

# Vegetation Resources Technical Data Report

## LNG Canada Export Terminal

October 2014



**LNG CANADA**  
Opportunity for British Columbia. Energy for the world

Joint venture companies



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## EXECUTIVE SUMMARY

LNG Canada Development Inc. is proposing to construct and operate a liquefied natural gas (LNG) facility (including an LNG processing and storage site and marine terminal) in the District of Kitimat, British Columbia, and to export LNG from the facility by shipping. This proposed project is called the LNG Canada Export Terminal (the Project).

This technical data report presents the baseline conditions for vegetation resources in support of the Environmental Assessment Certificate Application for the Project. Vegetation resources considered in this technical data report are:

- upland forests
- floodplain associations
- wetlands
- ecological communities at risk
- old forest
- plant species at risk
- traditional use plant species, and
- non-native invasive plant species.

These vegetation resources were documented using literature review and field studies conducted between June 2012 and May 2014. The literature review included review of existing information about vegetation resources using publicly available data sources such as the British Columbia Conservation Data Centre, the Kalum Predictive Ecosystem Mapping dataset, published literature, and other projects' files in provincial or federal environmental assessment registries. Traditional use plant species were identified and documented based on plant species listed in existing literature as important to the continued practice of treaty and asserted Aboriginal rights of the Haisla Nation and Tsimshian First Nation groups in the vegetation regional study area.

Field studies were conducted primarily in the local study area (LSA of 786 ha) and vicinity (i.e., within the wildlife LSA, which is an approximate 1.5 km buffer around the anticipated Project footprint). Field work included ground-truthing the 1:5,000 scale Terrestrial Ecosystem Mapping (TEM) developed for the Project. The TEM provides detailed geospatial data regarding the distribution and abundance of vegetation in the LSA. Publicly available datasets (Kalum Predictive Ecosystem Mapping and vegetation resource inventory) were used to characterize vegetation resources within the 127,893 ha regional study area (RSA).

Key results and findings are:

- Approximately 35% (278.9 ha) of the LSA consists of anthropogenic and sparsely or non-vegetated areas.
- The remainder of the LSA consists of 33% (260.6 ha) floodplain associations, 17% wetlands (135.6 ha), and 14% upland forest (110.9 ha). The surrounding RSA contains 4% floodplain, 13% wetland, and 76% upland forest. Avalanche (2%) and anthropogenic and sparsely or non-vegetated features comprise the remainder of the RSA.
- The LSA contains 130.4 ha of red-listed and 53.6 ha of blue-listed ecological communities.
- Swamps are the dominant wetland class in the LSA, comprising 58% (78.5 ha) of the wetlands (135.6 ha).
- Approximately 8% of the LSA (61.4 ha) and at least 34% of the RSA (43,255.3 ha) is comprised of old forest.
- Two blue-listed and one red-listed plant species at risk were detected in the LSA during field surveys in 2012.
- Plants used by Aboriginal Groups in the region were detected in the LSA, including 6 species of trees, 13 shrub species, 21 species of herbs (forbs and ferns), and 4 species of non-vascular (seaweed/algae/moss).
- Three non-native invasive plant species were detected in the LSA through field surveys. Of these three species, one was listed as noxious in the BC *Weed Control Act* and associated Regulation.

## ACRONYMS AND ABBREVIATIONS

BC .....	British Columbia
BEC .....	Biogeoclimatic Ecosystem Classification
CDC .....	Conservation Data Centre
CWH .....	Coastal Western Hemlock
GIS.....	geographic information systems
GPS .....	global positioning system
ha.....	hectares
LNG .....	liquefied natural gas
LNG Canada.....	LNG Canada Development Inc.
LSA .....	local study area
MH .....	Mountain Hemlock
NAD .....	North American Datum
NWIPC.....	Northwest Invasive Plant Council
PEM.....	Predictive Ecosystem Mapping Project..... LNG Canada Export Terminal Project
RSA .....	regional study area
SARA .....	<i>Species at Risk Act</i>
Stantec.....	Stantec Consulting Ltd.
TDR .....	technical data report
TEM .....	Terrestrial Ecosystem Mapping
UTM.....	Universal Transverse Mercator
VRI.....	Vegetation Resources Inventory



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# 1 INTRODUCTION

LNG Canada Development Inc. (LNG Canada) is proposing to construct and operate a liquefied natural gas (LNG) facility (including an LNG processing and storage site and marine terminal) in the District of Kitimat, British Columbia (BC), and to export LNG from the facility by shipping. This proposed project is called the LNG Canada Export Terminal (the Project).

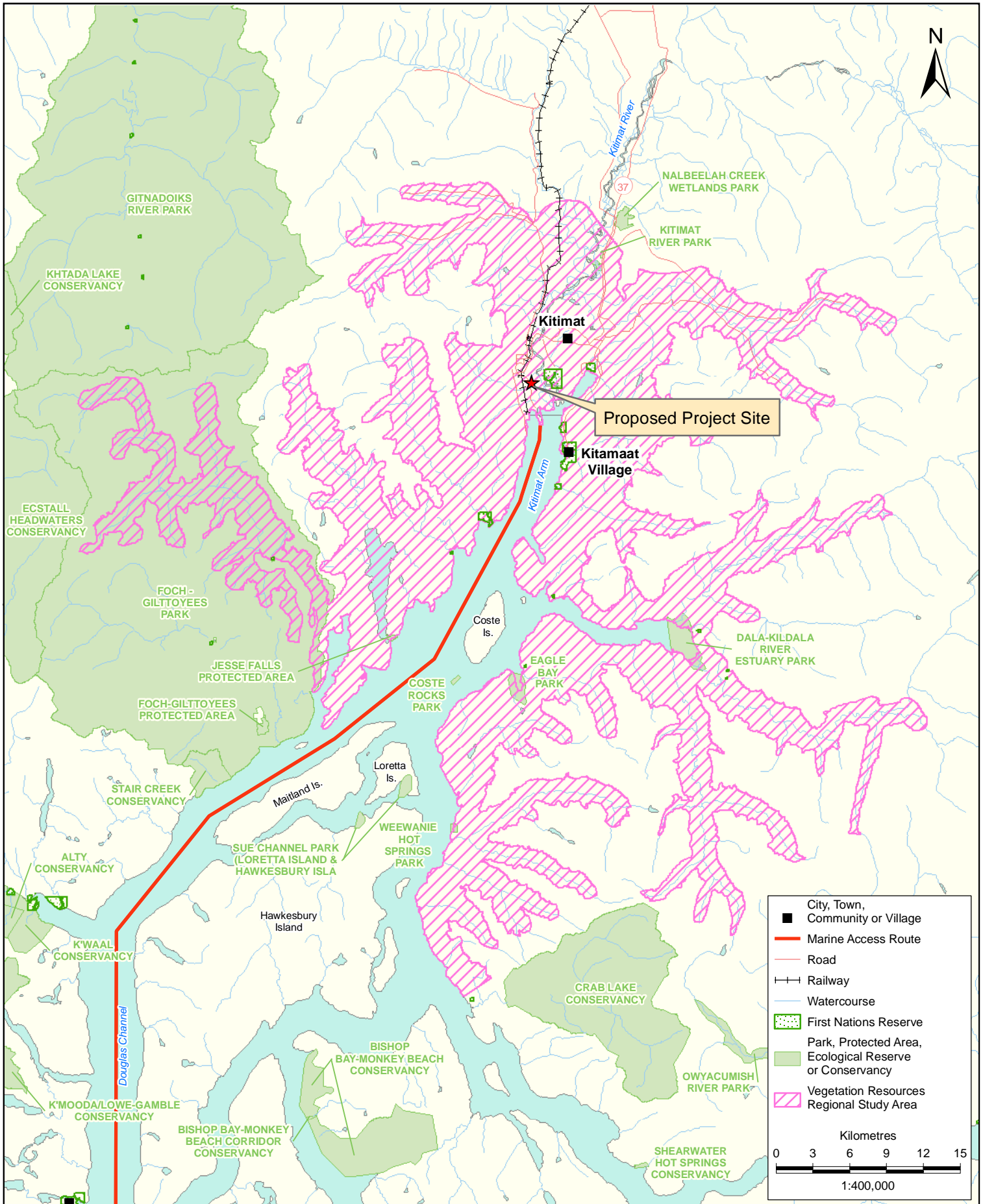
This Vegetation Resources Technical Data Report (TDR) presents background information, methods, and results for the baseline and potential effects studies conducted for the Project.

Professional judgment of the study team, and input from consultation with regulators, Aboriginal Groups and the public, guided the scope of the study. The study was initiated with a review of existing information. Field studies were then conducted to address the gap between existing information and the information required to support the Environmental Assessment Certificate Application.

## 1.1 Study Areas

The baseline conditions for vegetation resources are presented in the context of a regional study area (RSA) and a local study area (LSA).

- The RSA for vegetation resources is 127,893.1 ha and contains the terrestrial portion of the Coastal Western Hemlock Very Wet Maritime biogeoclimatic subzone (CWHvm) that occurs within the Wedeene and Hirsch landscape units (see Figure 1.1-1). Publicly available spatial boundaries of these landscape units and 2012 biogeoclimatic linework were downloaded from the Land and Resource Data Warehouse. The CWHvm is characterized by similar climate and vegetation to the Project footprint and is capable of supporting the vegetation resources described in Section 5.5 of the Application. The landscape units chosen are contiguous with the Project footprint and are management areas established to help guide forest resources and biodiversity management on Crown land.
- The LSA for vegetation resources is 785.9 ha and contains the Project footprint plus a 120 m buffer up to the landward limits of the average high tide (see Figure 1.1-2). This area was selected because vegetation in this area is susceptible to potential direct and indirect (edge) effects associated with vegetation clearing. Extension Note 21, issued by the BC Ministry of Forests, reports that edge effects on soil temperature and moisture resulting from removal of forest cover can extend 60 m to 120 m from a clear-cut edge (Voller 1998).



VEGETATION TECHNICAL DATA REPORT

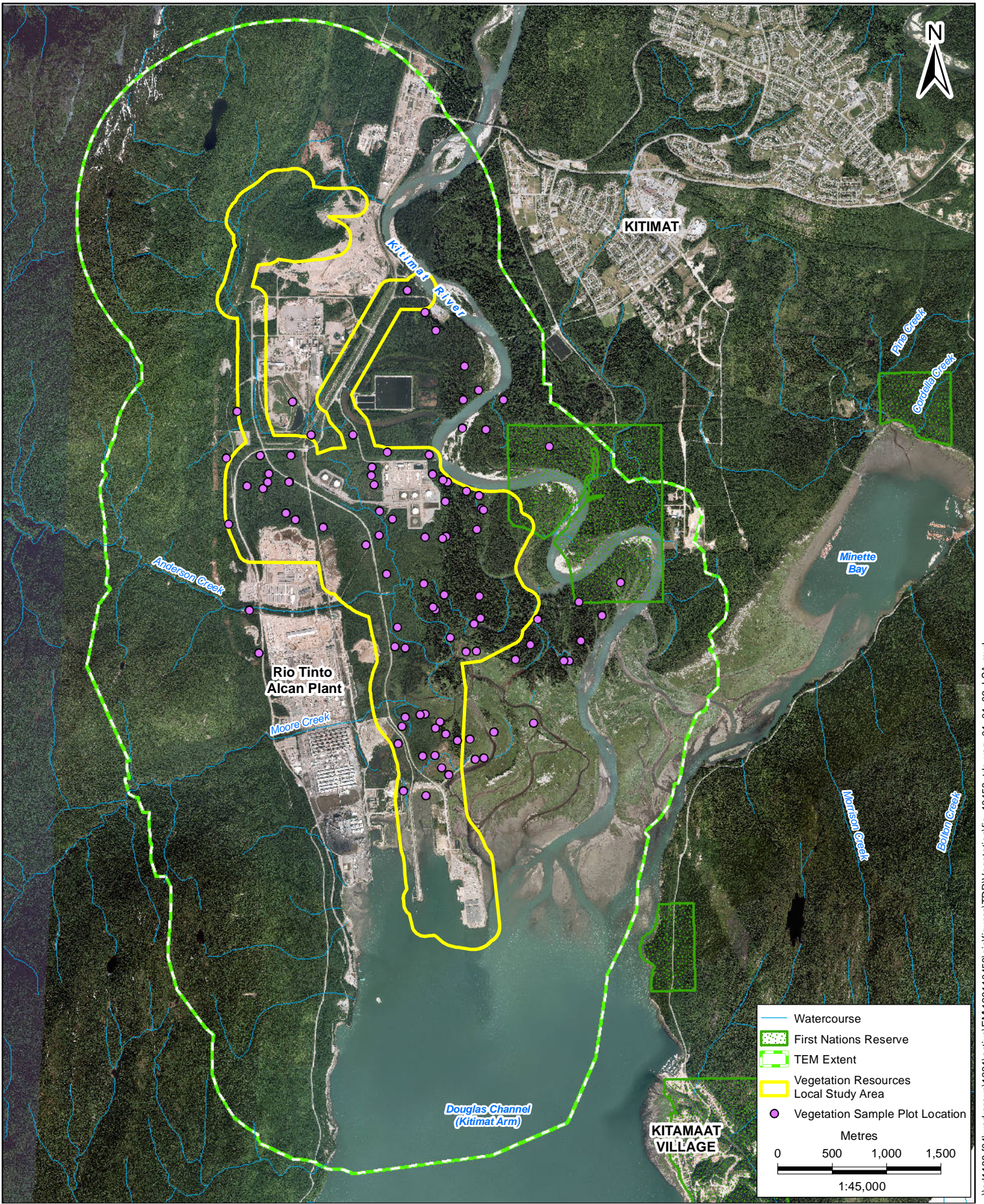
VEGETATION REGIONAL STUDY AREA

LNG CANADA EXPORT TERMINAL  
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	16-JUN-14	FIGURE NO.	1.1-1



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	Watercourse
	First Nations Reserve
	TEM Extent
	Vegetation Resources Local Study Area
	Vegetation Sample Plot Location

Metres

0 500 1,000 1,500

1:45,000



VEGETATION TECHNICAL DATA REPORT

**VEGETATION LOCAL STUDY AREA**

LNG CANADA EXPORT TERMINAL  
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	16-JUN-14	FIGURE NO.	<b>1.1-2</b>

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## 1.2 Vegetation Setting

The Project is located in the CWHvm biogeoclimatic subzone. The CWHvm occupies the inlets and river valleys along the west side of the Coast Mountains of BC (Banner et al. 1993). Two variants are delineated within the CWHvm: a submontane variant from 0 m to 400 m in elevation (vm1), and a montane variant that occurs from 400 m to 800 m in elevation (vm2). The CWHvm is characterized by relatively mild temperatures and heavy rainfalls. The soils in the CWHvm are predominantly Ferro-Humic and Humo-Ferric Podzols overlain on glaciomarine, glaciofluvial, and colluvium parent material.

The CWHvm is dominated by conifer stands of western hemlock (*Tsuga heterophylla*), amabilis fir (*Abies amabilis*), and western redcedar (*Thuja plicata*). Sitka spruce (*Picea sitchensis*) is common, particularly on alluvial soils. Old forests are quite common in this subzone due to the rarity of forest fires; however, logging is a frequent disturbance to the area. Red alder (*Alnus rubra*) and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) are the most common deciduous tree species and are often located on floodplains or other recently disturbed sites.

The vegetation LSA includes portions of the floodplain and estuary of the Kitimat River at the head of Kitimat Arm as well as adjacent uplands (Stantec 2008).

## 2 METHODS

The baseline conditions for vegetation resources were determined using a review of traditional ecological knowledge, academic literature, publicly available datasets, and completion of Terrestrial Ecosystem Mapping (TEM) and field studies.

### 2.1 Definitions

The vegetation resources described in this report are:

- upland forests
- floodplain associations
- wetlands
- ecological communities at risk
- old forest
- plant species at risk
- traditional use plant species, and
- non-native invasive plant species.

Ecological communities at risk are those listed as red or blue by the BC Conservation Data Centre (CDC), and these communities are important to biodiversity. They are often sensitive to disturbance and may be limited in distribution or extent over the landscape.

Plant species at risk for this Project are defined as vascular and non-vascular plant species that are listed:

- on the provincial red or blue lists developed and maintained by the CDC (BCCDC 2013a), and
- on Schedule 1 of the *Species at Risk Act* (SARA) (Government of Canada 2013).

Wetlands are areas where soils are water-saturated for a sufficient time that they influence vegetation and soil composition. Wetlands are described and classified according to Mackenzie and Moran (2004). Floodplain associations are described in Mackenzie and Moran (2004) as non-wetlands that occur on regularly flooded sites with well-drained coarse-textured soils. Periodic flooding or seasonally high water tables at these sites can promote hydrophytic vegetation, depending on the timing and duration of soil saturation. Floodplain associations are riparian ecosystems classified as occurring on either low-, mid-, or high-bench floodplains. Low- and mid-bench floodplain associations are described in MacKenzie and Moran (2004), while high-bench floodplain units are described in regional field guides to (primarily upland) forested communities. Because floodplain associations are influenced by adjacent aquatic ecosystems and are described in Mackenzie and Moran (2004), they are included in this report among the discussion of wetlands and riparian ecosystems.

Old forests in the Coastal Western Hemlock biogeoclimatic zone are stands with an average mature tree age of at least 250 years (BC MOFR and BCMOE 2010). These stands are indicated in TEM by structural stage 7 and in vegetation resource inventory (VRI) by the projected stand age of the leading tree species.

Traditional-use plant species are identified and documented by Aboriginal groups as being important to the continued practice of treaty and asserted Aboriginal rights.

This report also addresses the presence of non-native invasive plant species including noxious weeds listed in the *BC Weed Control Act* and associated Regulation (Government of BC 2013a and 2013b), as well as species targeted on the invasive plant list by the Northwest Invasive Plant Council (NWIPC 2013).

## 2.2 Review of Existing Data

This technical data report includes a review of existing traditional ecological knowledge, relevant literature, previous and current relevant environmental assessments, and historical data. In addition, publicly available datasets were reviewed. This review of existing data informed the approach to field surveys.

### 2.2.1 Regional Vegetation Mapping

The vegetation data used to describe the RSA was published as part of the Kalum Predictive Ecosystem Mapping (PEM) (Banner et al. 2003). The Kalum PEM was developed with data inputs that included terrain resource information management program and forest cover inventory from the Land and Resource Data Warehouse, the Biogeoclimatic Ecosystem Classification (BEC) mapping from the Skeena Contact Centre, and the Estuaries of BC – Preliminary Version 1.0 from the Skeena Contact Centre, care of the Pacific Estuary Conservation Program 2003, and Ducks Unlimited Canada (Banner et al. 2003). It was mapped at a scale of 1:50,000 projected using the Albers Equal Area Conic (NAD 83).

### 2.2.2 At-Risk Elements

Prior to conducting field surveys, the BC Species and Ecosystem Explorer database was queried for at-risk ecological communities and plant species with the potential to occur in the Kalum Forest District and/or CWHvm1 and/or CWHvm2 subzones (BCCDC 2013a). Schedule 1 of SARA (Government of Canada 2013) was reviewed to identify any federally designated plant species at risk that might occur in the RSA. These searches produced a list of 11 ecological communities at risk (see Table 2.2-1) and 24 plant species at risk (see Table 2.2-2) with potential to occur in the RSA. Based on this search, one SARA-listed vascular plant species and two SARA-listed lichen species were identified as having potential to occur. The CDC Internet Mapping Service was referenced to identify known occurrences of at-risk ecological communities or plant species near the LNG facility site; search results indicated that four at-risk species were recorded within 10 km of the LSA (BCCDC 2013b; Table 2.2-2).

This information was used to focus field surveys for at-risk ecological communities and plant species (see Appendix A).

