservation Status			Forest – Old coniferous forest	Forest - Seral deciduous forest	Wetland - Shrub-dominated bog	Wetland - Treed swamp or bog	Wetland – Estuarine tidal flat	Marine - ocean	Total Individuals by Species
	BC	SARA	COSEWIC							
White-crowned Sparrow	Yellow	-	-	1		2	2			5
White-winged Scoter	Yellow	-	-						2	2
Wilson's Warbler	Yellow	-	-				1			1
Woodpecker species	-	-	-		2		1			3
Yellow-rumped Warbler	Yellow	-	-		2	3				5
Yellow Warbler	Yellow	-	-	1						1
Total Birds per Community	**-**	**-**	**-**	**114**	**83**	**154**	**121**	**855**	**448**	**1,775**
Total Species per Community	**-**	**-**	**-**	**16**	**17**	**19**	**21**	**37**	**32**	**72**

Potential Effects on Migratory Birds

Change in Habitat

To measure effects change in habitat from the Project on terrestrial and marine migratory birds, the area of habitat that will be removed directly due to vegetation clearing or construction of the PDA was calculated by ecological community. With mitigative re-design of the marine terminal, a total of 172 ha of habitat will be removed by clearing for the PDA (including 164 ha terrestrial habitat and 5 ha of ocean and 3 ha of estuarine tidal habitat (Table 1)

The majority of the change in habitat in the modelling limits will occur in shrub dominated bog (36%), treed swamp or bog (29%), and old coniferous forest (22%). Removal of shrub-dominated bogs in the interior of Lelu Island will have the greatest effect on migratory bird species associated with wetland habitats. Breeding and foraging opportunities will be removed within the PDA for American robin, dark-eyed junco, hermit thrush, and orange-crowned warbler, amongst others (Table 3). Removal of treed swamp and old coniferous forest will decrease breeding and overwintering opportunities for migratory and resident species that nest and forage in coniferous forests, such as chestnut-backed chickadee, Pacific wren, Pacific-slope flycatcher, varied thrush, and Townsend's warbler (Table 3). Removal of dead or decaying trees will limit breeding, foraging, and roosting opportunities for cavity nesters (e.g., woodpeckers and chickadees) and insectivorous birds (e.g., chestnut-backed chickadee, and downey and hairy woodpecker). Clearing of treed swamp and old coniferous forest patches will also create openings in the forest along the boundary of the PDA. Breeding success will decrease for birds that nest within interior forest patches as they are more susceptible to predation by ravens, crows, and jays (Robinson et al. 1995, Burger 2002, Malt and Lank 2007). Seral deciduous forest provides habitat for American robin, western tanager, golden-crowned kinglet, and orange crowned warbler (Table 3); construction of the PDA will not result in changes to the extent of this ecological community. The area of ocean and estuarine tidal flat habitats removed for construction of the marine terminal, MOF, and bridge represent a small proportion of these habitats relative to their availability within the modelling limits. Clearing of tidal flats will have the greatest effect on birds that forage in this community type (e.g., herons, geese, dabbling ducks, and shorebirds). Construction and operations activities in marine habitat will influence habitat use for migratory birds using shallow, nearshore waters (e.g., dabbling and shallow-diving ducks, alcids, and gulls). Ecological communities that are either small in size, or are generally located outside the PDA (e.g., estuarine meadow, estuarine marsh, and seral coniferous and deciduous forests; Figure 1) will experience the smallest effect for migratory birds due to clearing for the Project.

Change in Mortality Risk

The Project is most likely to result in direct mortality to terrestrial and marine migratory bird species during vegetation clearing in the PDA. The *Migratory Birds Regulations* of the MBCA (Section 6) and the *Wildlife Act* (Section 34) prohibit the destruction of birds, their nests or eggs. Vegetation clearing during construction presents the greatest risk of mortality to birds. Destruction of active nests could result in direct mortality of young. Adult birds will temporarily or permanently abandon nests that are exposed to disturbances either close in proximity or long in duration (Carney and Sydeman 1999). Indirect mortality can result if adult birds fail to incubate eggs, feed young, or expose the nest to predation during prolonged absences (Malt and Lank 2009). Construction of the Project could also cause indirect mortality through the creation of edge habitats along the perimeter of the PDA. Forest edges that are created during construction will increase access to interior forest areas by potential predators (e.g., ravens, crows, squirrels, and coyotes) and parasitism species (e.g., cowbirds). Increased edge habitat can result in reduced nest success in these areas (Paton 1994, Malt and Lank 2009, Environment Canada 2014a). Nests and offspring of marine bird species are also protected under the *Migratory Birds Regulations* of the MBCA (Section 6) and the *Wildlife Act* (Section 34).