**Table 2.2-1: Ecological Communities at Risk with Potential to Occur in the RSA**

Common Name	Scientific Name	Wetland or Site Series	BC Status
amabilis fir - Sitka spruce / devil's club	<i>Abies amabilis</i> - <i>Picea sitchensis</i> / <i>Oplopanax horridus</i>	CWHvm1/08	blue
Sitka sedge / peat-mosses	<i>Carex sitchensis</i> / <i>Sphagnum</i> spp.	CWHvm1/Wf51	red
dune wildrye / beach pea	<i>Leymus mollis</i> ssp. <i>mollis</i> - <i>Lathyrus japonicus</i>	CWHvm1/00	red
Sitka spruce / salmonberry	<i>Picea sitchensis</i> / <i>Rubus spectabilis</i>	CWHvm1/09	red
black cottonwood - red alder / salmonberry	<i>Populus trichocarpa</i> / <i>Alnus rubra</i> / <i>Rubus spectabilis</i>	CWHvm1/10	blue
Labrador tea - western bog-laurel / peat-mosses	<i>Rhododendron groenlandicum</i> / <i>Kalmia microphylla</i> / <i>Sphagnum</i> spp.	CWHvm1/Wb50	blue
Sitka willow / Sitka sedge	<i>Salix sitchensis</i> / <i>Carex sitchensis</i>	CWHvm1/Ws06	blue
western redcedar - Sitka spruce / skunk cabbage	<i>Thuja plicata</i> - <i>Picea sitchensis</i> / <i>Lysichiton americanus</i>	CWHvm1/14	blue
western redcedar - western hemlock / sword fern	<i>Thuja plicata</i> - <i>Tsuga heterophylla</i> / <i>Polystichum munitum</i>	CWHvm1/04	blue
western hemlock - amabilis fir / deer fern	<i>Tsuga heterophylla</i> - <i>Abies amabilis</i> / <i>Blechnum spicant</i>	CWHvm1/06	blue
western hemlock - western redcedar / salal	<i>Tsuga heterophylla</i> - <i>Thuja plicata</i> / <i>Gaultheria shallon</i> Very Wet Maritime	CWHvm1/03	blue

**Table 2.2-2: Plant Species at Risk with Potential to Occur in the RSA**

Common Name	Scientific Name	BC Status	SARA Status
stalked moonwort	<i>Botrychium pedunculatum</i>	red	not listed
moose moonwort	<i>Botrychium tunux</i>	red	not listed
Hulten's bryhnia moss	<i>Bryhnia hultenii</i>	red	not Listed
swollen beaked sedge	<i>Carex rostrata</i>	red	not listed
orange bow moss	<i>Dicranodontium asperulum</i>	blue	not Listed
gray-leaved draba	<i>Draba cinerea</i>	blue	not listed
lance-fruited draba	<i>Draba lonchocarpa</i> var. <i>thompsonii</i>	blue	not listed
lance-fruited draba	<i>Draba lonchocarpa</i> var. <i>vestita</i>	blue	not listed
crested wood fern	<i>Dryopteris cristata</i>	blue	not listed
Kamchatka spike-rush	<i>Eleocharis kamtschatica</i>	blue	not listed
Hornemann's willowherb	<i>Epilobium hornemannii</i> ssp. <i>behringianum</i>	blue	not listed
small-fruited willowherb	<i>Epilobium leptocarpum</i>	blue	not listed
Edwards wallflower	<i>Eutrema edwardsii</i>	blue	not listed
bog rush <sup>a</sup>	<i>Juncus stygius</i> <sup>a</sup>	blue	not listed

Common Name	Scientific Name	BC Status	SARA Status
white adder's-mouth orchid <sup>a</sup>	<i>Malaxis brachypoda</i> <sup>a</sup>	blue	not listed
bog adder's-mouth orchid	<i>Malaxis paludosa</i>	blue	not listed
cryptic paw <sup>a</sup>	<i>Nephroma occultum</i> <sup>a</sup>	blue	special concern
river bristle-moss	<i>Orthotrichum rivulare</i>	blue	not listed
whitebark pine	<i>Pinus albicaulis</i>	blue	endangered
pleuroziopsis moss	<i>Pleuroziopsis ruthenica</i>	blue	not listed
eminent bluegrass	<i>Poa eminens</i>	blue	not listed
perfoliate pondweed	<i>Potamogeton perfoliatus</i>	blue	not listed
old growth specklebelly <sup>a</sup>	<i>Pseudocypbellaria rainerensis</i> <sup>a</sup>	blue	special concern
frosted glass whiskers <sup>a</sup>	<i>Sclerophora peronella</i>	red	not listed

**NOTE:**

<sup>a</sup> Historically observed in the area according to CDC Internet Mapping Service (BCCDC 2013b)

### 2.2.3 Non-Native Invasive Species

Multiple non-native invasive species listed in the BC *Weed Control Act* and associated Regulation have the potential to occur in the RSA (see Table 2.2-3; Government of BC 2013a and 2013b).

The Northwest Invasive Plant Council oversees the weed management of this region and maintains a Target Invasive Plant List of more regionally specific list of identified weeds (NWIPC 2013). In some instances, the regional invasive species overlap with the provincial list.

**Table 2.2-3: Non-Native Invasive Plant Species with Potential to Occur in the RSA**

Non-Native Invasive Plant Species			
Common Name	Scientific Name	Northwest Invasive Plant Council	BC <i>Weed Control Act</i> Regulation
annual sowthistle	<i>Sonchus oleraceus</i>	✓	✓
baby's breath	<i>Gypsophila paniculata</i>	✓	
blueweed	<i>Echium vulgare</i>	✓	
bull thistle	<i>Cirsium vulgare</i>	✓	
burdock	<i>Arctium minus</i>	✓	
Canada thistle	<i>Cirsium arvense</i>	✓	✓
chicory	<i>Cichorium intybus</i>	✓	
comfrey	<i>Symphytum officinale</i>	✓	
common crupina	<i>Crupina vulgaris</i>	✓	✓
common hops	<i>Humulus lupulus</i>	✓	

<b>Non-Native Invasive Plant Species</b>			
<b>Common Name</b>	<b>Scientific Name</b>	<b>Northwest Invasive Plant Council</b>	<b>BC Weed Control Act Regulation</b>
common toadflax	<i>Linaria vulgaris</i>	✓	
dalmatian toadflax	<i>Linaria dalmatica</i>	✓	✓
diffuse knapweed	<i>Centaurea diffusa</i>	✓	✓
dodder	<i>Cuscuta</i> spp.	✓	✓
English holly	<i>Ilex aquifolium</i>	✓	
English Ivy	<i>Hedera helix</i>	✓	
eyebright	<i>Euphrasia nemorosa</i>	✓	
field scabious	<i>Knautia arvensis</i>	✓	
yellow salsify	<i>Tragopogon dubius</i>	✓	
gorse	<i>Ulex europaeus</i>	✓	✓
hairy bittercrest	<i>Cardamine hisuta</i>	✓	
hawkweeds	<i>Hieracium</i> spp.	✓	
Himalayan balsam	<i>Impatiens glandulifera</i>	✓	
Himalayan blackberry	<i>Rubus discolor</i>	✓	
hoary alyssum	<i>Berteroa inana</i>	✓	
hound's-tongue	<i>Cynoglossum officinale</i>	✓	✓
jointed goatgrass	<i>Aegilops cylindrica</i>	✓	✓
leafy spurge	<i>Euphorbia esula</i>	✓	✓
loose strife	<i>Lythrum</i> spp.	✓	✓
marsh plume thistle	<i>Cirsium palustre</i>	✓	
mossy stone crop	<i>Sedum acre</i>	✓	
mountain bluet	<i>Centaurea montana</i>	✓	
night flowering catchfly	<i>Silene noctiflora</i>	✓	
oxeye daisy	<i>Chrysanthemum leucanthemum</i>	✓	
perennial sowthistle	<i>Sonchus arvensis</i>	✓	✓
plumeless thistle	<i>Carduus acanthoides</i>	✓	
purple foxglove	<i>Digitalis purpurea</i>	✓	
purple nutsedge	<i>Cyperus rotundus</i>	✓	✓
rush skeletonweed	<i>Chondrilla juncea</i>	✓	✓
Russian thistle	<i>Salsola kali</i>	✓	
scentless chamomile	<i>Matricaria maritima</i>	✓	✓
scotch broom	<i>Cytisus scoparius</i>	✓	
spotted knapweed	<i>Centaurea maculosa</i>	✓	✓
sulphur cinquefoil	<i>Euphorbia esula</i>	✓	
tansy	<i>Tanacetum vulgare</i>	✓	

Non-Native Invasive Plant Species			
Common Name	Scientific Name	Northwest Invasive Plant Council	BC Weed Control Act Regulation
tansy ragwort	<i>Senecio jacobaea</i>	✓	✓
velvetleaf	<i>Abutilon theophrasti</i>	✓	✓
wormwood	<i>Artemisia absinthium</i>	✓	
yellow archangel	<i>Lamium galeobdolon</i>	✓	
yellow flag iris	<i>Iris pseudacorus</i>	✓	✓
yellow toadflax	<i>Linaria vulgaris</i>	✓	✓

## 2.2.4 Traditional Ecological Knowledge of Traditional Use Plants

Traditional ecological knowledge for vegetation resources was collected through publicly available sources for the RSA pertaining to the Haisla Nation and some Tsimshian groups. The following information comes from traditional knowledge studies, ethnographic and ethno historic sources, and academic papers.

Many of the traditional plants identified by the Haisla Nation are the same as those identified by some of the Tsimshian groups. Haisla Nation has asserted that their traditional lands include the lower courses, estuary and mouth of the Kitimat River and Minette Bay, including the area surrounding it that includes Kitamaat Village, Qelxat'sinuxw, Lower Yadsda area, Zagwis, MK Hill, and Simgas Creek. The Haisla and some Tsimshian groups have identified a number of plants that provide food, material and medicinal resources within the RSA or LSA (see Table 2.2-4). These include 14 tree, 31 shrub, 28 forb, 2 fern, and 11 non-vascular or aquatic or species (Halpin and Seguin 1990; McDonald 1985; Deur and Turner 2006; Moerman 1998; Powell 2006, 2011 and 2013; Satterfield et al. 2013; Turner and Clifton 2006; and Turner and Turner 2013).

**Table 2.2-4: Traditional Use Plants with Potential to Occur in the RSA or LSA**

Common Name	Scientific Name	First Nation Use		
		Medicinal	Food	Material
<b>Trees</b>				
balsam fir	<i>Abies amabilis</i>	✓		
big-leaf maple	<i>Acer macrophyllum</i>			✓
black cottonwood	<i>Populus trichocarpa</i>			✓
Douglas fir	<i>Pseudotsuga menziesii</i>			✓
Pacific crab apple	<i>Malus fusca</i>		✓	✓
Pacific yew	<i>Taxus brevifolia</i>	✓	✓	✓
paper birch	<i>Betula papyrifera</i>	✓		
red alder	<i>Alnus rubra</i>			✓

Common Name	Scientific Name	First Nation Use		
		Medicinal	Food	Material
shore pine	<i>Pinus contorta</i> var. <i>contorta</i>		✓	
Sitka spruce	<i>Picea sitchensis</i>		✓	✓
trembling aspen	<i>Populus tremuloides</i>	✓		
western hemlock	<i>Tsuga heterophylla</i>		✓	✓
western redcedar	<i>Thuja plicata</i>		✓	✓
yellow cedar	<i>Xanthocyparis nootkatensis</i>	✓		✓
<b>Shrubs</b>				
bitter cherry	<i>Prunus emarginata</i>			✓
blueberries	<i>Vaccinium</i> spp.	✓	✓	
cloudberry	<i>Rubus chamaemorus</i>		✓	
common juniper	<i>Juniperus communis</i>	✓		✓
copper-bush	<i>Elliottia pyroliflora</i>	✓		
crowberry	<i>Empetrum nigrum</i>		✓	
devil's club	<i>Oplopanax horridus</i>	✓		✓
dogwood	<i>Cornus stolonifera</i>			✓
elderberry	<i>Sambucus racemosa</i>		✓	
gooseberry	<i>Ribes</i> spp.		✓	
highbush cranberry	<i>Viburnum edule</i>		✓	
Himalayan blackberry	<i>Rubus armeniacus</i>			
huckleberry	<i>Vaccinium parvifolium</i>	✓	✓	
Indian-plum	<i>Oemleria cerasiformis</i>		✓	
Labrador tea	<i>Rhododendron groenlandicum</i>	✓		
lingonberry	<i>Vaccinium vitis-idaea</i>		✓	
lowbush cranberry (bog cranberry)	<i>Oxycoccus oxycocco</i>		✓	
kinnikinnick	<i>Arctostaphylos uva-ursi</i>	✓		
raspberry	<i>Rubus ideaus</i>		✓	
Rocky Mountain maple (Douglas Maple)	<i>Acer glabrum</i>			✓
rose hips	<i>Rosa</i> spp.		✓	
salal berry	<i>Gaultheria shallon</i>		✓	
salmonberry	<i>Rubus spectabilis</i>			✓
Saskatoon berry	<i>Amelanchier alnifolia</i>		✓	
soap berry	<i>Shepherdia canadensis</i>	✓		
stink currant	<i>Ribes bracteosum</i>		✓	
swamp laurel	<i>Kalmia microphylla</i>	✓		
thimbleberry	<i>Rubus parviflorus</i>	✓		
trailing blackberry	<i>Rubusursinus</i>		✓	

Common Name	Scientific Name	First Nation Use		
		Medicinal	Food	Material
twinberry	<i>Lonicera involucrata</i>		✓	
Willow	<i>Salix</i> spp.		✓	
<b>Forbs</b>				
cattail	<i>Typha latifolia</i>			✓
clover	<i>Trifolium</i> spp.		✓	
common sweetgrass	<i>Hierochloë hirta</i>			✓
cow-parsnip	<i>Heracleum maximum</i>	✓	✓	
buttercup roots	<i>Ranunculus</i> spp.		✓	
fireweed	<i>Epilobium angustifolium</i>		✓	
hellebore	<i>Veratrum viride</i>	✓		
Indian potato	<i>Trientalis borealis</i> ssp. <i>latifolia</i>		✓	
Indian tobacco	<i>Lobelia inflata</i>			✓
kneeling angelica	<i>Angelica genuflexa</i>			✓
lupine	<i>Lupinus</i> spp.		✓	
nettle	<i>Galeopsis</i> spp.		✓	
nodding onion	<i>Allium cernuum</i>		✓	
Pacific silverweed	<i>Potentilla egedii</i>	✓	✓	✓
Pacific water parsley	<i>Oenanthe sarmentosa</i>	✓		✓
riceroot (chocolate lily)	<i>Fritillaria camschatcensis</i>			✓
skunk cabbage	<i>Lysichiton americanus</i>	✓	✓	✓
slough sedge grass	<i>Carex obnupta</i>			✓
Solomon's seal	<i>Maianthemum dilatatum</i>			✓
swamp gentian	<i>Gentiana douglasiana</i>	✓		
goatsbeard	<i>Aruncus dioicus</i>		✓	
yarrow	<i>Achillea millefolium</i>			✓
wild carrot	<i>Daucus carota</i>		✓	
western dock	<i>Rumex aquaticus</i>		✓	
wild onion	<i>Allium</i> spp.		✓	
wild potato	<i>Claytonia</i> spp.			
wild rhubarb	<i>Rheum rhabarbarum</i>		✓	
wild strawberry	<i>Fragaria virginiana</i>		✓	
wild rice	<i>Zizania aquatica</i>			✓
<b>Ferns</b>				
licorice fern	<i>Polypodium glycyrrhiza</i>		✓	
wood fern	<i>Dryopteris arguta</i>	✓		

Common Name	Scientific Name	First Nation Use		
		Medicinal	Food	Material
<b>Non-Vascular and Aquatics</b>				
bull kelp	<i>Nereocystis luekeana</i>	✓	✓	✓
black and yellow lichen				✓
cone liverwort moss	<i>Conocephalum conicum</i>	✓		
green algae	<i>Multiclavula mucida</i>	✓		
mushrooms				✓
nori (edible seaweed)	<i>Porphyra torta</i>		✓	
old man's beard lichen	<i>Usnea</i> spp.			✓
pond lily	<i>Nuphar polysepala</i>	✓		
red lichen	<i>Xanthoria elegens</i>			✓
seaweed	<i>Porphyra</i> spp.			✓
sphagnum moss	<i>Sphagnum</i> spp.			✓

## 2.3 Terrestrial Ecosystem Mapping

Prior to field work, preliminary TEM was completed at a scale of 1:5,000. Using ArcMap GIS software, the TEM extent (approximately 1.5 km buffer around the anticipated Project footprint, equal to the wildlife LSA) was delineated into ecosystem polygons based on biophysical and ecological features (slope position, aspect, soil properties, micro-climate, surficial materials and vegetation cover). Mapping was completed to provincial standards as described by the Resources Inventory Committee (1998).

Polygons were attributed following site series for the CWHvm1 according to Banner et al. (1993) and additional wetland classifications were applied based on MacKenzie and Moran (2004). There are 18 site series described for the CWHvm1 in Banner et al. (1993), including six site series that represent wetland ecosystems, also described in MacKenzie and Moran (2004). Each polygon was assigned up to three site series and a structural stage. Site modifiers were used infrequently because site series generally exhibited typical site conditions that were adequately characterized by the site series descriptions.

Preliminary mapping was based on digitally scanned aerial photographs from 2006 flown at 1:40,000 scale provided by the GeoBC Crown Registry and Geographic Base. This preliminary map was used during field work then refined and completed, post-field work, with data from the survey plots. The most recent provincial site series and map code list were used to develop the map legend for the project-specific TEM.

## 2.4 Old Forest

Old forests are at climax seral stages and are generally heterogeneous forests, with live and dead trees of various sizes, species, composition, and age classes (BC MOFR and BCMOE 2010). The age at which forests are considered old is based on the natural disturbance history of the region and the average return interval of major stand-initiating disturbances (mainly wildfire and defoliating insects). For this region, old forests are defined as greater than 250 years old (BC MOFR and BCMOE 2010). Old forests are important for their contribution to wildlife habitat and species biodiversity. Understanding the characteristic appearance and structure of old forest in the region contributed to assessing structural stage and seral status of communities during field work.

The extent of old forests in the RSA was derived from the VRI geospatial database developed through the Forest Analysis and Inventory Branch (BCGOV FOR 2013). VRI coverage of the RSA is incomplete, covering approximately 60% of the RSA (see Section 2.5 for more information). The extent of old forest in the RSA was determined using the projected age of the leading tree species.

## 2.5 Field Surveys

Baseline conditions were documented through field surveys having the following objectives:

- ground truth TEM data
- identify ecological communities at risk
- describe and classify wetland associations
- identify plant species at risk
- identify stands of old forest
- record approximate abundance and distribution of traditional use plant species, and
- collect information on the approximate abundance and distribution of non-native invasive species.

Preliminary ecosystem maps of the area were used for navigation and for sample plot selection. The maps displayed air photo imagery and known locations of forested and wetland ecosystems, and other points of interest in the area.

Fieldwork was conducted during June and August 2012, August and September 2013, and May 2014. One hundred and five surveys were evenly distributed throughout the TEM extent. A total of 67 polygons were sampled in the LSA, which is 25% of 263 mapped LSA polygons (see Figure 1.1-2). At each sample plot, vegetation and site characteristics were recorded on standard site visit forms. Sample plots were of two kinds:

- ground plots used to record full vegetation and site information, and
- visual plots where abbreviated information and point observations were recorded.

Data from these plots formed the basis for ecosystem classification. At each plot, the following site characteristics were recorded:

- geographical location (UTM coordinates using a GPS unit)
- plant species composition and percent cover
- soil data including soil nutrient regime and soil moisture regime
- general site information including slope, aspect and elevation
- ecosystem (site series, ecological community, and/or wetland site association), and
- structural stage and successional status.

Ecological communities were identified and described according to the BC Ministry of Forests, Lands and Natural Resource Operations site series codes and classification system (MFLNRO 2012). Forest stand age was determined by visual evaluation as well as using an increment borer to assist in counting tree rings. Structural stage classes (representing stand age and development) were used to describe all forest stands with structural stage 7, representing old forest.

Surveys for plant species at risk were conducted during June and August 2012, and September 2013. Sampling was done along meandering transects through the full range of representative ecological communities in the TEM extent, with targeted sampling in ecosystems that are likely to support plant species at risk within the anticipated Project footprint. Data collected included the identification of the site series and a detailed list of the plant species present (Triton 2013, presented in Appendix A, and see Appendix B).

## **2.6 Limitations of the Technical Data Report**

There are five limitations to the data presented in this technical data report:

- Limitation 1, accuracy of the Kalum PEM, which was created in 2003 and was used for the RSA site series (ecosystem) summaries: An accuracy assessment of the Kalum PEM conducted by Yole (2007) was assessed at 47% to 49% accuracy overall. This was averaged for all site series listed within the dataset region (entire Kalum Forest District). However, accuracy within the CWHvm, which is the subzone within the vegetation RSA, is assessed at 67% to 68%, which is acceptable to provincial standards for PEM accuracy (e.g., greater than 65% accuracy is acceptable for use of a PEM for timber supply analysis). All site series mapped by TEM within the TEM extent and LSA were field-verified.
- Limitation 2, RSA spatial boundary: The RSA spatial boundary is defined by the CWHvm as it was delineated in 2012, whereas the biogeoclimatic subzone boundaries in the PEM dataset were delineated in 2003. Therefore, the two versions of the subzone boundaries differ within portions of the RSA, resulting in some ecosystems within the PEM classified as other than CWHvm, such as mountain hemlock (MH) and CWHws (see Table 3.1-1). This type of variation between revisions of provincial biogeoclimatic line work is not uncommon because

the boundaries of zones are periodically revised by the Ministry of Forests Lands and Natural Resource Operations.