Birds, particularly marine species, are also susceptible to mortality events caused by sources of artificial lighting at the LNG facility (including emergency flaring), marine terminal, and berthed or anchored vessels. Birds are attracted to artificial lighting and can suffer mortality through direct collision with lighting structures. They may also deplete energy reserves by circling lit structures, eventually grounding themselves

from exhaustion or injury and becoming vulnerable to predation (Longcore et al. 2013, BirdLife International 2012). The potential for collisions with lit infrastructure on the suspension bridge component of the marine terminal is similar to other parts of the LNG facility. A detailed assessment of potential effects from lighting is provided in Section 11.5.3 of the EIS, and assessed specifically for the marine terminal in the EIS Addendum.

Alteration of Movement

Potential effects on alteration of movement for terrestrial migratory birds will generally be limited to noise disturbance during vegetation clearing, construction, and operations activities can result in avoidance behaviour. Although the response varies by species, birds tends to avoid noisy areas (Habib et al. 2007 and Bayne et al. 2008). Birds can habituate to predictable exposure to sensory disturbances over time and will reduce the extent to which they exhibit avoidance behaviour (Klopper et al. 2005). Marine components of the PDA (i.e., the marine terminal, MOF, and bridge) and marine shipping have potential to alter seasonal migration and local dispersal patterns of marine birds. Project infrastructure will impose physical or perceived barriers to important habitats if marine birds exhibit avoidance behaviour. This effect can be further complicated if birds are excluded from portions of the LAA or RAA that support locally or seasonally important foraging (e.g., eelgrass beds, salmon spawning areas) or habitat (e.g., staging) resources. Please refer to Section 11.5.4 of the EIS for a full discussion of potential effects.

Mitigation for Migratory Birds

To reduce potential project effects from change in habitat, change in mortality risk, and alteration of movement of terrestrial and marine species of migratory birds, the following mitigation measures will be employed:

- **Project location**—the project location is adjacent to existing road access and infrastructure
- **PDA clearing limits**—boundaries of the PDA will be clearly marked and clearing, grading or dredging, construction, and temporary storage of materials of terrestrial and marine habitat will be limited to within the PDA boundaries
- **Temporary workspace**—if temporary workspace or storage areas are required beyond the extent of the PDA, they will be located in existing cleared areas on the mainland to the extent possible. Clearing of forested habitats outside of PDA boundary (i.e., within the vegetated riparian buffer on Lelu Island) will be avoided
- **Riparian buffer**— A 30 m vegetation buffer will be retained around the perimeter of Lelu Island, except at access points (e.g., at the bridge, pioneer dock, MOF, trestle, and pipeline interconnection)
- **Restricted activity periods**—PNW LNG will follow guidelines for restricted activity periods to avoid incidental take of migratory birds
  - Consistent with Environment Canada's Avoidance Guidelines for Incidental Take (Environment Canada 2014b), clearing activities will occur outside of the breeding season for terrestrial and marine birds (April 9 through August 7)
  - If clearing is required during restricted activity periods, PNW LNG will ensure that bird surveys are conducted in advance of vegetation clearing by a BC-certified Registered Professional Biologist to comply with the *Migratory Birds Regulations* of the *Migratory Birds Convention Act*, Avoidance Guidelines for Incidental Take (Environment Canada 2014b), and the *BC Wildlife Act*. Buffers will be established around active nests and clearly marked to show the extent of clearing (BC MOE 2013)
- **Wetland Habitat Compensation**—The Wetland Habitat Compensation Plan (Appendix F of the EIS) will outline restoration and compensatory activities to recover the loss of wetland habitat function to terrestrial mammals, amphibians, and birds

- **Fish Habitat Offsetting**—The Conceptual Fish Habitat Offsetting Strategy (Appendix K of the EIS) will outline restoration and compensatory activities to recover the net loss of marine fish habitat used for foraging by marine birds
- **Speed limits**—LNG carriers, tugs, and barges will not exceed a speed of 16 knots within the LAA. Construction, operations, and decommissioning vessels will adhere to speed limits of 5 knots in Prince Rupert Harbour and Porpoise Channel and Harbour to reduce potential for marine bird collision or disturbance from vessel wake and underwater noise
- **Noise buffering**—Noise produced during construction and operations phases of the Project will follow standards set by the BC OGC (2009) which will limit noise disturbance to adjacent terrestrial and marine habitats. Specific mitigation is described in Section 8
- **Marine Construction Management Plan**—Timing of blasting will be developed in consultation with appropriate regulatory agencies and will be scheduled to avoid sensitive timing windows as per Environment Canada's Avoidance Guidelines for Incidental Take (Environment Canada 2014b)
- **Lighting**—to mitigate potential light-induced mortality, lighting mitigation will follow objectives contained within the Canada Green Building Council LEED guidelines and the International Commission on Illumination (LEED 2004, CIE 2003, and Section 9). The use of exterior lighting (including portable lighting structures) at the LNG facility, the MOF, marine terminal, and on berthed vessels will be limited as practical and permissible under federal safety and navigation regulations
- Should an emergency flaring and LNG facility shutdown event occur during project operations (see Section 22 of the EIS), a carcass search will be performed to record avian mortality after the emergency flaring event.

Characterization of Residual Effects for Migratory Birds

Change in Habitat

Change in the availability of terrestrial ecological communities is negligible to moderate and restricted to the terrestrial portion of the PDA (164 ha) (Table 1). Vegetation clearing for the PDA will have the greatest effect on shrub-dominated bogs, treed swamp or bog, and old coniferous forest. The greatest effect will be on terrestrial migratory bird species that use these habitats for foraging, breeding, staging during migration, and/or overwintering (e.g., those species listed in Table 3). The Wetland Habitat Compensation Plan will be implemented during project operations and offset the net loss of habitat used by wetland-dependent migratory birds that is removed during clearing. With mitigative redesign of the marine terminal, change in habitat for marine bird migratory species will be negligible to low in estuarine tidal flats and ocean ecological communities. The Conceptual Fish Habitat Offsetting Strategy will offset the net loss of marine communities, and subsequent marine bird foraging habitat, removed during construction. Direct habitat removal will occur once during clearing and will persist unless the PDA is reclaimed following decommissioning of the Project. Noise during construction and operations will cause additional disturbance of terrestrial and marine habitats occupied by migratory bird species, and extend locally to the LAA. Disturbance will be long-term and occur continuously through the life of the Project. Noise production will be lower during project operations than during construction but will still be concentrated around the PDA. Effects of sensory disturbance are expected to decrease along peripheral edges of the LAA, where noise returns to ambient levels and becomes predictable, allowing birds to habituate to project activities (Klopper et al. 2005). Habitat alteration from sensory disturbances is considered reversible following decommissioning of the Project.

Habitat loss and alteration will occur in an area that is subject to existing land-based anthropogenic disturbance due to the proximity and frequency of Port Edward and Prince Rupert, Skeena Drive, the CN railway, and industrial activity on Kaien and Ridley islands. Both terrestrial and marine birds inhabiting these areas have access to other suitable habitat in the LAA and RAA. Consequently, populations are expected to demonstrate moderate or high resilience to changes in habitat availability caused by the Project.

The likelihood of a residual effect of change in habitat on migratory birds is high. With the implementation of mitigation measures (including wetland compensation and fish habitat offsetting), the residual effect of the Project on migratory bird species is expected to be not significant. Based on the quality of available literature and professional opinion, the confidence in this prediction is high. Since the confidence in this prediction is not low, no additional risk analysis has been conducted.

Change in Mortality Risk

Potential for mortality of migratory bird species will be substantially reduced by adhering to applicable legislation (e.g., the MBCA) and federal Avoidance Guidelines for Incidental Take (Environment Canada 2014b), and through the implementation of project mitigation activities. Mortality of birds is expected to be low in magnitude (i.e., limited to a small number of individuals) since vegetation clearing will be completed outside of breeding periods when terrestrial species are more likely to be occupying nests. Mortality from clearing will be a single event occurring during initial clearing within the PDA. Potential residual effects of mortality will be short-term (i.e., vegetation clearing will occur over a period of a few months); and while mortality is permanent, natural recruitment (i.e., individuals recovered through reproduction and migration) is expected to potentially offset the loss of a few individuals within a regional population.