- **Limitation 3, vegetation resources inventory:** The VRI age data coverage was used to determine mature and old forest cover within the RSA. However, the spatial coverage of this spatial layer only comprises 63% of the RSA. Thus, the area of old forest prediction within the RSA is a conservative (minimum) estimate. Similarly, the PEM-predicted forested ecological communities at risk is used in combination with the VRI age data for mature and old forest to determine the mature and old stands of these communities. Therefore, where the VRI age data were lacking, the mature forest stands of predicted listed communities could not be separated from younger seral communities at risk. As such, reporting of potential listed forested communities in this TDR likely includes younger seral stages (i.e., for any communities within the 37% of the RSA lacking VRI coverage) and could be an over estimate of forested communities at risk. The known area for these parameters was reviewed and deemed reasonable to estimate the ecosystems distribution within the RSA.
- **Limitation 4, plant assemblage classifications:** The TEM classifies areas of land according to site series, which represents the climax community potentially supported by soils, climate, and landscape position at a given site. Provincially listed ecological communities are described by a particular species assemblage and sometimes by a particular structural or seral stage as well (e.g., late-successional mature forest ecosystem dominated by certain climax coniferous species and understorey species forming an association). Recently disturbed, early successional stage examples of some site series do not necessarily exhibit the characteristic plant species assemblage of the provincially listed ecological community. These instances may be considered either historical occurrences, or occurrences with low ecological integrity. In their current condition, they would not rank as high value conservation targets; however, given time and access to propagules, these areas may develop into the provincially listed ecological community indicated by the site series name and, therefore, could be managed for recruitment or restoration purposes. For the purposes of analysis in this report, the areas of blue- or red-listed forested ecological communities reported in the results (see Table 3.2-2) are limited to areas of Structural Stage 6 or greater—corresponding to the mature forest (80 to 250 years old) and old forest (greater than 250 years old)—because these stages are more likely to exhibit conifer dominance, multistoried canopy structure, and greater understorey species diversity characteristic of the listed ecological community. This is unlike the younger structural stages (pole sapling and young forest), which likely do not represent the plant assemblage of the provincially listed ecological communities, despite the name of the site series (BC MOFR and BCMOE 2010).
- **Limitation 5, plant species of concern:** Traditional use, listed, and non-native invasive plants evaluated in this TDR are limited to the species found during the field surveys between 2012 and 2014. Other species might be present that were not observed during these surveys.

## 3 RESULTS

### 3.1 Regional Study Area Vegetation Mapping

Distinct vegetated ecosystem units identified by PEM in the RSA consist of:

- 16 forested units
- 12 floodplain or wetland units
- 8 montane, alpine or sub-alpine units, and
- 1 avalanche unit.

Anthropogenic and sparsely or non-vegetated units were also identified, including rock outcrops, urban developments and glaciers (see Table 3.1-1). Despite the relatively complex landscape physiognomy of the Kitimat Range, the RSA is dominated by four ecosystems that comprise 50% of the area:

- CWHvm1/06 and CWHvm2/06 western hemlock-amabilis fir/deer fern at 17%
- CWHvm1/01 and CWHvm2/02 western hemlock-amabilis fir/blueberry at 17%
- CWHvm1/08 and CWHvm2/08 amabilis fir-Sitka spruce/devil's club at 10%, and
- CWHvm1/03 and CWHvm2/03 western hemlock–western redcedar/salal at 7%.

Approximately 76% of the RSA is forested upland, 4% is floodplain, and 13% is wetland (see Table 3.1-1). Avalanche (2%) and anthropogenic and sparsely or non-vegetated features comprise the remainder of the RSA. A complete legend of map codes and ecosystem descriptions for the Kalum PEM data set is available in Banner et al. (2003).

**Table 3.1-1: PEM Ecosystems in the Project RSA**

Ecosystem Code	Map Code	Ecosystem Name	Area in RSA (ha)
<b>Montane, Subalpine and Alpine Units</b>			
MHwh1/01 <sup>a</sup>	MB	mountain hemlock - Sitka spruce / blueberry	14.9
MHwh1/02	MM	mountain hemlock - yellow cedar / mountain-heather	1.2
MHwh1/04	YG	mountain hemlock - yellow cedar / goldthread	1.0
MHwh1/05	YT	yellow cedar - mountain hemlock / twisted stalk	5.2
MHmm1/06 <sup>b</sup> MHwh1/06	MD	mountain hemlock - yellow cedar / deer cabbage	0.3
MHmm1/01	MB	mountain hemlock - amabilis fir / blueberry	0.7
MHmm1/02	MM	mountain hemlock - amabilis fir / mountain heather	0.3
MHmm1/00	PF/Kr	Parkland / krummholz	0.3
<b>Montane, Sub Alpine and Alpine Units Total</b>			<b>23.9</b>

Ecosystem Code	Map Code	Ecosystem Name	Area in RSA (ha)
<b>Upland Forested Units</b>			
CWHws1/01 CWHws2/01	AB	western hemlock - amabilis fir / bramble	8,743.1
CWHws1/04 CWHws2/04	AO	amabilis fir - western redcedar / oak fern	4,151.1
CWHws1/05 CWHws2/05	HQ	western hemlock - amabilis fir / Queen's cup	8,743.1
CWHws1/06 CWHws2/06	AD	amabilis fir - western redcedar / devil's club	4,151.1
CWHvm1/01 CWHvm2/02	AB	western hemlock - amabilis fir / blueberry	21,442.5
CWHvm1/08 CWHvm2/08	AD	amabilis fir - Sitka spruce / devil's club	12,453.9
CWHvm1/05 CWHvm2/05	AF	amabilis fir - western redcedar / foamflower	5,173.4
CWHvm1/06 CWHvm2/06	HD	western hemlock - amabilis fir / deer fern	21,274.3
CWHvh2/04	HM	western hemlock - Sitka spruce / lanky moss	82.0
CWHws1/03 CWHws2/03	HM	western hemlock - lodgepole pine / feathermoss	1,900.7
CWHvh2/01	HS	western redcedar - western hemlock /salal	2.3
CWHvm1/03 CWHvm2/03	HS	western hemlock - western redcedar / salal	9,179.3
MHm1/03	MO	amabilis fir - mountain hemlock /oak fern	0.2
CWHvh2/03	RS	western redcedar - yellow cedar / salal	33.9
CWHvh2/07	SD	western redcedar - Sitka spruce / devil's club	1.5
<b>Forested Units Total</b>			<b>97,332.4</b>
<b>Floodplain Units</b>			
<b>High Fluvial Bench</b>			
CWHvm1/09 CWHws1/07 CWHws2/07	SS	Sitka spruce / salmonberry	2,010.6
<b>Mid Fluvial Bench</b>			
CWHws2/08	CD	black cottonwood / red-osier dogwood	157.7
CWHvm1/00	RS	riparian shrub	192.6
CWHws1/00 CWHws2/09	AW	alder / willow	2,555.6
<b>Low Fluvial</b>			
CWHws1/09	CW	black cottonwood / willow	136.9
<b>Floodplain Units Total</b>			<b>5,055.4</b>

Ecosystem Code	Map Code	Ecosystem Name	Area in RSA (ha)
<b>Wetland Units</b>			
<b>Wetlands (not classified by this dataset to class or site association at this map scale)</b>			
CWHvm1/00	WL	wetland	2,409.6
CWHvm2/00			
CWHws1/00			
CWHws2/00			
<b>Unclassified Wetland Total</b>			<b>2,409.6</b>
<b>Estuary</b>			
CWHvm1/00	ET	estuary	365.3
CWHvm1/00	MU	mudflat sediment	4.3
<b>Estuary Total</b>			<b>369.6</b>
<b>Swamp</b>			
CWHvm2/11	RC	western redcedar - yellow cedar / skunk cabbage	308.8
CWHvm1/14	RC	western redcedar - Sitka spruce / skunk cabbage	1,709.0
CWHws1/11			
CWHws2/11			
<b>Swamp Total</b>			<b>2,107.8</b>
<b>Bog Units</b>			
CWHvh2/11	YG	western redcedar - yellow cedar / goldthread	7,278.35
CWHvm1/12			
CWHvm2/09			
CWHvm1/13 CWHvm2/10 CWHws2/10	LS	lodgepole pine / sphagnum	5,008.1
<b>Bog Units Total</b>			<b>12,286.4</b>
<b>Wetland Units Total</b>			<b>17,083.4</b>
<b>Avalanche Units</b>			
CWHvm1/00	SA	slide - avalanche	404.7
CWHvm2/00	SA	slide - avalanche	1,312.8
CWHws2/00	SA	slide - avalanche	400.9
MHmm1/00	SA	slide - avalanche	<0.1
<b>Avalanche Units Total</b>			<b>2,118.4</b>
<b>Anthropogenic and Sparsely or Non-vegetated</b>			
CWHvh2/00	RO	rock outcrop	899.8
CWHvm1/00			
CWHvm2/00			
CWHws2/00			
MHmm1/00			
MHwh1/00			

Ecosystem Code	Map Code	Ecosystem Name	Area in RSA (ha)
CWHvm1/00 CWHvm2/00	GL	glacier	35.9
CWHvm1/00 CWHvm2/00 CWHws1/00 CWHws2/00	LA	lake	1,643.5
CWHvm1/00	OC	ocean	277.6
CWHvm1/00 CWHvm2/00 CWHws1/00 CWHws2/00	RI	river	1,705.5
CWHvm1/00 CWHvm2/00 CWHws2/00	SB	sand bar	158.2
CWHvm1/00 CWHvm2/00 CWHws1/00 CWHws2/00	DV	urban	1,559.1
<b>Anthropogenic and Sparsely or Non-vegetated Total</b>			<b>6,279.6</b>
<b>Grand Total</b>			<b>127,893.1</b>

**NOTES:**

- <sup>a</sup> MHwh1 is the Windward Wet Hypermaritime subzone of the Mountain Hemlock (MH) BGC zone.  
<sup>b</sup> MHmm1 is the Windward Moist Maritime subzone of the MH BGC zone.

### 3.1.1 Ecological Communities at Risk in the Vegetation RSA

Eight ecological communities at risk were mapped in the RSA based on the provincial red or blue lists developed and maintained by the CDC (BCCDC 2013a) and the Kalum PEM (see Table 3.1-2). The area of each community was derived using the Kalum PEM data and VRI together to select mature (greater than 80 years) stands (see Section 2.5). The western hemlock amabilis fir–deer fern blue-listed ecological community encompasses the largest area in the RSA, among the listed communities, with at least 10,128.0 ha (8%).

**Table 3.1-2: Ecological Communities at Risk in the Vegetation RSA**

Ecosystem Code	PEM Map Code	Ecosystem Name	Area (ha)	Proportion (%) of RSA
<b>Blue Listed</b>				
CWHvm1/08 CWHvm2/08	AD	amabilis fir – Sitka spruce / devil's club	3,328.0	3
CWHvm1/06 CWHvm2/06	HD	western hemlock - amabilis fir / deer fern	10,128.0	8

Ecosystem Code	PEM Map Code	Ecosystem Name	Area (ha)	Proportion (%) of RSA
CWHws1/03 CWHws2/03	HM	western hemlock - lodgepole pine / feathermoss	1,377.6	1
CWHws1/04 CWHws2/04	AO	amabilis fir - western redcedar / oak fern	2,998.9	2
CWHws1/06	AD	amabilis fir - western redcedar / devil's club	<0.1	<1
CWHvm1/04	RS	western redcedar - western hemlock / sword fern	19.4	<1
CWHvm1/14 CWHws1/11 CWHws2/11	RC	western redcedar - Sitka spruce / skunk cabbage	1,040.2	<1
<b>Red Listed</b>				
CWHvm1/09 CWHws1/07 CWHws2/07	SS	Sitka spruce / salmonberry	895.4	<1
<b>Total</b>			<b>19,787.5</b>	<b>15</b>

**NOTE:**

Totals in this table only include mature stands (greater than 80 years based on VRI age data). Coverage of VRI in the RSA is incomplete (approximately 60%); therefore, actual areas are likely larger.

### 3.1.2 Old Forest

Due to infrequent disturbance, the forests of this region include extensive stands of old forest. In the RSA, at least 43,255.3 ha (34%) is old forest (see Table 3.1-3).

**Table 3.1-3: Old Forest in the RSA**

Ecosystem Code	Map Code	Ecosystem Name	Area (ha)
MHmm1/01	MB	mountain hemlock – amabilis fir / blueberry	0.3
MHmm1/02	MM	mountain hemlock – amabilis fir / mountain-heather	<0.1
MHmm1/03	MO	amabilis fir – mountain hemlock / oak fern	<0.1
MHmm1/06	MD	mountain hemlock – yellow cedar / deer cabbage	<0.1
CWHvm1/01 CWHvm2/01	AB	western hemlock – amabilis fir / blueberry	5,539.3
CWHvm1/03 CWHvm2/03	HS	western hemlock – western redcedar / salal	2,291.6
CWHvm1/05 CWHvm2/05	AF	amabilis fir – western redcedar / foamflower	1,623.4
CWHvm1/06 CWHvm2/06	HD	western hemlock – amabilis fir / deer fern	8,997.6
CWHvm1/08 CWHvm2/08	AD	amabilis fir – Sitka spruce / devil's club	2,489.7

Ecosystem Code	Map Code	Ecosystem Name	Area (ha)
CWHvm1/12 CWHvm2/09	YG	western redcedar – yellow cedar / goldthread	2,261.5
CWHvm1/13 CWHvm2/10 CWHws2/10	LS	Lodgepole pine / sphagnum	2,558.3
CWHvm1/14 CWHws2/11	RC	western redcedar – Sitka spruce / skunk cabbage	731.3
CWHvm2/11	RC	western redcedar – yellow cedar / skunk cabbage	14.9
CWHvm1/09 CWHws2/07	SS	Sitka spruce / salmonberry	234.3
CWHws1/03 CWHws2/03	HM	western hemlock – Lodgepole pine / feathermoss	1,029.5
CWHws2/01	AB	western hemlock – amabilis fir / bramble	5,188.8
CWHws2/05	HQ	western hemlock – amabilis fir / Queen's cup	5,188.8
CWHws2/04	AO	amabilis fir – western redcedar / oak fern	2,496.9
CWHws2/06	AD	amabilis fir – western redcedar / devil's club	2,496.9
CWHws2/08	CD	black cottonwood / red-osier dogwood	13.9
CWHvm1/00 CWHvm2/00 CWHws2/00	WL	wetland <sup>a</sup>	98.3
<b>Total</b>			<b>43, 255.3</b>

**NOTES:**

Totals reflect the extent of the VRI coverage within the RSA, actual totals may be larger.

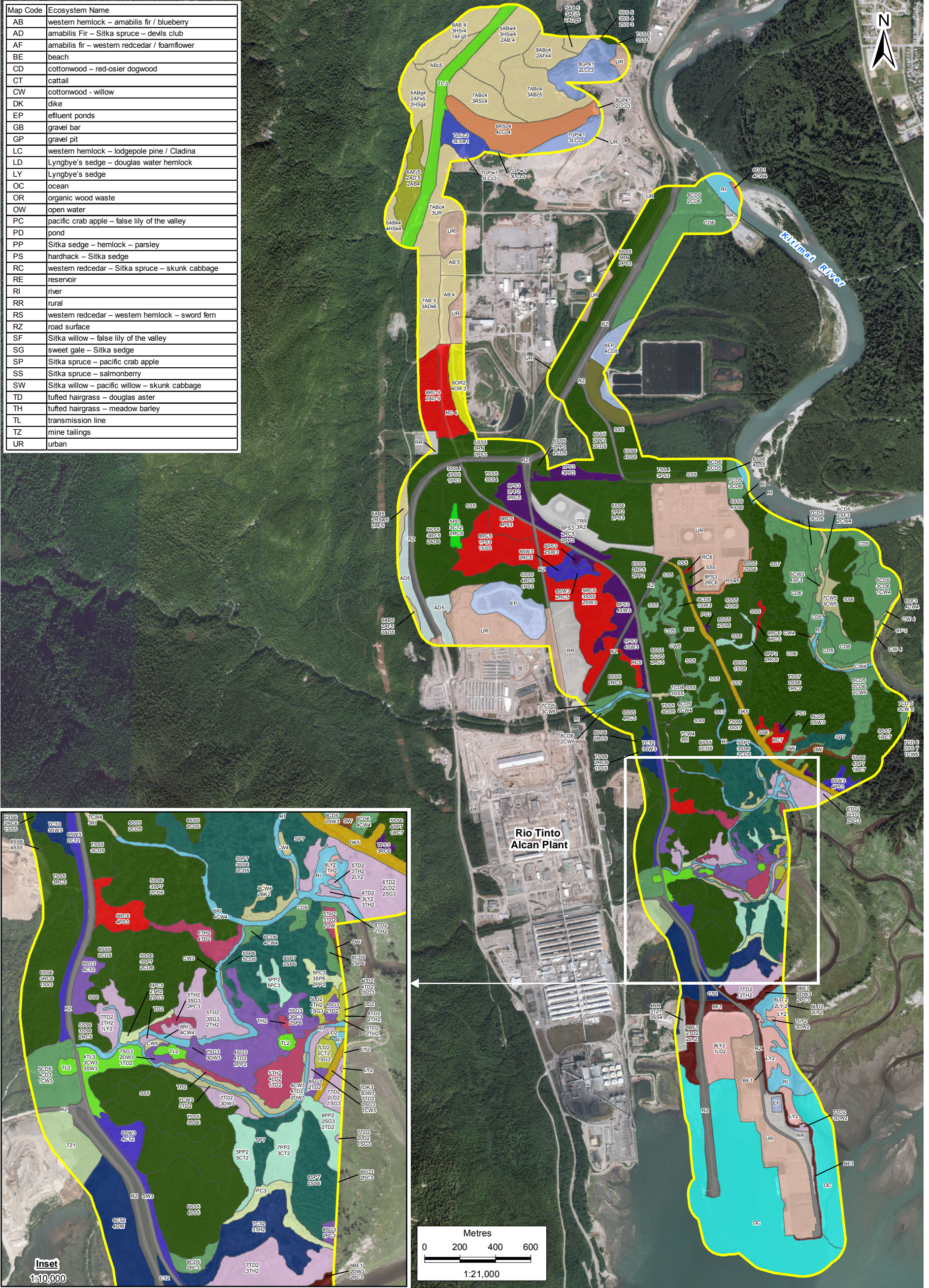
<sup>a</sup> Wetlands are included because these ecosystems could be swamps or bogs containing old forest; however, they are only classified as "wetland" within PEM

## 3.2 Local Study Area Vegetation Resources

Data from 105 field surveys were used to ground-truth the TEM for the Project. Within the vegetation LSA, 263 map polygons were delineated in the final TEM, 67 of which were sampled on the ground (25%). Approximately one-third of the polygons were delineated to contain only one ecosystem unit; the remainder of the polygons were complexes of two or more ecosystem units (see Figure 3.2-1 and Figure 3.2-2).

Twenty-five ecological communities (including open shallow water) and 17 anthropogenic and sparsely or non-vegetated map units were identified in the LSA through TEM (see Figure 3.2-1 and see Table 3.2-1). The LSA consists of 14% upland forest, 33% floodplain and 17% wetlands. The most common ecosystem in the LSA is the Sitka spruce - salmonberry high fluvial bench floodplain, which covers 179.8 ha (23% of LSA). Anthropogenic and sparsely or non-vegetated features comprised the remaining 36% of the LSA. See Figure 3.2-2 for dominant vegetation within the TEM extent.

Map Code	Ecosystem Name
AB	western hemlock – amabilis fir / blueberry
AD	amabilis Fir – Sitka spruce – devils club
AF	amabilis fir – western redcedar / foamflower
BE	beach
CD	cottonwood – red-osier dogwood
CT	cattail
CW	cottonwood – willow
DK	dike
EP	effluent ponds
GB	gravel bar
GP	gravel pit
LC	western hemlock – lodgepole pine / Cladina
LD	Lyngbye's sedge – douglas water hemlock
LY	Lyngbye's sedge
OC	ocean
OR	organic wood waste
OW	open water
PC	pacific crab apple – false lily of the valley
PD	pond
PP	Sitka sedge – hemlock – parsley
PS	hardhack – Sitka sedge
RC	western redcedar – Sitka spruce – skunk cabbage
RE	reservoir
RI	river
RR	rural
RS	western redcedar – western hemlock – sword fern
RZ	road surface
SF	Sitka willow – false lily of the valley
SG	sweet gale – Sitka sedge
SP	Sitka spruce – pacific crab apple
SS	Sitka spruce – salmonberry
SW	Sitka willow – pacific willow – skunk cabbage
TD	tufted hairgrass – douglas aster
TH	tufted hairgrass – meadow barley
TZ	mine tailings
UR	urban



Dominant Map Code	
AB	EP
AD	GB
AF	GP
BE	LC
CD	LD
CT	LY
CW	OC
DK	OR
OW	RR
PC	RS
PD	RZ
PP	SF
PS	SG
RC	SP
RE	SS
RI	SW
RR	TH
RS	TL
RZ	TZ
SF	UR
SG	
SP	
SS	
SW	

Vegetation Resources Local Study Area (Yellow outline)  
 Ecosystem Label e.g. 5SHx7  
 5 = decile  
 SH = map code  
 x = map code modifier  
 7 = structural stage

VEGETATION TECHNICAL DATA REPORT

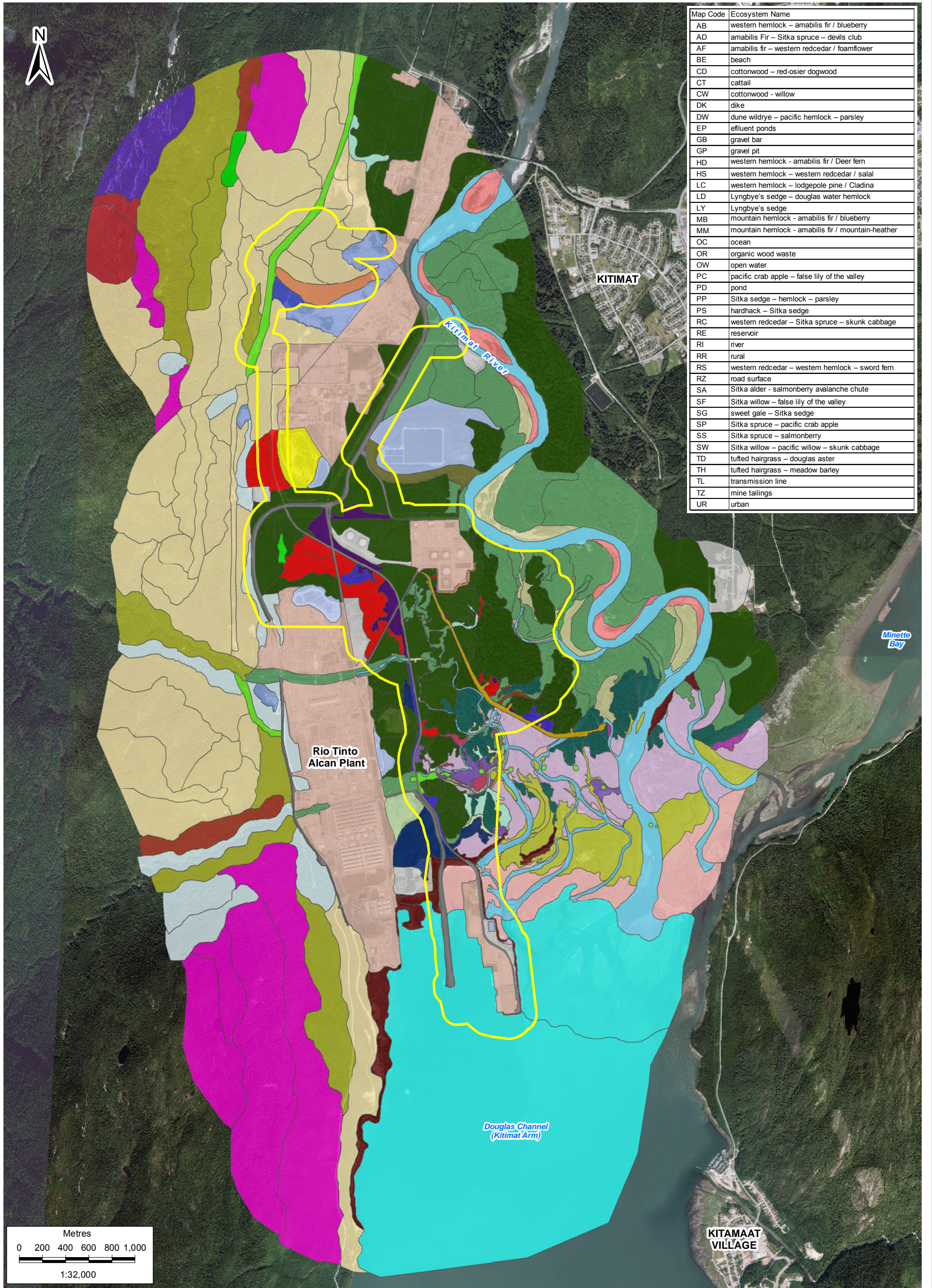
**VEGETATION TERRESTRIAL ECOSYSTEM MAPPING FOR THE LSA**

LNG CANADA EXPORT TERMINAL  
KITIMAT, BRITISH COLUMBIA

Sources:

Opportunity for British Columbia. Energy for the world

PROJECTION: UTM 9	DRAWN BY: SS
DATUM: NAD 83	CHECKED BY: SW
DATE: 20-MAY-14	FIGURE NO: 3.2-1



Map Code	Ecosystem Name
AB	western hemlock – amabilis fir / blueberry
AD	amabilis Fir – Sitka spruce – devils club
AF	amabilis fir – western redcedar / foamflower
BE	beach
CD	cottonwood – red-osier dogwood
CT	cattail
CW	cottonwood - willow
DK	dike
DW	dune wildrye – pacific hemlock – parsley
EP	effluent ponds
GB	gravel bar
GP	gravel pit
HD	western hemlock - amabilis fir / Deer fern
HS	western hemlock – western redcedar / salal
LC	western hemlock – lodgepole pine / Cladina
LD	Lyngbye's sedge – douglas water hemlock
LY	Lyngbye's sedge
MB	mountain hemlock - amabilis fir / blueberry
MM	mountain hemlock - amabilis fir / mountain-heather
OC	ocean
OR	organic wood waste
OW	open water
PC	pacific crab apple – false lily of the valley
PD	pond
PP	Sitka sedge – hemlock – parsley
PS	hardhack – Sitka sedge
RC	western redcedar – Sitka spruce – skunk cabbage
RE	reservoir
RI	river
RR	rural
RS	western redcedar – western hemlock – sword fern
RZ	road surface
SA	Sitka alder - salmonberry avalanche chute
SF	Sitka willow – false lily of the valley
SG	sweet gale – Sitka sedge
SP	Sitka spruce – pacific crab apple
SS	Sitka spruce – salmonberry
SW	Sitka willow – pacific willow – skunk cabbage
TD	tufted hairgrass – douglas aster
TH	tufted hairgrass – meadow barley
TL	transmission line
TZ	mine tailings
UR	urban

Dominant Map Code	
AB	EP
AD	GB
AF	GP
BE	HD
CD	HS
CT	LC
CW	LD
DK	LY
DW	MB
MM	MM
RE	RE
SS	SS
SW	SW
OR	OR
RR	RR
RS	RS
RZ	RZ
SA	SA
SF	SF
SG	SG
SP	SP
OC	OC
RI	RI
TD	TD
TH	TH
TL	TL
TZ	TZ
UR	UR

5 = decile  
 SH = map code  
 x = map code modifier  
 7 = structural stage

Vegetation Resources Local Study Area

VEGETATION TECHNICAL DATA REPORT

**DOMINANT VEGETATION WITHIN THE TERRESTRIAL ECOSYSTEM MAPPING EXTENT**

LNG CANADA EXPORT TERMINAL  
KITIMAT, BRITISH COLUMBIA

Sources:

Opportunity for British Columbia. Energy for the world

PROJECTION: UTM 9	DRAWN BY: SS
DATUM: NAD 83	CHECKED BY: SW
DATE: 20-MAY-14	FIGURE NO: 3.2-2

**Table 3.2-1: Mapped Ecosystems in the Vegetation LSA**

Site Series/Wetland Code	Map Code	Ecosystem Name	Area (ha)
			LSA
<b>Upland Forest Units</b>			
CWHvm1/01	AB	western hemlock – amabilis fir / blueberry	49.3
CWHvm1/02	LC	western hemlock – lodgepole pine / Cladina	6.7
CWHvm1/03	HS	western hemlock – western redcedar / salal	6.3
CWHvm1/04 <sup>a</sup>	RS	western redcedar – western hemlock / sword fern	9.6
CWHvm1/05	AF	amabilis fir – western redcedar / foamflower	6.3
CWHvm1/08 <sup>a</sup>	AD	amabilis fir – Sitka spruce / devils club	12.5
CWHvm1/19 <sup>a</sup>	SP	Sitka spruce / Pacific crab apple	20.2
<b>Upland Forest Total <sup>c</sup></b>			<b>110.9</b>
<b>Floodplain Associations</b>			
<b>High Fluvial Bench</b>			
CWHvm1/09 <sup>b</sup>	SS	Sitka spruce / salmonberry	179.8
<b>Mid Fluvial Bench</b>			
CWHvm1/Fm00	PC	Pacific crab apple / false lily of the valley	2.2
CWHvm1/10	CD	cottonwood / red-osier dogwood	67.3
<b>Low Fluvial Bench</b>			
CWHvm1/FI50	SF	Sitka willow / false lily of the valley	1.0
CWHvm1/11	CW	cottonwood / willow	10.3
<b>Floodplain Total <sup>c</sup></b>			<b>260.6</b>
<b>Wetland Associations</b>			
<b>Estuarine</b>			
CWHvm1/Em05 <sup>b</sup>	LY	Lyngbye's sedge estuarine marsh	13.1
CWHvm1/Em06 <sup>a</sup>	LD	Lyngbye's sedge-Douglas water hemlock estuarine marsh	2.8
CWHvm1/Ed01 <sup>b</sup>	TH	tufted hairgrass-meadow barley estuarine meadow	5.0
CWHvm1/Ed02 <sup>b</sup>	TD	tufted hairgrass-Douglas aster estuarine meadow	10.8
CWHvm1/Ed00	DW	dune wildrye-Pacific hemlock - parsley estuarine meadow	0.9
<b>Estuarine Total <sup>c</sup></b>			<b>32.5</b>
<b>Fen</b>			
CWHvm1/Wf01	BK	water sedge -beaked sedge fen	0.1
CWHvm1/Wf52 <sup>b</sup>	SG	sweet gale / Sitka sedge fen	4.7
<b>Fen Total <sup>c</sup></b>			<b>4.8</b>
<b>Marsh</b>			
CWHvm1/Wm05 <sup>a</sup>	CT	cattail marsh	6.8
CWHvm1/Wm50 <sup>a</sup>	PP	Sitka sedge - hemlock - parsley marsh	11.4
<b>Marsh Total <sup>c</sup></b>			<b>18.2</b>
<b>Swamp</b>			

Site Series/Wetland Code	Map Code	Ecosystem Name	Area (ha)
			LSA
CWHvm1/14	RC	western redcedar– Sitka spruce / skunk cabbage swamp	46.0
CWHvm1/Ws50	PS	hardhack / Sitka sedge swamp	20.0
CWHvm1/Ws51 <sup>b</sup>	SW	Sitka willow – Pacific willow / skunk cabbage swamp	12.5
<b>Swamp Total<sup>c</sup></b>			<b>78.5</b>
CWHvm1/00	OW	shallow open water	1.6
<b>Wetland Total<sup>c</sup></b>			<b>135.6</b>
<b>Anthropogenic and Sparsely or Non-vegetated</b>			
CWHvm1/00	BE	beach	4.3
CWHvm1/00	DK	dike	5.3
CWHvm1/00	EP	effluent ponds <sup>d</sup>	3.0
CWHvm1/00	ES	exposed soil	1.0
CWHvm1/00	GB	gravel bar	0.2
CWHvm1/00	GP	gravel pit	0.2
CWHvm1/00	OC	ocean	56.3
CWHvm1/00	OR	organic wood waste	1.0
CWHvm1/00	PD	pond	0.7
CWHvm1/00	RE	reservoir	3.7
CWHvm1/00	RI	river	14.1
CWHvm1/00	RN	railway	3.9
CWHvm1/00	RR	rural	0.7
CWHvm1/00	RZ	road surface	6.0
CWHvm1/00	TL	transmission line / shrub cutline <sup>d</sup>	19.0
CWHvm1/00	UR	urban	4.0
CWHvm1/00	BU	Industrial Build-up <sup>d</sup>	155.5
<b>Anthropogenic and Sparsely or Non-vegetated Total<sup>c</sup></b>			<b>278.9</b>
<b>Total<sup>c</sup></b>			<b>785.9</b>

**NOTE:**

<sup>a</sup> blue-listed ecological community

<sup>b</sup> red-listed ecological community

<sup>c</sup> totals may be slightly off due to rounding

<sup>d</sup> Disturbance layers developed from the combination of public sources and delineation from 2012 orthophoto imagery were 'stamped' into the TEM for disturbed land that were too small to delineate as pure polygons using the standard TEM methodology. These disturbance areas have been removed from the TEM summaries where these occurred and accounted for in the effluent pond, transmission line, and industrial build-up map codes.

### 3.2.1 Upland Forests

Upland forests occupy 110.9 ha (14%) of the LSA and include seven ecosystems.

#### 3.2.1.1 CWHvm1/01: western hemlock – amabilis fir / blueberry

The zonal western hemlock – amabilis fir / blueberry ecosystem is the dominant upland site series that occurs in the CWHvm1 subzone. Soil nutrients are poor to medium; moisture is sub-mesic to mesic. This ecosystem can occur in a variety of landscape positions, including slopes and level areas on top of colluvial, morainal, or fluvial blankets. The canopy is dominated by western hemlock and amabilis fir, with western redcedar being the tertiary canopy species. Blueberry species (*Vaccinium* sp.) dominate the shrub layer, along with thick conifer regeneration. Deer fern (*Blechnum spicant*), bunchberry (*Cornus canadensis*) and Queen's cup (*Clintonia uniflora*) form the majority of the herb layer. Other dominant species include spiny wood fern (*Dryopteris expansa*), five leaved bramble (*Rubus pedatus*), step moss (*Hylocomium splendens*), and lanky moss (*Rhytidiadelphus loreus*).

#### 3.2.1.2 CWHvm1/02: western hemlock – lodgepole pine / Cladina

This ecosystem is uncommon to rare, occurring on dry outcrops of bedrock with thin soils (Banner et al. 1993). This is the driest site series in the CWHvm1 subzone. Open forests consist of stunted western hemlock, western redcedar and lodgepole pine (*Pinus contorta*). The shrub layer consists primarily of salal (*Gaultheria shallon*), with some Alaskan blueberry (*Vaccinium alaskaense*). The herb layer is sparse with a well-developed moss layer, including rock mosses (*Racomitrium* spp.), reindeer lichens (*Cladina* spp.) and red-stemmed feathermoss (*Pleurozium schreberi*) commonly occurring.

#### 3.2.1.3 CWHvm1/03: western hemlock – western redcedar / salal

This ecosystem is found on bedrock with rapid drainage. The stunted trees are primarily western hemlock and western redcedar (Banner et al. 1993). The shrub layer has an abundance of salal, conifer regeneration and Alaska blueberry. Similar to the CWHvm1/02, this unit has a very sparse herb layer, consisting of deer fern and cordilleran bunchberry (*Cornus unalaschensis*). Species in the moss layer include step moss, lanky moss, Oregon beaked moss (*Kindbergia oregana*) and common green sphagnum (*Sphagnum girgensohnii*).

#### 3.2.1.4 CWHvm1/04: western redcedar – western hemlock / sword fern

This ecosystem occurs almost exclusively on steep slopes with basic soil parent material. The canopy is composed of Sitka spruce, western hemlock and western redcedar. The shrub layer is dominated by ferns, including spiny wood fern, oak fern (*Gymnocarpium dryopteris*) and sword fern (*Polystichum munitum*). Productivity is average, as this site is typically steep and dry. Other dominant species include Alaskan blueberry, deer fern, step moss, lanky moss, Oregon beaked moss, and leafy mosses (*Mnium* sp.).

### 3.2.1.5 CWHvm1/05: amabilis fir – western redcedar / foamflower

This productive ecosystem occurs on freely drained colluvium soil parent material on mid to lower slopes. The canopy is composed of western hemlock, Sitka spruce, western redcedar and amabilis fir. Ferns are abundant in the understorey, with a low cover of devil's club (*Oplopanax horridus*), abundant western hemlock regeneration and Alaskan blueberry. Other dominant species include salmonberry (*Rubus spectabilis*), deer fern, spiny wood fern, lady fern (*Athyrium filix-femina*), step moss, and lanky moss.

### 3.2.1.6 CWHvm1/08: amabilis fir – Sitka spruce / devil's club

This ecosystem occurs on colluvial seepage slopes. Large western hemlock, western redcedar, Sitka spruce and amabilis fir dominate this productive community. The understorey is dominated by devil's club, salmonberry, spiny wood fern, oak fern and lanky and leafy mosses. The high cover of devil's club distinguishes it from most other sites. Other dominant species include Alaskan blueberry, foamflowers (*Tiarella* ssp.), step moss, lanky moss, and leafy mosses.

### 3.2.1.7 CWHvm1/19: Sitka spruce / Pacific crab apple

This shoreline forest also occurs in estuaries, but is raised above the tideline. Rich soils support Sitka spruce, as well as an abundance of Pacific crab apple (*Malus fusca*). Dominant species of the understorey include salal, salmonberry, false lily-of-the-valley (*Maianthemum dilatatum*), deer fern, slough sedge (*Carex obnupta*) and skunk cabbage (*Lysichiton americanus*). The moss layer includes Oregon beaked moss, lanky moss, step moss, and leafy mosses.

## 3.2.2 Floodplain Associations

Floodplain forests occupy 260.6 ha (33%) of the LSA and include five ecosystems. Soils are generally poorly developed Brunisols or Regisols. See Figure 3.2-3 for floodplain communities in the LSA.

### 3.2.2.1 High Fluvial Bench

#### 3.2.2.1.1 CWHvm1/09: Sitka spruce / salmonberry

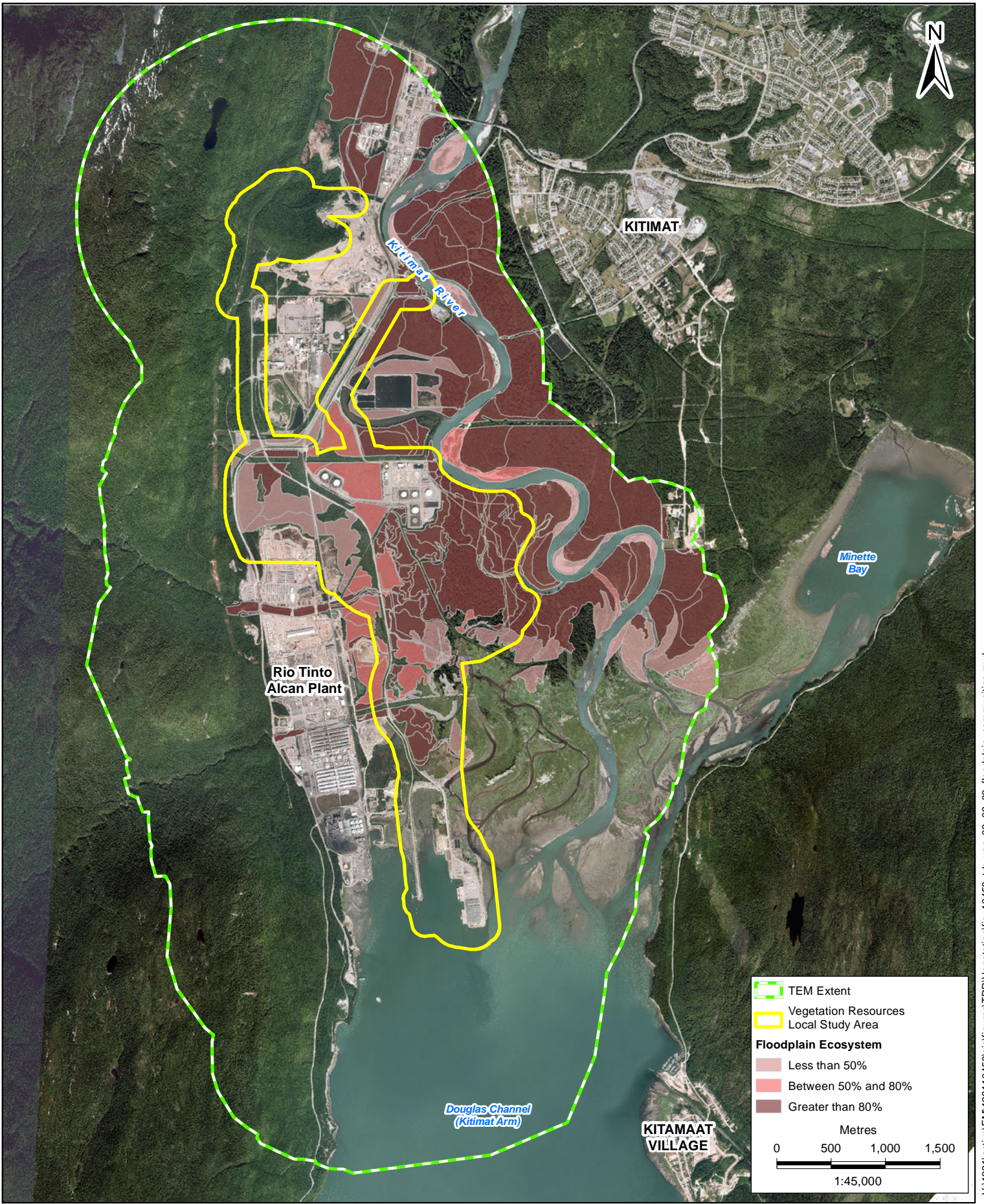
Seasonal water table fluctuations, rather than annual flooding, characterize the hydrology of this high-bench floodplain ecosystem. Sitka spruce and western hemlock dominate this highly productive site. Salmonberry and devil's club are common in the understorey, with ferns and leafy mosses populating the moderately well-developed herb layer. The dominance of conifers distinguishes this floodplain ecosystem from others. Other dominant species include western redcedar, amabilis fir, red alder, red-osier dogwood (*Cornus stolonifera*), stink currant (*Ribes bracteosum*), sword fern, foamflowers, and lanky moss.