Potential for light-induced mortality of migratory species will be low to moderate in magnitude when facility structures are regularly lit during operations or during emergency flaring events. Mortality events are expected to occur irregularly and might increase under certain weather conditions (i.e., fog or precipitation) or during seasonal migratory periods when increased numbers of birds pass through the LAA. Residual effects of mortality from emergency flaring is expected to be very low given that an emergency flaring event will be less than one hour in duration and likely be unnoticeable if it occurred during daylight hours. In general, lighting mitigations are expected to reduce potential mortality risk for terrestrial and marine bird species. For secure populations (i.e., those designated Not-at-Risk under SARA or on the BC Yellow List), natural recruitment is expected to offset the loss of a few individuals within a regional population. Effects of artificial lighting would occur for the lifetime of the Project but are reversible following project decommissioning. Migratory birds will have a moderate to high degree of resilience to potential effects of mortality; effects are reversible following decommissioning of the Project. Implementation of lighting mitigation is expected to substantially reduce temporal and spatial effects of lighting.

The likelihood of a residual effect of change in mortality risk on migratory birds is moderate. With the implementation of mitigation measures, the residual effect of the Project on migratory bird species is expected to be not significant. Based on the quality of available literature and the effectiveness of presented mitigations, the confidence in this prediction is moderate. Since the confidence in this prediction is not low, no additional risk analysis has been conducted.

Alteration of Movement

Project-related effects on migratory bird movement from site preparation and construction of the LNG facility, operation of construction equipment, and installation of bridge and access road, will be low to moderate in magnitude and short in duration. Potential changes to movement patterns will generally affect species whose range is restricted to the LAA. Larger ranging species and migrants passing through the RAA will experience negligible effects. The effects on movement will occur continuously throughout construction and operations phases of the Project, but are reversible following reclamation. Both terrestrial and marine migratory bird species are currently exposed to a low to moderate degree of disturbance and displacement from existing projects and activities; species are expected to exhibit a moderate degree of resilience to the incremental contribution created by the Project.

Potential Project-related effects on marine bird movement from the marine terminal, MOF, and bridge are expected to be negligible. Project infrastructure is unlikely to limit access to key foraging and staging habitats (e.g., Lelu Slough and Flora Bank). An increase in vessel traffic in the LAA is expected to result in multiple, regular displacement of marine birds within the LAA. Displacement will vary by species, age, or seasonal sensitivities to vessel traffic. Available literature suggests that the duration of this effect will be

short-term and reversible as species that use habitats in the LAA consistently may habituate to project activities (please see Section 11.5.4 of the EIS for a detailed discussion). Alteration of marine bird movement will be restricted to the LAA and will be a multiple-regularly occurring event as individuals adjust daily or seasonal movement patterns in response to marine infrastructure and transiting vessels. There will be a low degree of marine bird displacement along vessel transit routes between Prince Rupert or Port Edward and Lelu Island and along the shipping route during operations. Consistent with guidance from Environment Canada (2013b; 2014b), the potential routes for the primary and alternate shipping lanes will be located greater than 500 m from marine bird colonies and transiting vessels will travel at steady speeds of 16 knots, parallel to colonies. Displacement of marine birds along the shipping route will be further moderated by implementing a vessel speed of 5 knots in Porpoise Channel and Harbour which will further decrease as vessels approach the berth. Consequently, disturbance from infrastructure and transiting vessels will be short-term. Although the degree of sensitivity varies by species, marine birds are generally expected to recover quickly as the distance from the disturbance increases (Schwemmer et al. 2011). The extent of disturbance may decrease or reverse over time as individuals habituate to the regular presence of infrastructure and vessels (Kaiser et al. 2006). Declines in the sustainability of marine bird populations have not been directly associated with effects from alteration of movement. In the RAA, marine birds are exposed to disturbance and displacement from existing projects and activities. There is reasonable expectation that marine birds will exhibit a moderate degree of resilience to the incremental contribution created by the Project.

The likelihood of a residual effect of alteration of movement on migratory birds is high. With the implementation of mitigation measures, the residual effect of the Project on migratory bird movement is expected to be not significant. Based on the quality of available literature and professional opinion, the confidence in this prediction is high. Since the confidence in this prediction is not low, no additional risk analysis has been conducted.

Assessment of Cumulative Effects to Migratory Birds

Based on the information provided in this report, combined with information presented in Section 11 and Appendix H of the EIS, characterization of residual effects from change in habitat, change in mortality risk, and alteration of movement to migratory birds remain unchanged from the EIS. Accordingly, conclusions of the assessment of project effects on migratory birds remain the same and no additional changes to the cumulative effects assessment are considered necessary.

Ecological Community Modelling and Wetland Habitat Compensation

Six wetland-associated ecological communities are modelled within the habitat modelling limits (Figure 1). Four of these communities will be affected by construction of the Project. Based on consultation with Environment Canada, additional information was requested regarding wetland mitigation for the Project and it's relation to the assessment of effects to migratory birds.

The *Federal Policy on Wetland Conservation* (the Policy; Government of Canada 1991) was considered during the assessment of potential effects to wildlife, and associated mitigation for the Project. The mitigation hierarchy for wetlands includes activities to avoid, minimize, and compensate to achieve no net loss of wetland function on federal lands and waters. Due to the extent of wetlands on Lelu Island, avoiding wetlands within the site is not possible. An Environmental Protection Plan (EPP) will be implemented to minimize adverse effects to wetlands that remain outside of the PDA. This plan will include drainage and erosion-control techniques to maintain the hydrology of remaining wetlands and measures to protect water quality within remaining waterbodies.

To address the remaining unavoidable adverse effects to wetlands that may occur following all avoidance and minimization measures, a Wetland Habitat Compensation Plan was developed (Appendix F of the EIS). The Wetland Habitat Compensation Plan presented by PNW LNG is consistent with the Policy's goal of "no net loss of wetland functions on federal lands and waters" (Government of Canada 1991).

The focus of the compensation plan is on replacing wetland functions lost during project construction. The compensation plan identifies three categories of wetland function: hydrological, biogeochemical, and habitat (including migratory bird habitat). Results of ecological community modelling (Table 1) indicate that 76 ha of shrub-dominated bog and 43 ha of treed swamp or bog will be most affected by construction of the Project with smaller amounts of estuarine tidal flat (3 ha) and aquatic wetland (1 ha) removed in the PDA. The Wetland Habitat Compensation Plan supports securement and enhancement of wetlands that will provide foraging, breeding, and staging habitat values for migratory birds and other wildlife (e.g., mammals and amphibians) most likely to use these communities. Based on results from baseline surveys and regional occurrence records, compensation for shrub-dominated bog should support habitat for representative species such as orange-crowned warbler, hermit thrush, purple finch, and dark-eyed junco. Similarly, wetland compensation activities to support treed swamp or bog removed by the PDA should provide habitat for migratory species using forested wetland habitats, including Wilson's warbler, orange-crowned warbler, red-eyed vireo, and American robin. Compensation for estuarine tidal flat would ideally support resident and staging shorebirds and dabbling duck species (e.g., western sandpiper, sanderling, and American wigeon). A full list of species identified in each ecological community is provided in Table 3. Wetland compensation sites will be chosen as close to Prince Rupert as possible.

Summary

The modelling approaches used in the assessment are consistent with methods recommended by Environment Canada (BC MSRM 2005; CIT 2004; EC 2013a; Hanson et al. 2009). Ecological modelling provides a robust assessment of project effects on migratory birds without relying on the use of indicator species. Habitat suitability modelling was conducted for species listed on Schedule 1 of SARA with potential to occur in the project area (marbled murrelet, northern goshawk, and olive-sided flycatcher) to facilitate compliance with the SARA.

Ecological communities modelled in the assessment are consistent with broader habitat types that define habitat niches in the Bird Conservation Strategy for BCR5 (Table 2). This approach allows PNW LNG to implement mitigation measures, such as the Wetland Habitat Compensation Plan, to reduce residual project effects on migratory birds. Combined with habitat suitability modelling to facilitate compliance with SARA, the ecological modelling approach provides an appropriate assessment of the effects to migratory birds. No changes in the assessment of the Project or cumulative effects are considered necessary and results and conclusions in the EIS remain valid.

Closure

This letter and the attached figure provide the Outstanding Information requested by the Government of Canada. If you have any questions, please contact PNW LNG.