### 3.2.2.2 Mid Fluvial Bench

#### 3.2.2.2.1 CWHvm1/Fm00: Pacific crab apple / false lily of the valley

This ecosystem occurs on the outer coast at the upper limits of tidal influence and is thus transitional between estuarine and upland ecosystems. Pacific crab apple dominates the canopy; however, Sitka spruce can persist on raised microsites and the whole ecosystem can eventually convert to a Sitka

spruce forest if enough sediment is deposited. A sparse to well-developed forb dominated understorey is common. Dominant species include false lily-of-the-valley, sweet-scented bedstraw (*Galium triflorum*), skunk cabbage, and leafy mosses.



  TEM Extent  
  Vegetation Resources  
  Local Study Area  
**Floodplain Ecosystem**  
 Less than 50%  
 Between 50% and 80%  
 Greater than 80%

Metres

0      500      1,000      1,500  
  
 1:45,000

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VEGETATION TECHNICAL DATA REPORT

**FLOODPLAIN COMMUNITIES**

LNG CANADA EXPORT TERMINAL  
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	20-MAY-14	FIGURE NO.	<b>3.2-3</b>

5/20/2014 - 2:13:19 PM

#### **3.2.2.2 CWHvm1/10: cottonwood - red-osier dogwood**

This mid-bench floodplain experiences annual inundation, which inhibits conifer development. Black cottonwood and red alder dominate the forest canopy, distinguishing this ecosystem from the CWHvm1/09. Salmonberry, red-osier dogwood and stink currant dominate the understorey, with a lack of herb and moss layers. This ecosystem is slightly higher and has a lack of willow (*Salix* sp.) compared to the CWHvm1/11 ecosystem. Other dominant species include Sitka spruce, devil's club, sword fern, deer, oak fern, lady fern, and foamflowers.

#### **3.2.2.3 Low Fluvial Bench**

##### **3.2.2.3.1 CWHvm1/FI50: Sitka willow / false lily of the valley**

This ecosystem is at the uppermost influence of brackish influence in estuaries, transitioning to freshwater conditions of fluvial systems. This ecosystem is elevated above mid-season flooding, but can be inundated during the freshet. The shrub layer is dominated by Sitka willow (*Salix sitchensis*), with a moderately well-developed population of graminoids and forbs. Often the moss layer is not well-developed. Soils are typically sandy-textured Gleysols or Regisols. Other dominant species include salmonberry, blue wildrye (*Elymus glaucus*), cow-parsonip (*Heracleum maximum*), and false lily of the valley.

##### **3.2.2.3.2 CWHvm1/11: cottonwood / willow**

This ecosystem sits directly adjacent to rivers with prolonged annual flooding. Sediment erosion and deposition drives soil properties, promoting the growth of black cottonwood, red alder and Sitka and Pacific (*Salix lucida*) willows. The prolonged flooding excludes conifer establishment and scours vegetation that is not firmly rooted. Herb and moss layers are not well developed. Other dominant species include salmonberry, red-osier dogwood, and rock mosses (sparse).

### **3.2.3 Wetlands**

Wetlands occupy approximately 17% (135.6 ha) of the LSA and include 13 wetland site associations. See Figure 3.2-4 for wetland site associations in the LSA, and Figure 3.2-5 for wetlands in the TEM extent.

#### **3.2.3.1 Estuarine Marshes**

##### **3.2.3.1.1 CWHvm1/Em05: Lyngbye's sedge**

This plant community occurs in locations such as tidal flats and channel margins, where there are strong fluctuations of brackish water, active sedimentation and diurnal flooding and exposure. Species diversity is generally low. Lyngbye's sedge (*Carex lyngbyei*) often occurs in dense, pure communities. When other species are present, they may include coast silverweed (*Potentilla egedii*), tufted hairgrass (*Deschampsia cespitosa*), sea milkwort (*Glaux maritima*), and seaside arrow-grass (*Triglochin maritima*). Soils are generally composed of silty, or fine-sandy, Gleysols or Humic Gleysols. Soil profiles frequently exhibit layered mineral deposits with embedded sedge roots and shoots.

### **3.2.3.1.2 CWHvm1/Em06: Lyngbye's sedge / Douglas water hemlock**

This plant community thrives in estuarine regions of low-salinity and commonly occurs in fjord-type estuaries of large rivers where there are strong fluctuations of weakly brackish water, active sedimentation and diurnal flooding and exposure. Species diversity is generally high. Lyngbye's sedge is typically dominant. Species which are intolerant of high salinity are generally prominent in these communities, including members of the carrot family (Apiaceae). Soils are composed of silty, or fine-sandy Gleysols or Humic Gleysols that experience constant erosion and deposition.

### **3.2.3.2 Estuarine Meadows**

#### **3.2.3.2.1 CWHvm1/Ed01: tufted hairgrass / meadow barley**

This plant community occurs in areas experiencing daily but generally brief flooding by brackish water such as on fan estuaries, on creekside areas within moderate-sized estuaries, and as narrow fringes on steep coastal shores with abundant groundwater seepage. Species diversity is generally low and grasses such as tufted hairgrass are dominant. The soils generally consist of sandy or loamy-textured Gleysols and Regosols with little or no humus form development.

#### **3.2.3.2.2 CWHvm1/Ed02: tufted hairgrass / Douglas' aster**

This plant community exists in medium to large estuaries in the north and central coast of BC. It is most often found in broad and extensive flats in the high marsh zone between the backshore shrub communities and the low marsh. In these areas, weakly brackish conditions are common and flooding is irregular. Many species exist in these communities; however, tufted hairgrass and Douglas' aster (*Symphyotrichum subspicatum*) are the dominant species. Soils consist of mostly Humic Gleysols with silty and sandy textures.

#### **3.2.3.2.3 CWHvm1/FI00: dune wildrye / Pacific hemlock-parsley**

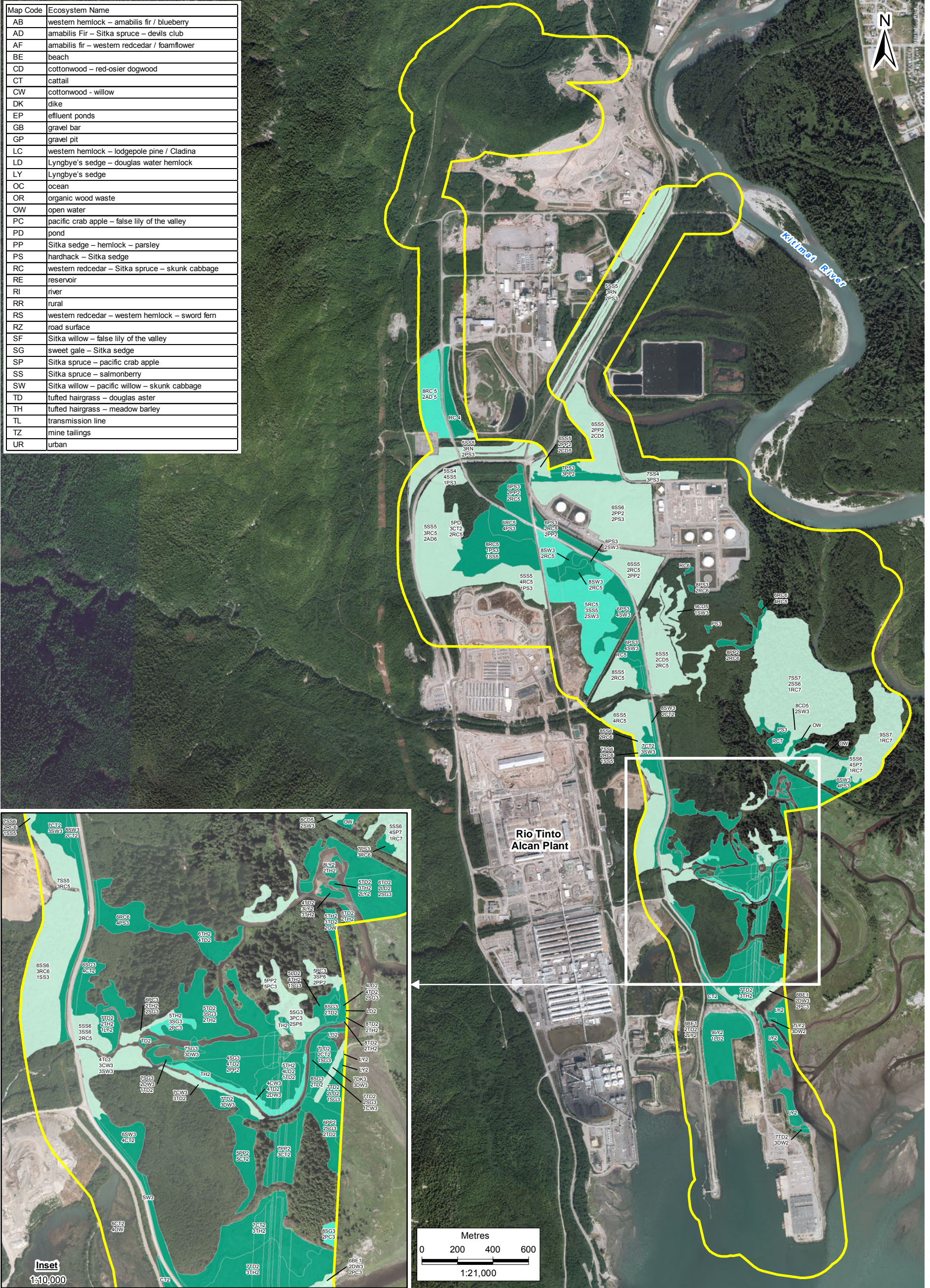
This ecosystem occurs on raised beaches or berms where soil coarse fragments have been deposited. Little or no flooding occurs on these sites, although salt spray and inundation during storm events is common. Cow-parsnip, yarrow (*Achillea millefolium*), dune wildrye (*Leymus mollis*), and Pacific hemlock-parsley (*Conioselinum gmelinii*) are some of the plants that may be scattered throughout. Tree, shrub, and bryophyte layers are typically absent from this site.

### **3.2.3.3 Fens**

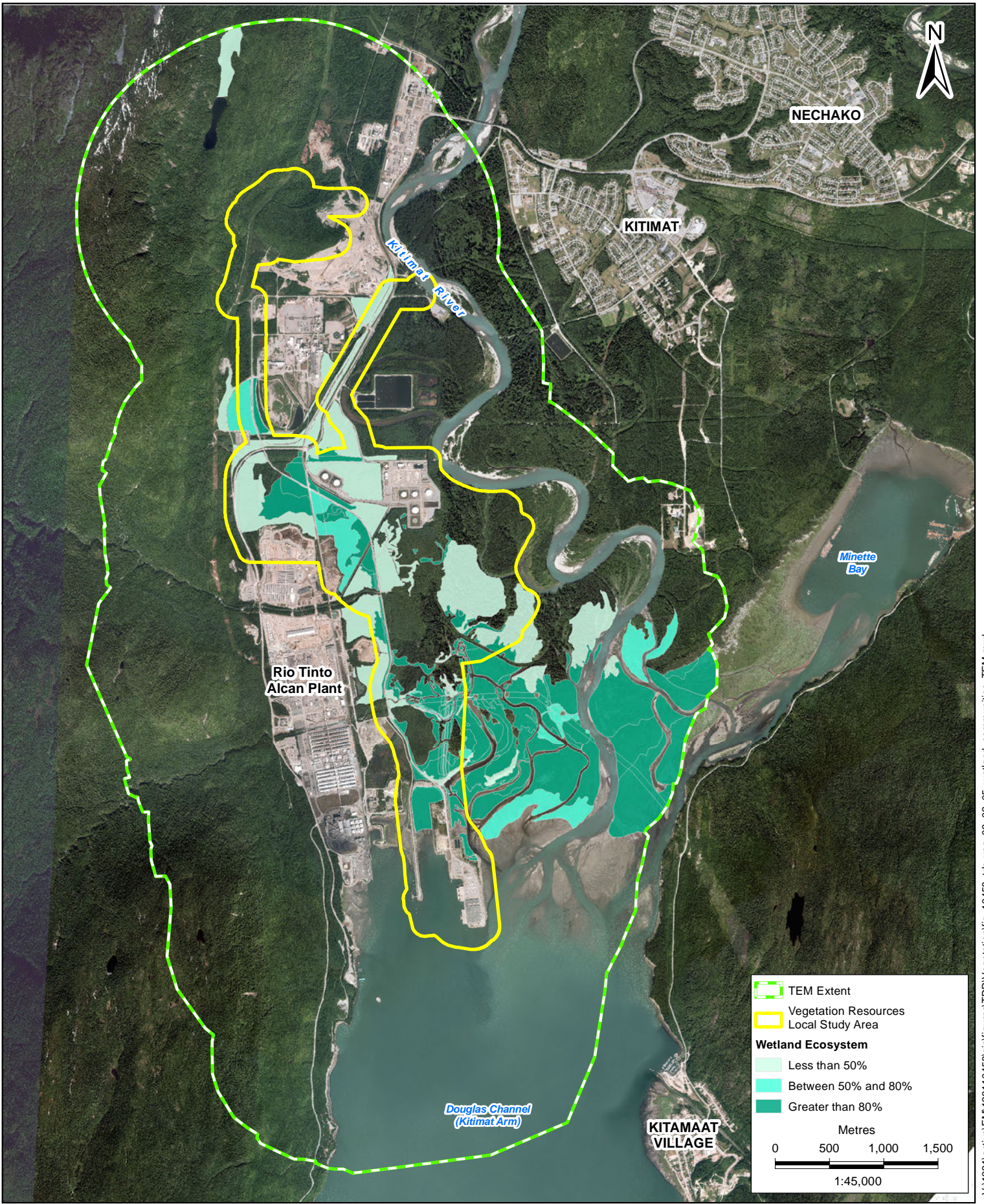
#### **3.2.3.3.1 CWHvm1/Wf01: water sedge / beaked sedge**

This wetland occurs in areas inundated by shallow low-energy flood waters. They are most commonly found in palustrine basins and occupy wetter zones in large peatland complexes. Species diversity is low; however, in sites that dry out at the surface, the species diversity increases and sites develop characteristics of meadows. Peat accumulations can range from 30 cm to 300 cm; common soil types include terric Fibrisols and Mesisols.

Map Code	Ecosystem Name
AB	western hemlock – amabilis fir / blueberry
AD	amabilis Fir – Sitka spruce – devils club
AF	amabilis fir – western redcedar / foamflower
BE	beach
CD	cottonwood – red-osier dogwood
CT	cattail
CW	cottonwood – willow
DK	dike
EP	effluent ponds
GB	gravel bar
GP	gravel pit
LC	western hemlock – lodgepole pine / Cladina
LD	Lyngbye's sedge – douglas water hemlock
LY	Lyngbye's sedge
OC	ocean
OR	organic wood waste
OW	open water
PC	pacific crab apple – false lily of the valley
PD	pond
PP	Sitka sedge – hemlock – parsley
PS	hardhack – Sitka sedge
RC	western redcedar – Sitka spruce – skunk cabbage
RE	reservoir
RI	river
RR	rural
RS	western redcedar – western hemlock – sword fern
RZ	road surface
SF	Sitka willow – false lily of the valley
SG	sweet gale – Sitka sedge
SP	Sitka spruce – pacific crab apple
SS	Sitka spruce – salmonberry
SW	Sitka willow – pacific willow – skunk cabbage
TD	tufted hairgrass – douglas aster
TH	tufted hairgrass – meadow barley
TL	transmission line
TZ	mine tailings
UR	urban



<p><b>Vegetation Resources</b></p> <p>Local Study Area</p> <p><b>Wetland Ecosystem</b></p> <p>Less than 50%</p> <p>Between 50% and 80%</p> <p>Greater than 80%</p>	<p><b>Ecosystem Label</b></p> <p>e.g. 5SHx7</p> <p>5 = decile</p> <p>SH = map code</p> <p>x = map code modifier</p> <p>7 = structural stage</p>	<p>VEGETATION TECHNICAL DATA REPORT</p> <p><b>WETLAND COMMUNITIES</b></p> <p>LNG CANADA EXPORT TERMINAL KITIMAT, BRITISH COLUMBIA</p>		
		<p>Sources:</p>		<p>Opportunity for British Columbia. Energy for the world</p>
		<p>PROJECTION: UTM 9</p> <p>DATUM: NAD 83</p> <p>DATE: 20-MAY-14</p>	<p>DRAWN BY: SS</p> <p>CHECKED BY: SW</p> <p>FIGURE NO: 3.2-4</p>	



	TEM Extent
	Vegetation Resources Local Study Area
<b>Wetland Ecosystem</b>	
	Less than 50%
	Between 50% and 80%
	Greater than 80%
Metres	
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VEGETATION TECHNICAL DATA REPORT

**WETLANDS WITHIN THE  
TERRESTRIAL ECOSYSTEM MAPPING EXTENT**

LNG CANADA EXPORT TERMINAL  
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	20-MAY-14	FIGURE NO.	<b>3.2-5</b>

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### **3.2.3.3.2 CWHvm1/Wf52: sweet gale / Sitka sedge**

Sites generally experience shallow flooding in the early season; but, water levels usually remain subsurface for the majority of the growing season. No trees are present, but a shrub layer of sweet gale (*Myrica gale*) and hardhack (*Spiraea douglasii*) can form a dense thicket generally less than 1.5 m in height. The bryophyte layer is generally sparse due to the duration of flooding; but, on some sites the cover of moss species such as sphagnum mosses (*Sphagnum* sp.) may be relatively high. Terric Humisols and Mesisols are typical soil types.

### **3.2.3.4 Marshes**

#### **3.2.3.4.1 CWHvm1/Wm05 : cattail marsh**

This plant community occurs in highly saturated low-elevation zones with warm summers. Water depths may be up to 1 m in the spring, but recede in late summer. No trees or shrubs are present; the herb layer is dominated by cattail (*Typha latifolia*), often with a few other rooted plants present. Other potential species include beaked sedge (*Carex utriculata*), hard-stemmed bullrush (*Schoenoplectus acutus*) or duckweed (*Lemna* sp.). The substrate often includes well-decomposed organic layers.

#### **3.2.3.4.2 CWHvm1/Wm50: Sitka sedge / hemlock - parsley**

This plant community tolerates variable hydrology and disturbance and occurs on mineral soil substrates or shallow peat veneers. Within the herb layer, Sitka sedge is often the only species present; however, other species are occasionally prominent. At sites with flowing headwaters, Pacific water-parsley (*Oenanthe sarmentosa*) or tall mannagrass (*Glyceria elata*) often exist; at drier sites, a mix of forbs such as marsh speedwell (*Veronica scutellata*), St. John's-wort (*Hypericum anagalloides*), and small bedstraw (*Galium trifidum*) may exist.

### **3.2.3.5 Swamps**

#### **3.2.3.5.1 CWHvm1/14: western redcedar - Sitka spruce / skunk cabbage**

This ecosystem is considered rich, but too wet to be a productive stand. Western redcedar, western hemlock, Sitka spruce and red alder establish on elevated mounds and form a canopy. Skunk cabbage has a high cover on these sites, which distinguishes it from other ecosystems. This unit is also referred to as 'western redcedar – western hemlock – skunk cabbage (Ws54) in MacKenzie and Moran (2004). Organic veneers of woody humic or mesic peat over fine textured lacustrine soil parent material are most common.

#### **3.2.3.5.2 CWHvm1/Ws50: hardhack / Sitka sedge**

Hardhack (syn. pink spirea) - Sitka sedge swamps are most common at low elevations in basins, gullies and margins of water bodies and peatlands. Species diversity is low, and hardhack dominates these sites. The only other species common in these sites is Sitka sedge. Bryophytes are rarely present; however, occasionally glow moss (*Aulacomnium palustre*) or sphagnum mosses occur. The most common soil types include Humisols and Gleysols.

### **3.2.3.5.3 CWHvm1/Ws51: Sitka willow / skunk cabbage**

Sitka willow - skunk cabbage swamps occur sporadically at low elevation points and in coastal transition areas such as floodplain depressions. This plant community commonly includes a closed canopy of tall shrubs and low trees, including predominantly Sitka and Pacific willows. The moss layer is typically sparse; however, the community typically has a lush understorey dominated by skunk cabbage and lady fern. Soils are typically Gleysols with peat veneers.

### **3.2.3.6 Shallow Open Water**

#### **3.2.3.6.1 CWHvm1/00: Shallow open water**

Shallow open water wetlands are characterized by permanent open water that is typically less than 2 m deep in mid-summer. They often support either floating- or rooted-aquatic plant species. Deeper waterbodies are classified as ponds or lakes. Shallower waterbodies often support emergent vegetation and belong to one of the other wetland classes.