Attachment: Figure 1: Ecological Communities at Baseline

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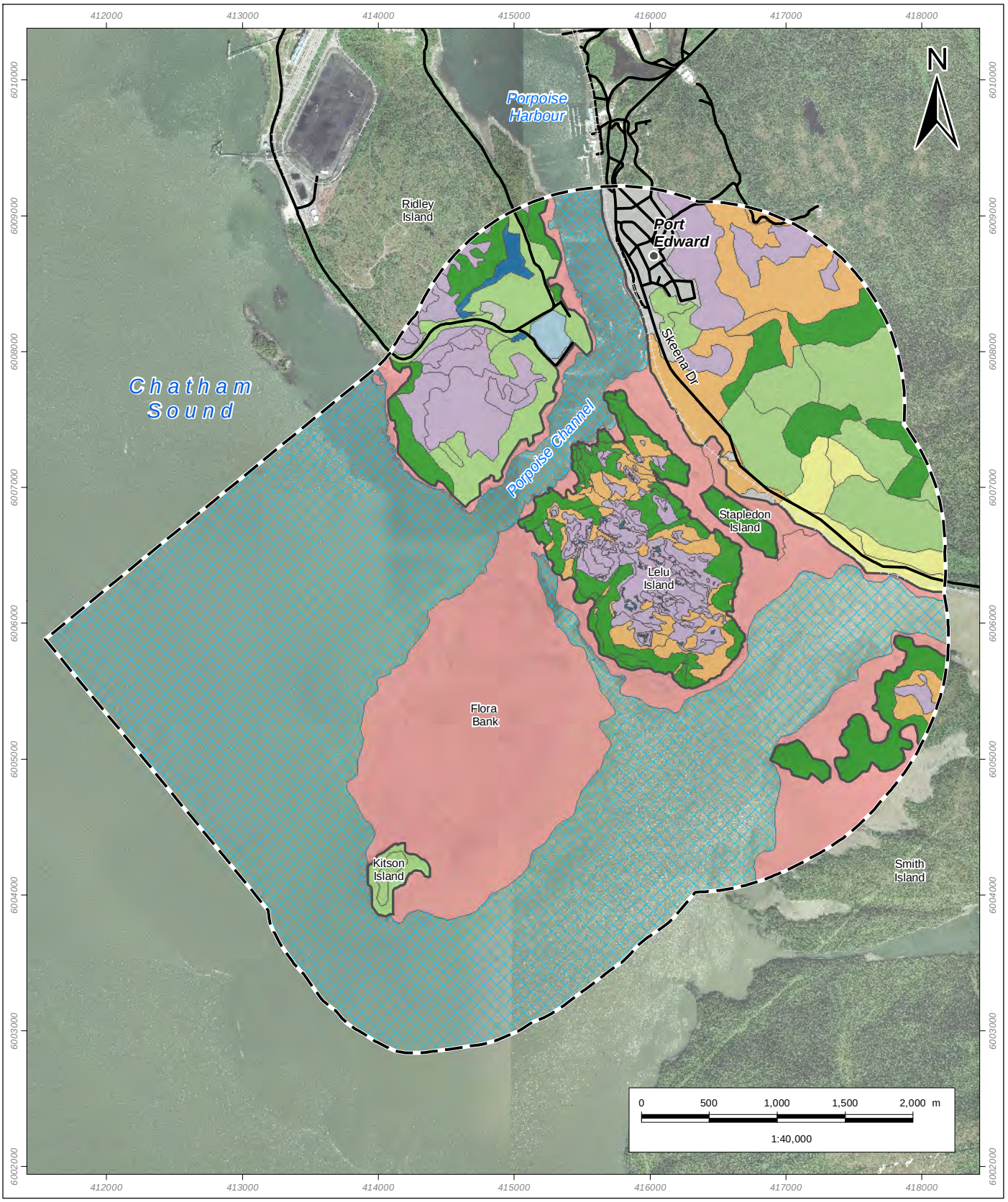

Ecological Communities

- Anthropogenic
- Forest - Old Coniferous Forest
- Forest - Seral Coniferous Forest
- Forest - Seral Deciduous Forest
- Marine - Ocean
- Wetland - Aquatic
- Wetland - Estuarine Marsh
- Wetland - Estuarine Meadow
- Wetland - Estuarine Tidal Flat
- Wetland - Shrub-dominated Bog
- Wetland - Treed Swamp or Bog

- Habitat Modelling Limit
- City or Town
- Railway
- Road
- Shoreline

Please refer to the Vegetation and Wetlands TDR for detailed descriptions of vegetation communities.

Pacific NorthWest LNG

Ecological Communities at Baseline

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd. WorldView-2 Imagery. Imagery date: 2011.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

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DRAWN BY: K. POLL	CHECKED BY: M. WILLIE

PREPARED BY: Stantec

PREPARED FOR: Pacific NorthWest LNG

FIGURE NO: **1**

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