### **3.2.3.7 Wetland Function**

Wetlands are classified into three broad types, described in the following subsections.

#### **3.2.3.7.1 Hydrological Function**

Hydrological function is the capacity of a wetland to store, moderate, and release water in a watershed (i.e., providing groundwater recharge, flood flow alteration or base flow augmentation). This function maintains human and ecological life support systems, protects infrastructure, and enhances social values. This function of a wetland is driven by its hydrogeomorphic setting, basin form, water balance, water quantity and water velocity moving through the system (Hanson et al. 2008; Hruby et al. 1999).

The wetlands and floodplains in the LSA have the potential to absorb the energy (velocity) and volume of major flooding events from the Kitimat River by allowing the flood flows to spread out across the relatively flat terrain and encounter the roughness provided by woody vegetation structure. Fens and marshes (both freshwater and estuarine) also have the potential to attenuate peak flows of storm events prior to discharging into receiving water bodies; however, in this instance, the actual opportunity to provide this function is limited since the receiving water body immediately downstream is the ocean. During the summer months, the wetlands (all classes) in the LSA have the potential to augment baseflows in smaller watercourses. Wetlands in the LSA are not likely to contribute to groundwater recharge considering their position in the watershed and proximity to the marine environment in Kitimat Arm.

#### **3.2.3.7.2 Biogeochemical Function**

Biogeochemical function of wetlands refers to the capacity of the wetland to improve water quality or store carbon. The wetlands and floodplains in the LSA have the potential to improve water quality by retaining suspended sediments and absorbing excess nutrients (e.g., phosphorus or nitrogen). The wetlands and floodplains also have the potential to store carbon in soils and biomass. The ability of the wetland

complex to sequester and store carbon contributes to maintenance of the global carbon cycle and its role in global climate regulation.

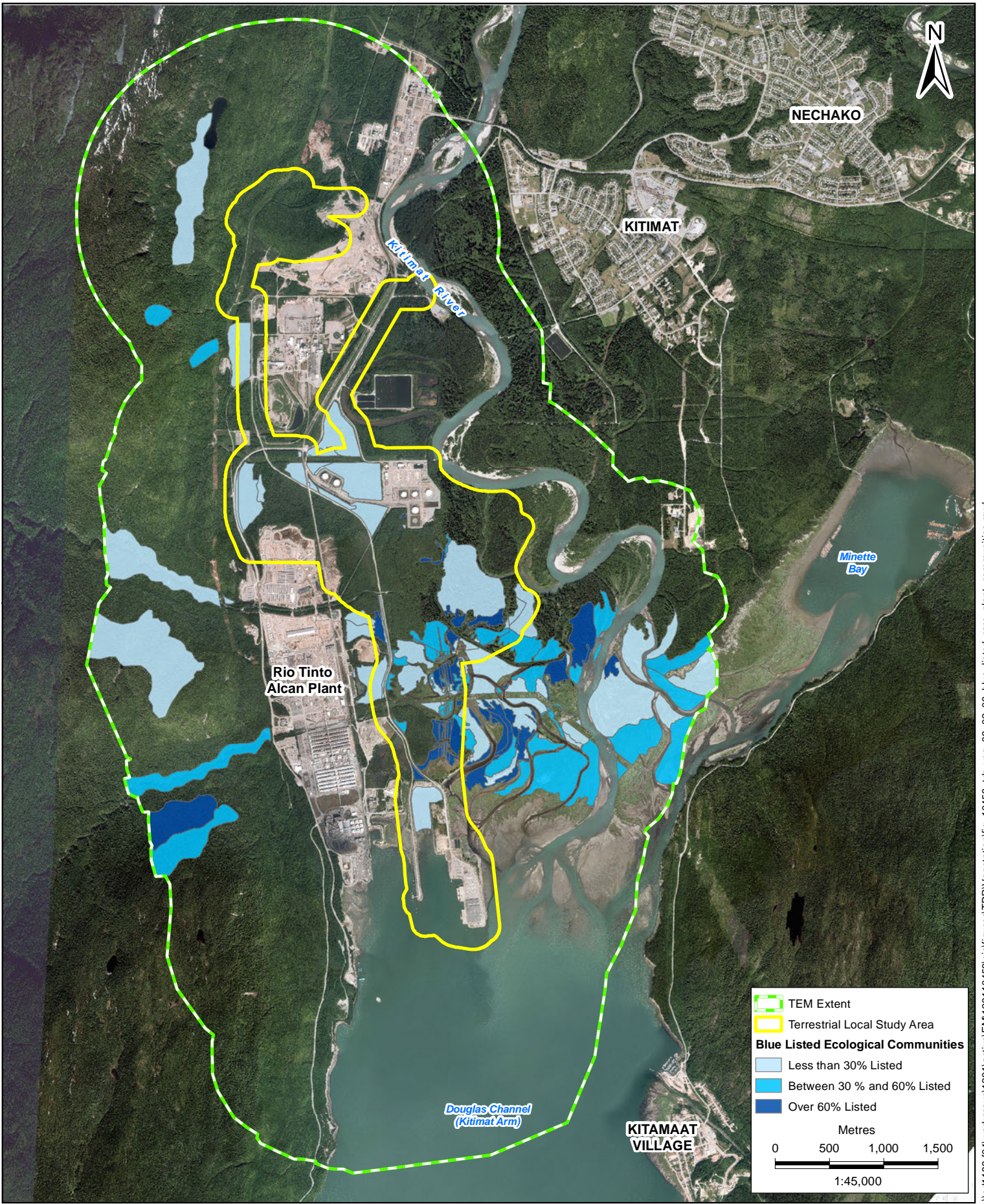
### 3.2.3.7.3 Habitat Function

Habitat function refers to the manner in which a wetland contributes to biological productivity and diversity. Habitat functions provided by wetlands include the following:

- foraging, nesting and stopover habitat for migratory birds, including songbirds and shorebirds, which totaled 58 species (Stantec 2014)
- providing breeding and dispersal habitat for amphibians such as the western toad (*Anaxyrus boreas*), Columbia spotted frog (*Rana luteiventris*), northwestern salamander (*Ambystoma gracile*), and wood frog (*Rana sylvatica*), which were all found during the field studies (Stantec 2014)
- contributing to habitat diversity, as indicated by supporting five red-listed and four blue-listed wetland communities
- potentially supporting federally and provincially listed wildlife species identified in the wildlife technical data report, such as western toad (*Anaxyrus boreas*), great blue heron (*Ardea herodias* ssp. *fannini*), coastal tailed frog (*Ascaphus truei*), California gull (*Larus californicus*), peregrine falcon (*Falco peregrinus*), barn swallow (*Hirundo rustica*), and grizzly bear (*Ursus arctos*) (Stantec 2014)

### 3.2.4 Ecological Communities at Risk

Six blue-listed and six red-listed ecological communities comprise 7% and 17% of the LSA, respectively (see Table 3.2-2, Figure 3.2-6, and Figure 3.2-7). The dominant at-risk ecological communities include the Sitka spruce / salmonberry forest (red-listed) covering 84.3 ha (11%), the Sitka spruce / Pacific crab apple forest (blue-listed) covering 20.2 ha (3%), and Lyngbye's sedge estuary (red-listed), covering 13.1 ha (2%) of the LSA.



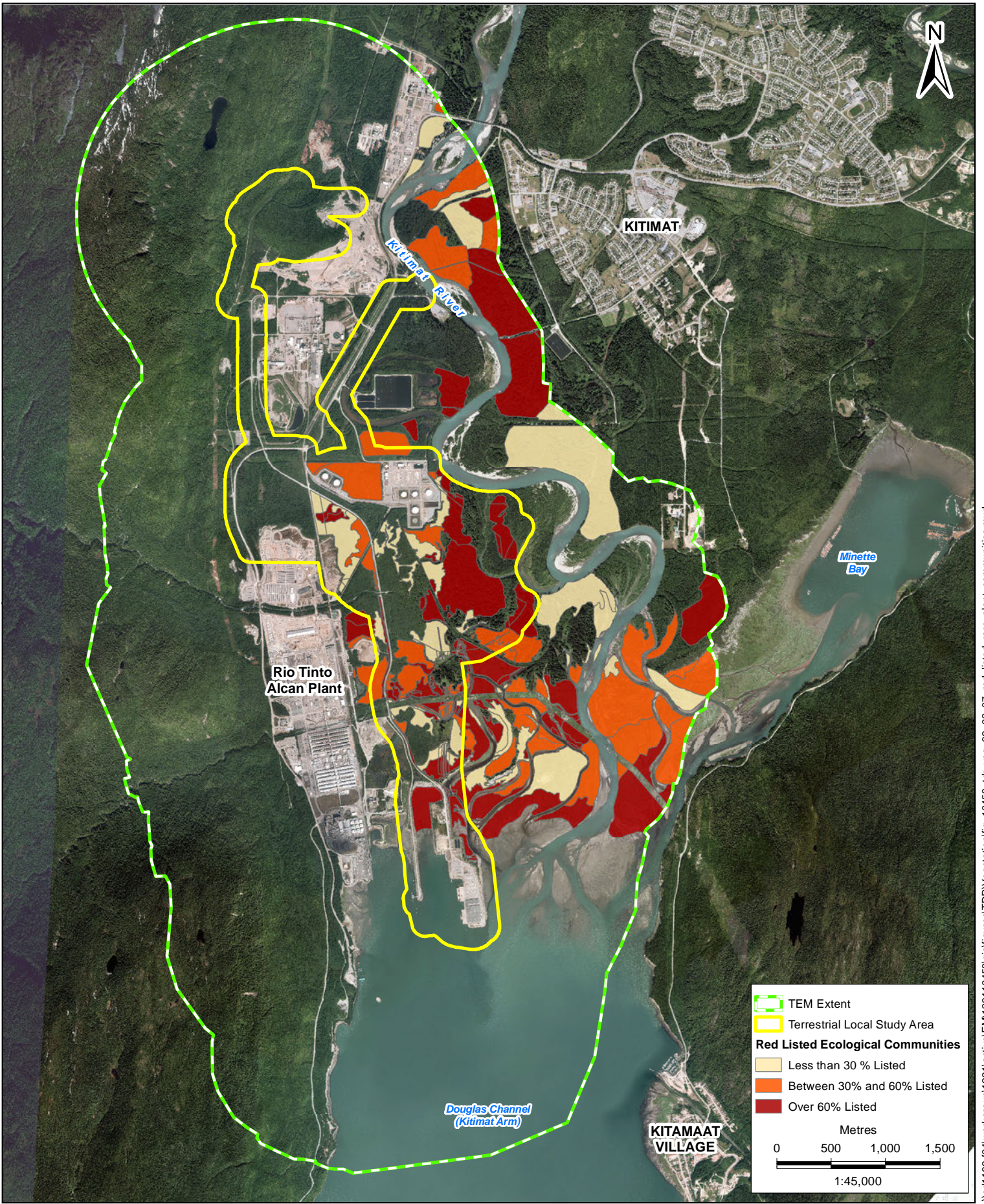
  TEM Extent  
  Terrestrial Local Study Area  
**Blue Listed Ecological Communities**  
 Less than 30% Listed  
 Between 30 % and 60% Listed  
 Over 60% Listed

Metres

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	 <small>Opportunity for British Columbia. Energy for the world</small>	VEGETATION TECHNICAL DATA REPORT	
		<b>BLUE LISTED ECOLOGICAL COMMUNITIES</b>	
		LNG CANADA EXPORT TERMINAL KITIMAT, BRITISH COLUMBIA	
		PROJECTION UTM9	DRAWN BY SS
DATUM NAD 83	CHECKED BY SW		
DATE 08-JUL-14	FIGURE NO. <b>3.2-6</b>		



  TEM Extent  
  Terrestrial Local Study Area  
**Red Listed Ecological Communities**  
 Less than 30 % Listed  
 Between 30% and 60% Listed  
 Over 60% Listed

Metres

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1:45,000



VEGETATION TECHNICAL DATA REPORT  
**RED LISTED  
 ECOLOGICAL COMMUNITIES**  
 LNG CANADA EXPORT TERMINAL  
 KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	08-JUL-14	FIGURE NO.	<b>3.2-7</b>

**Table 3.2-2: Ecological Communities at Risk in the Vegetation LSA**

Site Series/Wetland Code	Map Code	Ecosystem Name	Area (ha)	Proportion (%) of LSA
<b>Blue Listed</b>				
CWHvm1/08 <sup>a</sup>	AD	amabilis fir – Sitka spruce / devils club	4.1	<1
CWHvm1/14 <sup>a</sup>	RC	western redcedar - Sitka spruce / skunk cabbage	8.3	1
CWHvm1/19 <sup>a</sup>	SP	Sitka spruce / Pacific crab apple	20.2	3
CWHvm1/Em06	LD	Lyngbye’s sedge / Douglas water hemlock estuary	2.8	<1
CWHvm1/Wm05	CT	cattail marsh	6.8	1
CWHvm1/Wm50	PP	Sitka sedge / hemlock / parsley marsh	11.4	1
<b>Subtotal –blue listed</b>			<b>53.6</b>	<b>7</b>
<b>Red Listed</b>				
CWHvm1/09 <sup>a</sup>	SS	Sitka spruce / salmonberry	84.3	11
CWHvm1/Ed01	TH	tufted hairgrass / meadow barley estuary	5.0	<1
CWHvm1/Ed02	TD	tufted hairgrass / Douglas aster estuary	10.8	1
CWHvm1/Em05	LY	Lyngbye’s sedge estuary	13.1	2
CWHvm1/Wf52	SG	sweet gale / Sitka sedge fen	4.7	<1
CWHvm1/Ws51	SW	Sitka willow / Pacific willow / skunk cabbage swamp	12.1	2
<b>Subtotal – red listed</b>			<b>130.4</b>	<b>17</b>
<b>Total</b>			<b>184.0</b>	<b>23</b>

**NOTE:**

<sup>a</sup> Indicates plant community with a structural stage greater than or equal to six (mature forest >80 years old).

**3.2.4.1 Blue-Listed Ecological Communities**

**3.2.4.1.1 Upland Units**

CWHvm1/04, CWHvm2/04: western redcedar – western hemlock / sword fern

CWHvm1/08, CWHvm2/08: amabilis fir – Sitka spruce / devil’s club

BC contains 10% to 50% of the range of mature to climax vegetation from the CWHvm2/04 and CWHvm1/04 ecological communities (BCCDC 2013c). BC also contains 10% to 50% of the range of mature to climax vegetation from the CWHvm1/08 and CWHvm2/08 ecological communities (BC Conservation Framework 2013a). These communities are productive ecosystems that have historically been targeted for harvesting for their timber.

#### **3.2.4.1.2 Estuarine and Transitional Units**

CWHvm1/19: Sitka spruce / Pacific crab apple

CWHvm1/Em06: Lyngbye's sedge / Douglas water hemlock estuary

The CWHvm1/19 and CWHvh2/19 ecological communities occur only at the intersection between upland forests and estuaries, at the upper margin of tidal influence, and in coastal areas in small patches. BC contains 10% to 50% of the range of these communities (BC Conservation Framework 2013b). Estuaries are not naturally abundant, comprising a small percentage of the BC coastline. In many parts of BC, estuaries have already been diked and drained. The Dala-Kildala Rivers Estuaries Provincial Park was created to protect estuaries and is located near Kitimat (BCMOE 2006).

#### **3.2.4.1.3 Wetland Units**

CWHvm1/Wm05: cattail marsh

CWHvm1/Wm50: Sitka sedge / hemlock-parsley marsh

Although referred to as the "common" cattail marsh (CWHvm1/Wm05), this ecological community is restricted in its natural setting. BC contains less than 10% of the range of this community (BC Conservation Framework 2013c). Despite tolerating variable hydrology and disturbance (MacKenzie and Moran 2004), the CWHvm1/Wm50 site series is also considered at risk in the study area.

CWHvm1/14: western redcedar – Sitka spruce / skunk cabbage

This swamp forest is nutrient-rich, but does not support productive forests because it is too wet. Elevated mounds may occur, which support western hemlock, Sitka spruce, red alder, and western redcedar. These wetter transitional sites dominate the CWHvm1 (Banner et al. 1993). These sites have been targeted for timber harvesting and are sensitive to soil disturbance during harvest due to saturated conditions.

#### **3.2.4.2 Red-Listed Ecological Communities**

##### **3.2.4.2.1 Upland Units**

CWHvm1/09: Sitka spruce / salmonberry

This community has experienced significant harvesting pressure historically due to its large diameter, Sitka spruce component. Its current range is restricted and occurs on narrow bands around rivers. It is also subject to wind-throw due to adjacent harvesting. It has a high value for grizzly bear. Short- and long-term trends indicate a rapid and substantial decline in this community (BCCDC 2013c).

##### **3.2.4.2.2 Estuarine Units**

CWHvm1/Ed01: tufted hairgrass / meadow barley estuary

CWHvm1/Ed02: tufted hairgrass / Douglas aster estuary

CWHvm1/Em05: Lyngbye's sedge estuary

Estuaries are not naturally abundant, comprising a small percentage of the BC coastline. These ecological communities require specific site conditions associated with estuarine systems and in many

parts of BC, estuaries have already been diked and drained and threats to the integrity of the system are ongoing (BC Conservation Framework 2013b).

**3.2.4.2.3 Wetland Units**

CWHvm1/Wf52: sweet gale / Sitka sedge fen

CWHvm1/Ws51: Sitka willow / Pacific willow / skunk cabbage swamp

The Wf52 site series typically persists in small patches. BC contains 10% to 50% of the range of this community (BCCDC 2013d). The CWHvm1/Ws51 site series persists only in linear, small patches (BC Conservation Framework 2013d).

**3.2.5 Old Forest**

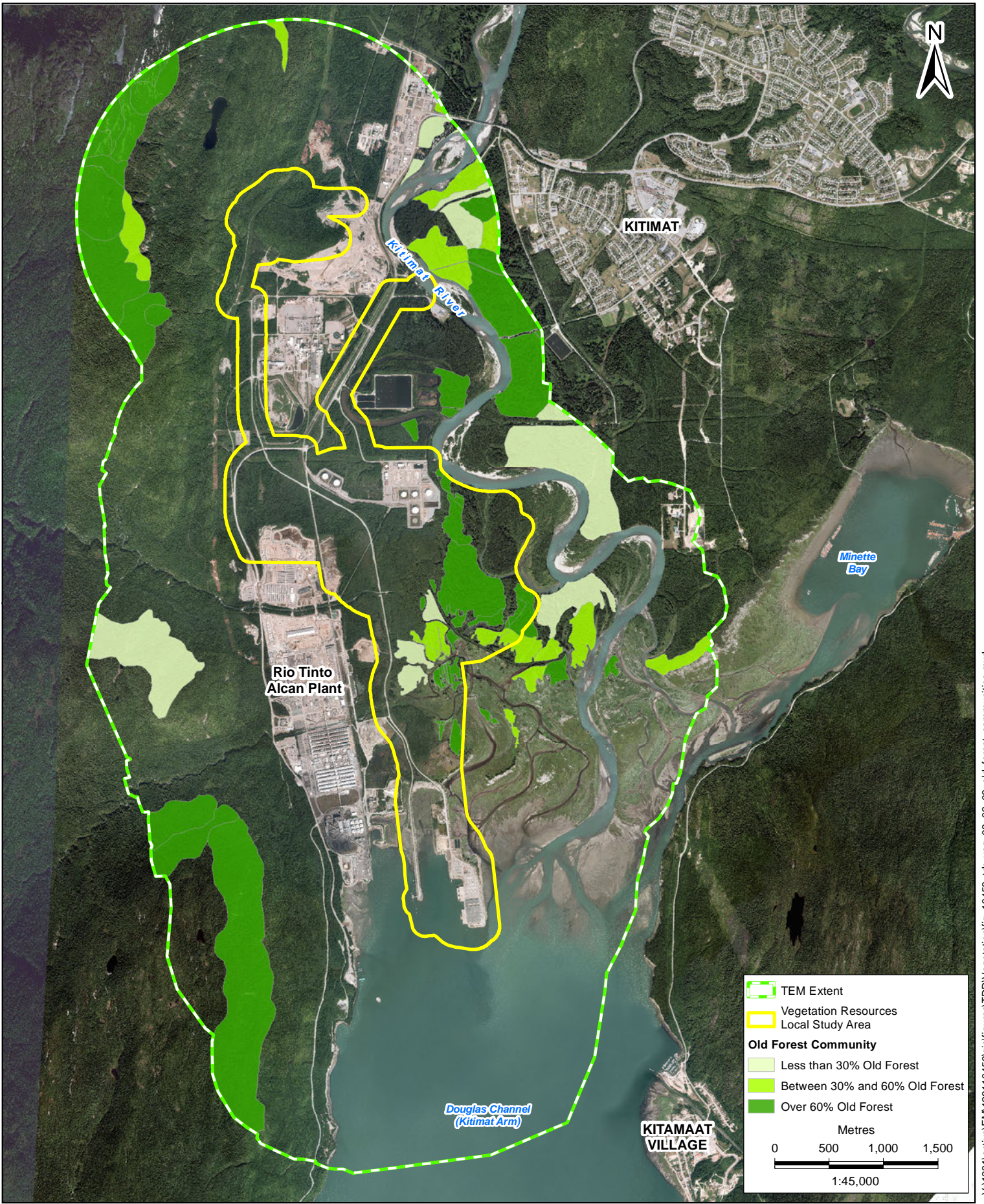
Old forest comprises 61.4 ha (8%) of the LSA, among three ecosystem units (see Table 3.2-3 and Figure 3.2-8). Most of this old forest occurs in the CWHvm1/09 Sitka Spruce / salmonberry (high-bench floodplain) community (36.8 ha), which is also one of the red-listed ecological communities (see Table 3.2-2).

**Table 3.2-3: Old Forest in the Vegetation LSA**

Ecosystem Code	Ecosystem Name	Map Code	Area (ha)	Proportion (%) of LSA
CWHvm1/14 <sup>a</sup>	cottonwood – Sitka spruce / skunk cabbage	RC	5.7	1
CWHvm1/19 <sup>a</sup>	Sitka spruce / Pacific crab apple	SP	18.9	2
CWHvm1/09 <sup>a</sup>	Sitka spruce / salmonberry	SS	36.8	5
<b>Total</b>			<b>61.4</b>	<b>8</b>

**NOTE:**

<sup>a</sup> Indicates plant community with Structural Stage 7



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VEGETATION TECHNICAL DATA REPORT

**OLD FOREST COMMUNITIES**

LNG CANADA EXPORT TERMINAL  
KITIMAT, BRITISH COLUMBIA

PROJECTION	UTM9	DRAWN BY	SS
DATUM	NAD 83	CHECKED BY	SW
DATE	20-MAY-14	FIGURE NO.	<b>3.2-8</b>

### 3.2.6 Plant Species at Risk

During field surveys, three at-risk plant species were identified among four locations in, or near, the LSA (see Table 3.2-4; also see Appendix A). Eminent bluegrass (*Poa eminens*) was identified at two locations, the first falls within LSA, while the second falls outside of the LSA by approximately 300 m. Rock sandwort (*Minuartia stricta*) is along the gravel floodplain adjacent to existing facilities in somewhat disturbed surroundings. It is typically found in gravel floodplains, rocky slopes, and subalpine and alpine meadows (BCCDC 2013b). Long-leaved aster (*Symphotrichum ascendens*) was identified within the tidal estuary near the Eurocan wharf (Appendix A) and is typically found on dry slopes and forest openings (E-Flora BC 2013).

There are only six known records of rock sandwort in BC, according to the CDC, UBC Herbarium, and BC E-flora databases; the closest location is near the BC border with Alaska. Of the multiple records of long-leaved aster occurrences in BC, the only one close to Kitimat is approximately 200 km southeast. However, the CDC (BCCDC 2013c) reports that “although collections are few, the taxon occurs in remote areas with extensive appropriate habitat, and additional populations almost certainly occur.” Types of recorded locations of long-leaved aster in BC include harvested forests, near a campsite, and beside an irrigation ditch, where human activities could cause further disturbance; or, it may be suited to disturbance regimes (BCCDC 2013c). Often plants are listed because their occurrence is unknown, yet can be locally abundant within a region.

**Table 3.2-4: Plant Species at Risk Detected in the Vegetation LSA**

Common Name	Species Name	Provincial Status	SARA Status
eminent bluegrass	<i>Poa eminens</i>	blue	not listed
rock sandwort	<i>Minuartia stricta</i>	blue	not listed
long leaved aster	<i>Symphotrichum ascendens</i>	red	not listed

### 3.2.7 Traditional Use Plant Species

Six of the 14 tree species documented as used by First Nations were found in the LSA during field surveys (Halpin and Seguin 1990; McDonald 1985; Powell 2006, 2011 and 2013; Satterfield et al. 2013; Turner and Clifton 2006; Turner and Turner 2013). These species include cottonwoods, hemlocks, Pacific crab apple, Sitka spruce, western redcedar and red alder (Table 3.2-5). Thirty-one shrub species were identified as used by Aboriginal Groups and, 13 were found during surveys (McDonald 1985; Satterfield et al. 2013; Turner and Clifton 2006; Turner and Turner 2013). These included Alaskan blueberry, devil's club, dogwood, gooseberry, high bush cranberry (*Viburnum edule*), huckleberries (*Vaccinium* spp.), raspberry (*Rubus idaeus*), rose hips (*Rosa* sp.), salmonberry, stink currant, thimbleberry (*Rubus parviflorus*), twinberry (*Lonicera involucrata*), and willow (Table 3.2-5). Twenty-one of the 30 herb species (including forbs and ferns) were found, such as fireweed (*Epilobium angustifolium*), nettle (*Urtica dioica*), lupine (*Lupinus* sp.), yarrow (*Achillea millefolium*), Pacific silverweed and licorice fern (*Polypodium glycyrrhiza*) (McDonald 1985; Satterfield et al. 2013; Turner and Clifton 2006; Turner and Turner 2013) (Table 3.2-5). Four species of non-vascular and aquatic species were identified as well (Table 3.2-5).

**Table 3.2-5: Traditional Use Plants Found in the Vegetation LSA**

Common Name	Latin Name	First Nation Use		
		Medicinal	Food	Material
<b>Trees</b>				
black cottonwood	<i>Populus trichocarpa</i>			✓
Pacific crab apple	<i>Malus fusca</i>		✓	✓
red alder	<i>Alnus rubra</i>			✓
Sitka spruce	<i>Picea sitchensis</i>		✓	✓
western hemlock	<i>Tsuga heterophylla</i>		✓	✓
western redcedar	<i>Thuja plicata</i>		✓	✓
<b>Shrubs</b>				
blueberry	<i>Vaccinium</i> spp.		✓	
devil's club	<i>Oplopanax horridus</i>	✓		✓
dogwood	<i>Cornus stolonifera</i>			✓
gooseberry	<i>Ribes</i> spp.		✓	
highbush cranberry	<i>Viburnum edule</i>		✓	
huckleberry	<i>Vaccinium parvifolium</i>		✓	
raspberry	<i>Rubus ideaus</i>		✓	
rose hips	<i>Rosa</i> spp.		✓	
salmonberry	<i>Rubus spectabilis</i>			✓
stink currant	<i>Ribes bracteosum</i>		✓	
thimbleberry	<i>Rubus parviflorus</i>	✓		
twinberry	<i>Lonicera involucrata</i>		✓	
willow	<i>Salix</i> spp.		✓	
<b>Herbs</b>				
cattail	<i>Typha latifolia</i>			✓
clover	<i>Trifolium</i> spp.		✓	
common sweetgrass	<i>Hierochloë hirta</i>			✓
cow-parsnip	<i>Heracleum maximum</i>	✓	✓	
buttercup roots	<i>Ranunculus</i> spp.		✓	
fireweed	<i>Epilobium angustifolium</i>		✓	
hellebore	<i>Veratrum viride</i>	✓		
kneeling angelica	<i>Angelica genuflexa</i>			✓
lupine	<i>Lupinus</i> spp.		✓	
stinging nettle	<i>Urtica dioica</i>		✓	
Pacific silverweed	<i>Potentilla egedii</i>	✓	✓	✓
Pacific water parsley	<i>Oenanthe sarmentosa</i>	✓		✓
riceroot (chocolate lily)	<i>Fritillaria camschatcensis</i>			✓

Common Name	Latin Name	First Nation Use		
		Medicinal	Food	Material
skunk cabbage	<i>Lysichiton americanus</i>	✓	✓	✓
Solomon's seal	<i>Maianthemum dilatatum</i>			✓
goatsbeard	<i>Aruncus dioicus</i>		✓	
yarrow	<i>Achillea millefolium</i>			✓
wild carrot	<i>Daucus carota</i>		✓	
western dock	<i>Rumex aquaticus</i>		✓	
licorice fern	<i>Polypodium glycyrrhiza</i>		✓	
wood fern	<i>Dryopteris arguta</i>	✓		
<b>Non Vascular and Aquatics</b>				
cone liverwort moss	<i>Conocephalum conicum</i>	✓		
green algae	<i>Multiclavula mucida</i>	✓		
seaweed	<i>Porphyra</i> spp.			✓
peat moss	<i>Sphagnum</i> spp.			✓

### 3.2.8 Non-Native Invasive Plant Species

Three non-native invasive plant species were found during field surveys in the LSA (Table 3.2-6), one of which, Canada thistle (*Cirsium arvense*), is currently regulated under the BC *Weed Control Act*. The other two species are listed by the Northwest Invasive Plant Council according to the council's ranking system (NWIPC 2013). These species were found primarily in disturbed areas of the LSA.

**Table 3.2-6: Non-Native Invasive Plant Species Observed in the LSA**

Common Name	Species Name	Northwest Invasive Plant Council	BC <i>Weed Control Act</i> Regulation
Canada thistle	<i>Cirsium arvense</i>	✓ (very invasive)	✓ (noxious)
oxeye daisy	<i>Chrysanthemum leucanthemum</i>	✓ (very invasive)	
tansy	<i>Tanacetum vulgare</i>	✓ (extremely invasive)	

### 3.3 Key Results and Findings

Baseline data on vegetation resources were collected to support an assessment of potential effects on vegetation associated with the Project. Key results and findings include:

- Approximately 35% (278.9) of the LSA consists of anthropogenic and sparsely or non-vegetated areas.
- The remainder of the LSA consists of 33% (260.6 ha) floodplain associations, 17% wetlands (135.6 ha), and 14% upland forest (110.9 ha). The abundance of these ecosystems in the LSA contrasts with the surrounding RSA where 4% is floodplain, 13% is wetlands and 76% is upland forest.
- The LSA contains 130.4 ha of red-listed and 53.6 ha of blue-listed ecological communities.
- Swamps are the dominant wetland class in the LSA, comprising 58% (78.5 ha) of the wetlands (135.6).
- Approximately 8% of the LSA (61.4 ha) and at least 34% of the RSA (43,255.3 ha) is old forest.
- Two blue-listed and one red-listed plant species were detected in the LSA during field surveys in 2012.
- Plants used by Aboriginal Groups of the region were detected in the LSA, including 6 species of trees, 13 shrub species, 21 species of herbs (forbs and ferns), and four species of non-vascular (seaweed/algae/moss).
- Three non-native invasive plant species were detected in the LSA through field surveys. Of these three species, one was listed as noxious in the BC *Weed Control Act* and associated Regulation.

## 4 CLOSURE

This TDR has been prepared for the sole benefit of LNG Canada to describe baseline conditions of vegetation resources in the study areas. This report is based on field studies and review of existing data completed between May 2012 and May 2014. If there are any questions regarding the content of the report, please contact Sandra Webster by e-mail at [sandra.webster@stantec.com](mailto:sandra.webster@stantec.com).

Respectfully submitted,

**Stantec Consulting Ltd.**

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# APPENDIX A

## LNG Canada Vegetation – Rare Plants Triton (2013)

*Project number: 6018  
Final Report  
February 3, 2014*

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# LNG CANADA VEGETATION – RARE PLANTS

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<b>Project Number</b>		6018	
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<b>Document #</b>		P3043	
<b>Report Author(s)</b>		Brent Thiessen	
<b>Date</b>	<b>Version</b>	<b>Review Type</b>	<b>Reviewed by</b> <i>(name, company)</i>

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## 1.0 Introduction

LNG Canada Development Inc. (LNG Canada) is proposing to construct and operate a liquefied natural gas (LNG) facility (including an LNG processing and storage site and marine terminal) in the District of Kitimat, British Columbia (BC; Figure 1), and to export LNG from the facility by shipping. This project is called the LNG Canada Export Terminal (the Project).

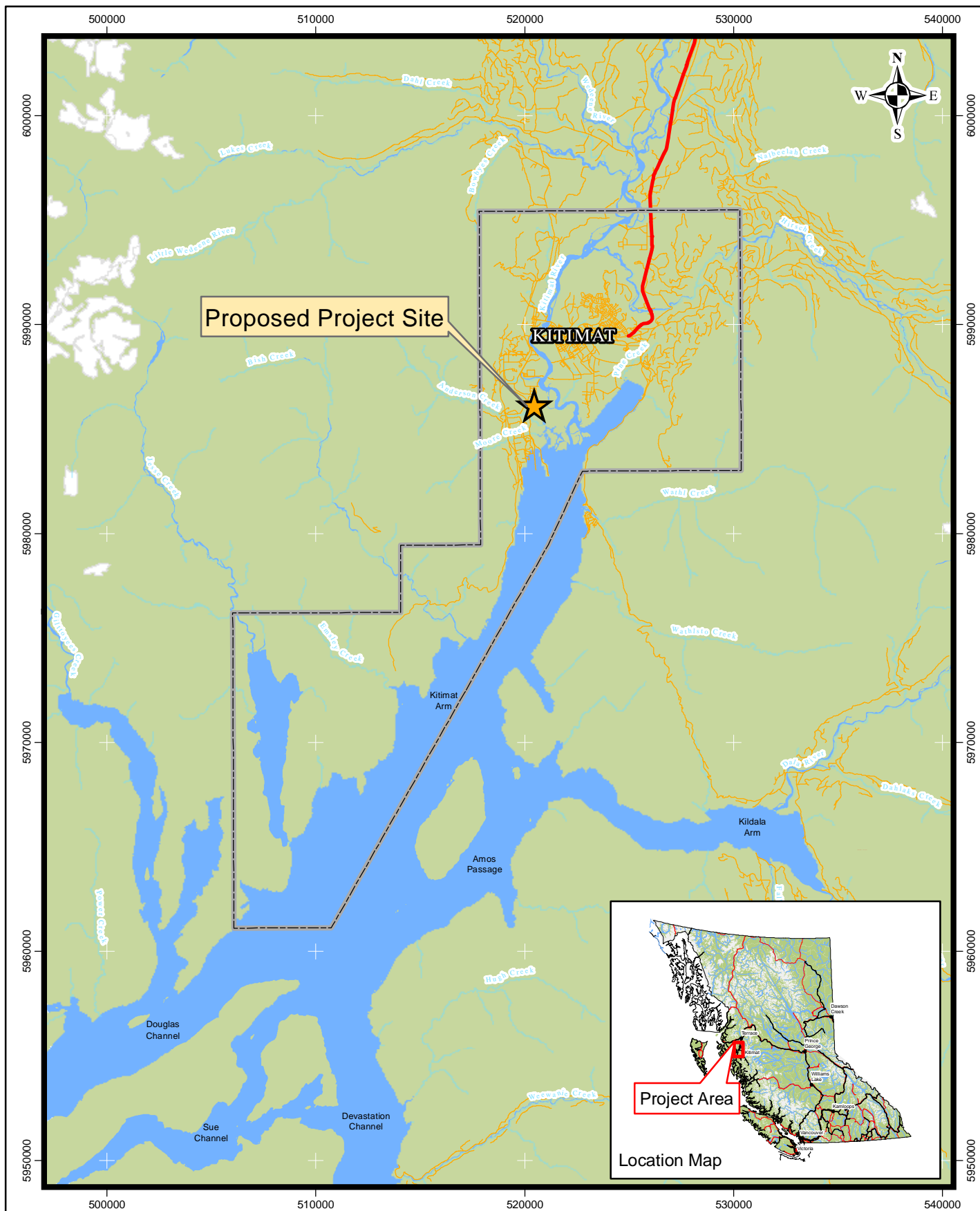
The intent of this document is to present and discuss the methods and findings of the baseline rare plant surveys conducted by Triton Environmental Consultants in 2012 for the Project.

### 1.1 Rare Plant Survey Area

The Project is located within the Kitimat Ranges (KIR) Ecosection of the Coastal Gap (COG) Ecoregion in the Coast and Mountains Ecoprovince. The rare plant survey area includes the LNG processing and storage site, marine terminal, and cryogenic rundown line (Figure 2).

The survey area lies within the Very Wet Maritime subzone and Submontane variant of the Coastal Western Hemlock biogeoclimatic zone (CWHvm1; Banner *et al.*, 1993). On average the CWH is the wettest biogeoclimatic zone in British Columbia and the CWHvm subzones receive a mean annual precipitation of 2728mm (Meidinger and Pojar, 1991). The maritime influence of the Pacific Ocean moderates air temperatures and delivers moisture-laden air to the CWHvm1 that rises and forms precipitation as it encounters the Coast Mountains. The subzone has a mean annual temperature of 8.2°C, and is characterized as a wet, humid and mild maritime climate, with relatively little snow and a long growing season (Meidinger and Pojar, 1991; Banner *et al.*, 1993).

While much of the CWH zone is characterized by steep and mountainous terrain, the SURVEY AREA is dominated by floodplain, estuary, and wetland sites located along the Kitimat River and Douglas Channel.



Proposed Project Site

**KITIMAT**

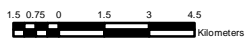
Project Area

Location Map

LNG Canada Ltd.

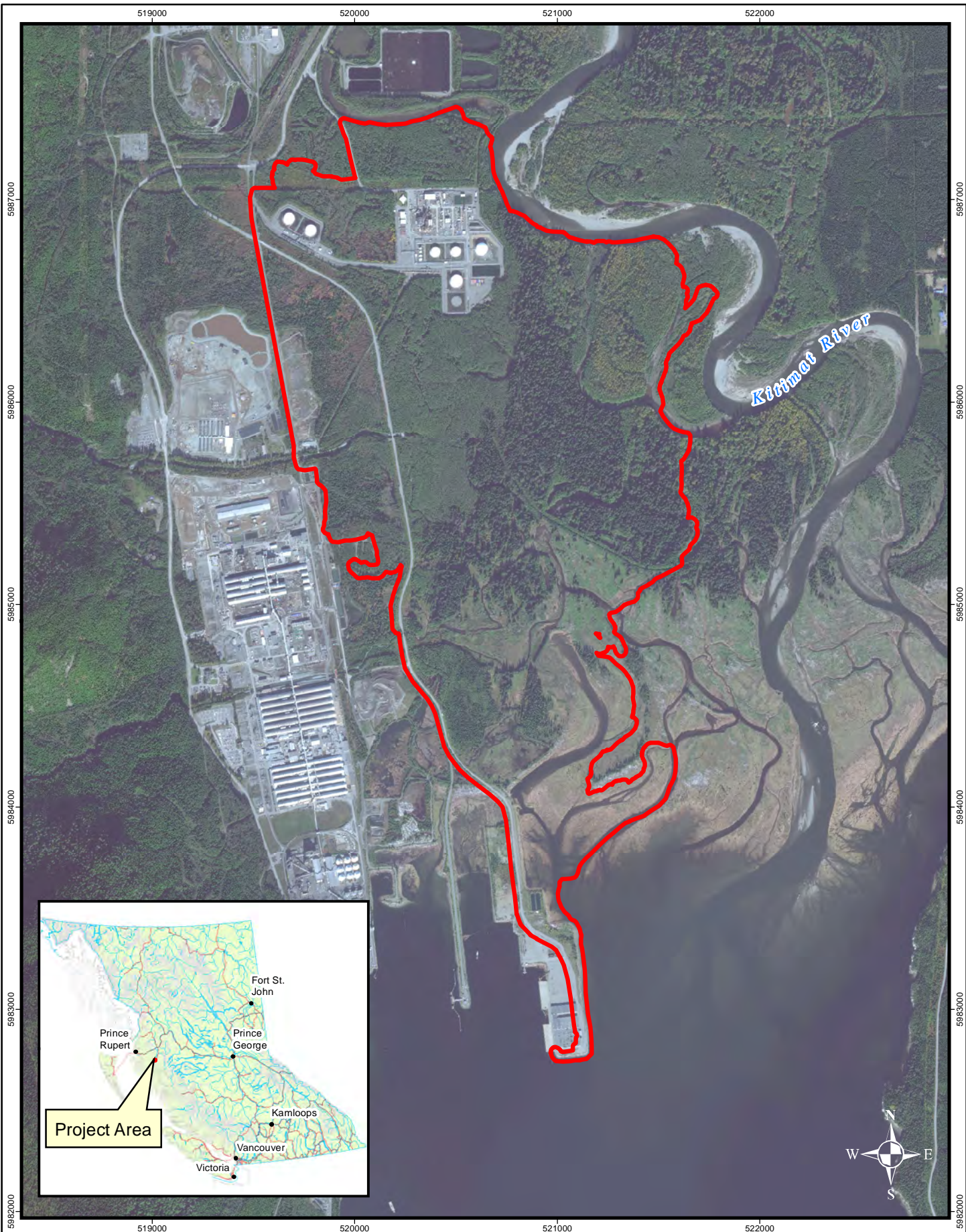
Figure 1. Site Location Map

**TRITON**  
ENVIRONMENTAL CONSULTANTS LTD.

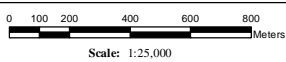


Legend  
 Proposed Project Site

Project No: 6018	Basemap Source: NTS 250k Mapsheet	Date: Nov 06, 2013	Map Datum: UTM NAD 83 Zone 9
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LNG Canada Ltd.



File No:  
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Figure 2. Rare Plant Survey Area Map

**Legend**  
 Rare Plant Survey Area

Project No:	6018
Date:	Feb 03, 2014
Basemap Source:	Orthophoto
Map Datum:	NAD 1983 UTM Zone 9N

**TRITON**  
 ENVIRONMENTAL CONSULTANTS LTD.

## **2.0 Methods**

### **2.1 Desktop Study**

The desktop study included the use of the BC Species and Ecosystems Explorer website (CDC, 2012) to produce a list of at-risk (i.e., red- or blue-listed, or SARA) vascular and non-vascular plant species that could potentially occur within the survey area (Table 1). The criteria for the plant species search included red-listed, blue-listed, and legally designated (i.e., schedule 1 of SARA) species within the Kalum Forest District.

A literature review was conducted to familiarize the biologists with the individual plant species listed in Table 1. Specific information included photos and taxonomic illustrations, preferred habitat, elevation and geographic range, and known occurrences near the survey area (Environment Canada, 2011; FNA, 2007; Ignatov, 2009; Ireland, 2002; Klinkenberg, 2012; and Vitt, 2009).

### **2.2 Study Design**

The study design for the rare plant survey included the pre-field stratification the survey area. A preliminary ecosystem map was prepared for the survey area by delineating polygons of similar ecological characteristics (site, soil, and vegetation) using aerial imagery. The polygons were classified to the site series, site association, or broad ecosystem unit level (Banner *et al.*, 1993; Mackenzie and Moran, 2004; MWLAP, 2004). The abundance of the ecosystems identified in the preliminary ecosystem map was used to develop a field sampling plan.

### **2.3 Sample Plan**

A field sampling plan was developed to ensure that at least one polygon was sampled for each of the ecosystems identified. The number of additional polygons targeted for sampling was based on the proportion of the survey area that contains each identified ecosystem and the likelihood that an at-risk plant species may be present within it. Polygons with estuary, wetland, or transitional characteristics were also targeted for sampling as several rare plant species are known to exist within similar habitats. Unique or uncommon habitats such as seepages and eroding banks were included in the field survey whenever they were encountered.

**Table 1. At-risk plant species potentially present within the study area**

Scientific Name	English Name	BC List	SARA	Preferred Habitat	Likelihood of Occurrence
<i>Botrychium pedunculosum</i>	stalked moonwort	Red	Not Assessed	Wetlands, terrestrial, 300-2000m elevation <sup>1</sup> .	Low – Study area outside elevation range (SAOER)
<i>Bryhnia hultenii</i>	Hulten's bryhnia moss	Red	Not Assessed	Soil and rocks at cliff bases, under dense <i>Alnus</i> canopy, bottom of gullies, sides of brooks, moderate to strong shade, wet to mesic places; 0-300 m <sup>2</sup> .	Moderate
<i>Carex rostrata</i>	swollen beaked sedge	Blue	Not Assessed	Peat bogs in the montane and subalpine zones <sup>1</sup> .	Low – SAOER
<i>Dicranodontium asperulum</i>	orange bow-moss	Blue	Not Assessed	Damp, shaded, acidic cliff faces and cliff shelves, occasionally on earth of overturned tree roots; 0-1200 m <sup>3</sup> .	Low – No cliff-like topography
<i>Draba cinerea</i>	gray-leaved draba	Blue	Not Assessed	Mesic to dry meadows and cliffs in the alpine zone <sup>1</sup> .	Low – SAOER
<i>Draba lonchocarpa</i> var. <i>thompsonii</i>	lance-fruited draba	Blue	Not Assessed	Mesic to dry meadows, cliffs and scree slopes in the subalpine and alpine zones <sup>1</sup> .	Low – SAOER
<i>Draba lonchocarpa</i> var. <i>vestita</i>	lance-fruited draba	Blue	Not Assessed	Mesic to dry meadows, cliffs and scree slopes in the subalpine and alpine zones <sup>1</sup> .	Low – SAOER
<i>Dryopteris cristata</i>	crested wood fern	Blue	Not Assessed	Wet swamps and meadows in the steppe and montane zones <sup>1</sup> .	Low – SAOER
<i>Eleocharis kamtschatica</i>	Kamchatka spike-rush	Blue	Not Assessed	Marshes, wet meadows and bog margins in the lowland zone <sup>1</sup> .	High – Marsh habitat expected
<i>Epilobium hornemannii</i> ssp. <i>behringianum</i>	Hornemann's willowherb	Blue	Not Assessed	Wet to moist rocky cliffs, meadows, thickets, and river banks in the montane zone <sup>1</sup> .	Low – SAOER
<i>Epilobium leptocarpum</i>	small-fruited willowherb	Blue	Not Assessed	Moist meadows and streambanks in the montane to alpine zones <sup>1</sup> .	High – known to occur near Kitimat
<i>Eutrema edwardsii</i>	Edwards wallflower	Blue	Not Assessed	Dry talus slopes in the subalpine and alpine zones <sup>1</sup> .	Low – SAOER
<i>Juncus stygius</i>	bog rush	Blue	Not Assessed	Pond margins and peat bogs in the lowland and montane zones <sup>1</sup> .	Moderate
<i>Malaxis brachypoda</i>	white adder's-mouth orchid	Blue	Not Assessed	Moist forests, mudflats, fens and streambanks in the lowland and montane zones <sup>1</sup> .	High – similar habitats expected
<i>Malaxis paludosa</i>	bog adder's-mouth orchid	Blue	Not Assessed	Bogs and muskegs in the lowland and montane zones <sup>1</sup> .	High – Known to occur near Kitimat
<i>Nephroma occultum</i>	cryptic paw	Blue	1-SC (Dec 2007)	Infrequent over conifers in open old-growth maritime forests <sup>1</sup> .	Moderate
<i>Orthotrichum rivulare</i>	river bristle-moss	Blue	Not Assessed	Exposed tree roots, bases of trees along streams, also commonly on siliceous boulders at the edges of streams and rivers,	Moderate

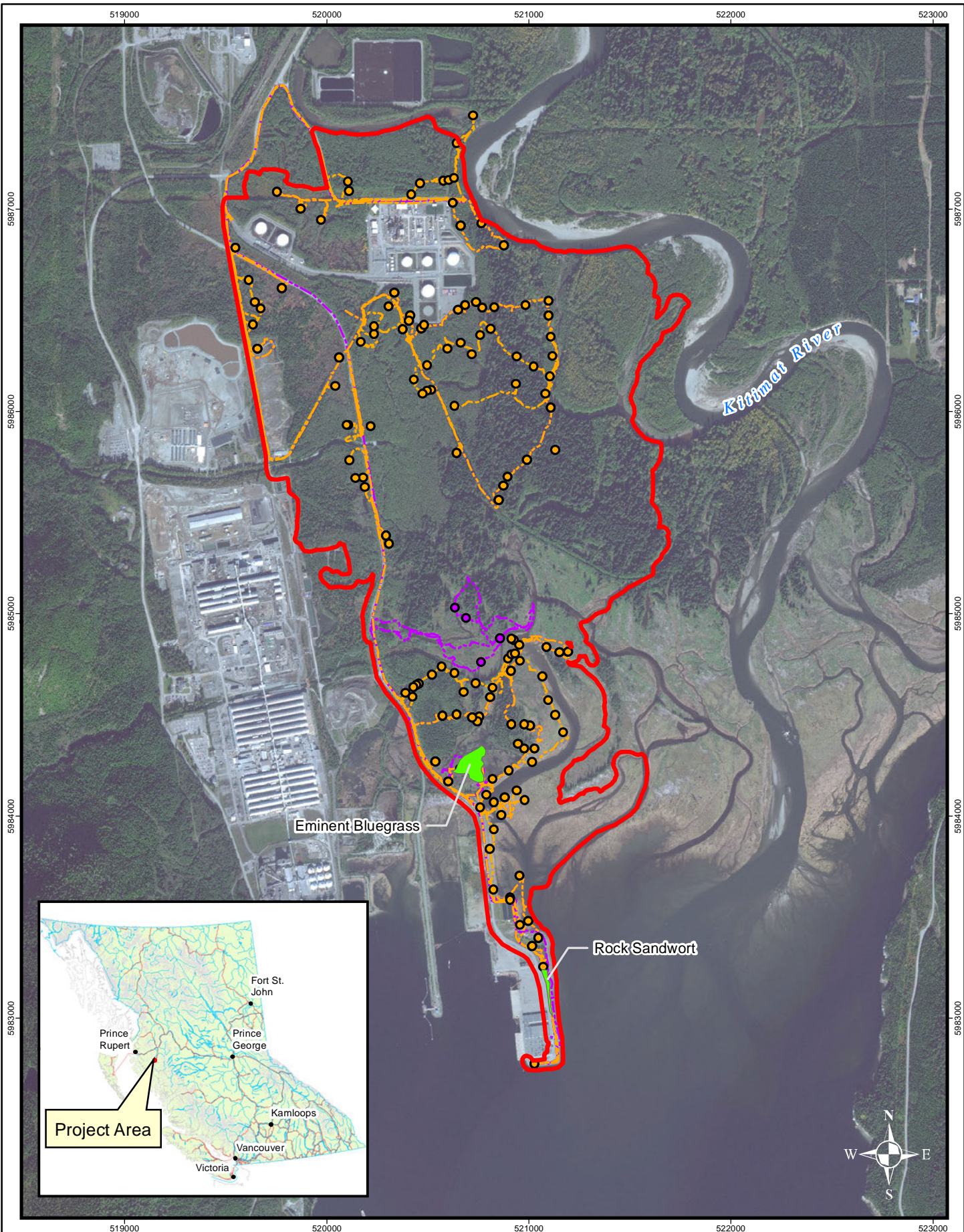
Scientific Name	English Name	BC List	SARA	Preferred Habitat	Likelihood of Occurrence
				occasionally on rocks that are frequently inundated, rarely in aquatic habitats <sup>4</sup> .	
<i>Pinus albicaulis</i>	whitebark pine	Blue	1-E (Jul 2012)	Mesic to dry slopes in the subalpine to alpine zones <sup>1</sup> .	Low – SAOER
<i>Pleuroziopsis ruthenica</i>	pleuroziopsis moss	Blue	Not Assessed	Humus on ground or logs along creeks and rivers, or other moist, shaded habitats <sup>5</sup> .	Moderate
<i>Poa eminens</i>	eminent bluegrass	Blue	Not Assessed	Coastal salt marshes and gravelly beaches in the lowland zone <sup>1</sup> .	High – known to occur near Kitimat
<i>Potamogeton perfoliatus</i>	perfoliate pondweed	Blue	Not Assessed	Lakes in the montane zone <sup>1</sup> .	Low – SAOER
<i>Pseudocypbellaria rainierensis</i>	oldgrowth specklebelly	Blue	1-SC (Jul 2012)	Rare over trees and shrubs in humid coast old-growth forests at lower elevations <sup>1</sup> .	Moderate
<i>Sclerophora peronella</i>	frosted glass-whiskers	Red	Not Assessed	Occurs in the heartwood of old, living deciduous trees; maritime climate <sup>6</sup> .	Low – few old deciduous trees.

<sup>1</sup> Klinkenberg, 2012; <sup>2</sup> Ignatov, 2009; <sup>3</sup> FNA, 2007; <sup>4</sup> Vitt, 2009; <sup>5</sup> Ireland, 2002; <sup>6</sup> Environment Canada, 2011

## **2.4 Field Surveys**

Sampling was conducted on June 5 and 6, 2012 by two field crews. Each crew consisted of one biologist and one assistant from the Haisla First Nation. Sampling was also conducted on August 9<sup>th</sup> by one field crew that consisted of one senior biologist, two intermediated biologists, and one assistant from the Haisla First Nation. This second round of sampling was necessary for the identification of plants that were not mature and/or did not have the necessary diagnostic features such as flowers, seeds/fruits, etc. during the June field surveys.

Sampling consisted of sample plots and visual inspections along meandering transects. GPS waypoints were used to record the locations of the sample plots, and GPS tracks were used to map the path of the field crews through the survey area and those polygons that were visually inspected (Figure 3). Data collected at the sample plots included the dominant plant species used to describe the site association, the identification of the site series composition of the polygon, a detailed list of the plant species present, as well as descriptions of other notable polygon features. Photos were taken, and/or voucher specimens collected for plant species that could not be positively identified in the field. Plant voucher specimens that were collected in the field were pressed and dried for laboratory identification at a later date.



**LNG Canada Ltd.**  
**Figure 3. Rare Plant Survey Area Map**

**Legend**

Rare Plant Survey Area	Spring Veg Survey Tracks
Spring Veg Survey Waypoints	Summer Veg Survey Tracks
Summer Veg Survey Waypoints	Rare Plants Location

File No:	N:\ACTIVE\6018_Kitimat_Creeks\MXD\Figure2RarePlantSurveyAreaMap.mxd	
Project No:	6018	
Date:	Feb 11, 2014	
Basemap Source:	Orthophoto	
Map Datum:	NAD 1983 UTM Zone 9N	



## **2.5 Post-field Processing**

In the laboratory, a dissecting microscope and authoritative keys (Brayshaw, 2000; Crum, 1981; Douglas *et al.*, 1998a, b, 1999a, b, 2000, 2001a, b, and 2002; and Lawton, 1971) were used to identify the voucher plant specimens to the species level, and where applicable, to the subspecies or variety level. The E-Flora website (Klinkenberg, 2012) was used to provide the most recent nomenclature for plant species.

Field notes were used to make the necessary adjustments to the preliminary ecosystem map so that representation of ecological communities was accurate, as well as to quantify the amount of similar habitats that may support any at-risk plant species found within the survey area.

## 3.0 Results and Discussion

### 3.1 Plant Species

During the field surveys, 199 individual plant species were observed within the survey area. Two of the identified plant species were found to be blue-listed: eminent bluegrass (*Poa eminens*), and rock sandwort (*Minuartia stricta*; Table 2). Please see Table 3 for a full list of plant species observed within the rare plant survey area.

**Table 2. Blue-listed plant species found within the Local Assessment area.**

Scientific Name	English Name	Provincial Status	BC List
<i>Poa eminens</i>	eminent bluegrass	S2S3	Blue
<i>Minuartia stricta</i>	rock sandwort	S2S3	Blue

Eminent bluegrass (Figure 4) was observed within the rare plant survey area in the tidal estuary near the RTA Wharf “B” (Figure 3). Eminent bluegrass was not observed elsewhere in the survey area.



**Figure 4. Eminent bluegrass (*Poa eminens*)**

Rock sandwort (Figure 5) was observed within the rare plant survey area on the disturbed area near the RTA Wharf “B” (Figure 3). Rock sandwort is blue-listed and has a provincial status of S2S3 – imperilled and vulnerable. It was found on the flat gravelled area immediately next to the asphalt of the wharf and the surrounding beach. Rock sandwort was not observed elsewhere in the survey area.



**Figure 5. Rock Sandwort (*Minuartia stricta*)**

**Table 3. Plant species observed within the survey area**

Scientific Name	Common Name	Group	Voucher	Photo	Taxonomic confidence	Comments
<i>Acer glabrum</i>	Douglas maple	tree	no	no	1	
<i>Achillea millefolium</i>	yarrow	herb	no	no	1	
<i>Actaea rubra</i>	baneberry	herb	no	no	1	
<i>Agrostis aequivalvus</i>	Alaska bentgrass	grass/sedge/rush	yes	no	1	
<i>Agrostis gigantea</i>	redtop	grass/sedge/rush	yes	no	1	
<i>Agrostis stolonifera</i>	creeping bentgrass	grass/sedge/rush	yes	no	1	
<i>Alnus rubra</i>	red alder	tree	no	yes	1	
<i>Alopecurus geniculatus</i>	water meadow-foxtail	grass/sedge/rush	yes	no	1	
<i>Anaphalis margaritacea</i>	pearly everlasting	herb	no	no	1	
<i>Angelica genuflexa</i>	kneeling angelica	herb	yes	yes	1	
<i>Angelica lucida</i>	sea-watch	herb	no	no	1	
<i>Aquilegia formosa</i>	red columbine	herb	no	no	1	
<i>Arabidopsis lyrata ssp. kamchatica</i>	Kamchatka rockcress	herb	yes	no	1	
<i>Arnica latifolia</i>	broadleaf arnica	herb	yes	no	1	
<i>Aruncus dioicus</i>	goat's beard	herb	no	no	1	
<i>Athyrium felix-femina subsp. cyclosorum</i>	lady fern	herb	yes	yes	1	
<i>Atriplex patula</i>	common orache	herb	yes	yes	2	immature plants
<i>Barbarea orthoceras</i>	American winter-cress	herb	yes	yes	1	
<i>Bolboschoenus maritimus var. paludosus</i>	seacoast bulrush	grass/sedge/rush	yes	yes	1	
<i>Calamagrostis canadensis</i>	bluejoint	grass/sedge/rush	yes	yes	1	
<i>Campanula scouleri</i>	Scouler's harebell	herb	yes	no	4	no flowers
<i>Cardamine occidentalis</i>	big western bittercress	herb	yes	yes	2	stem leaves mostly broken off
<i>Cardamine oligosperma</i>	few-seeded bitter-cress	herb	yes	no	3	no fruits, young specimen
<i>Carex aquatilis</i>	water sedge	grass/sedge/rush	no	no	2	based on field ID
<i>Carex canescens</i>	grey sedge	grass/sedge/rush	yes	no	1	
<i>Carex deweyana var. leptopoda</i>	Dewey's sedge	grass/sedge/rush	yes	yes	1	
<i>Carex lenticularis var. lipocarpa</i>	Kellogg's sedge	grass/sedge/rush	yes	yes	1	
<i>Carex lyngbyei ssp. Cryptocarpa</i>	Lyngbye's sedge	grass/sedge/rush	no	yes	1	
<i>Carex macrochaeta</i>	large-awned sedge	grass/sedge/rush	yes	no	1	

Scientific Name	Common Name	Group	Voucher	Photo	Taxonomic confidence	Comments
<i>Carex mertensii</i>	Merten's sedge	grass/sedge/rush	yes	no	1	
<i>Carex pachystachya</i>	thick-headed sedge	grass/sedge/rush	yes	no	1	
<i>Carex pluriflora</i>	many-flowered sedge	grass/sedge/rush	yes	no	1	
<i>Carex stitchensis</i>	Sitka sedge	grass/sedge/rush	yes	yes	1	
<i>Carex stipata</i> var. <i>stipata</i>	awl-fruited sedge	grass/sedge/rush	yes	no	1	
<i>Castilleja miniata</i>	common red paintbrush	herb	yes	yes	1	
<i>Castilleja unalascensis</i>	unalaska paintbrush	herb	yes	yes	1	
<i>Cerastium arvense</i>	field chickweed	herb	yes	no	1	
<i>Ceratodon purpureus</i>	fire moss	hepatic	no	no	1	
<i>Cicuta douglasii</i>	Douglas's water hemlock	herb	yes	yes	1	
<i>Circaea alpina</i>	enchanter's nightshade	herb	no	no	1	
<i>Cirsium edule</i> var. <i>macounii</i>	edible thistle	herb	no	no	2	immature plant
<i>Cladonia</i> sp.	clad lichens	lichen	no	no	1	
<i>Climacium dendroides</i>	tree moss	hepatic	no	no	1	
<i>Clintonia uniflora</i>	Queen's cup	herb	no	no	1	
<i>Comarum palustre</i>	marsh cinquefoil	herb	yes	no	1	
<i>Conioselenium gmelini</i>	Pacific hemlock-parsley	herb	yes	yes	3	no flowers
<i>Conocephalum conicum</i>	snake liverwort	hepatic	yes	no	1	
<i>Cornus stolonifera</i>	red-osier dogwood	shrub	no	yes	1	
<i>Cornus unalascensis</i>	Alaskan bunchberry	herb	no	no	1	
<i>Cotula coronopifolia</i>	brass buttons	exotic	yes	yes	1	
<i>Dicranum fuscescens</i>	curly herons-bill moss	hepatic	no	no	1	
<i>Dodecatheon pulchellum</i>	few-flowered shooting star	herb	yes	yes	1	
<i>Dryopteris expansa</i>	spiny wood fern	herb	yes	no	2	no sori present
<i>Eleocharis palustris</i>	creeping spike-rush	grass/sedge/rush	no	no	1	
<i>Epilobium angustifolium</i>	fireweed	herb	no	no	1	
<i>Epilobium luteum</i>	yellow willowherb	herb	yes	no	3	no flowers
<i>Equisetum arvense</i>	common horsetail	herb	yes	no	1	
<i>Equisetum fluviatile</i>	swamp horsetail	herb	no	no	1	
<i>Equisetum pratense</i>	meadow horsetail	herb	yes	no	1	
<i>Euphrasia nemorosa</i>	eastern eyebright	exotic	yes	no	1	
<i>Eurhynchium oregana</i>	Oregon beaked-moss	hepatic	no	no	1	
<i>Festuca rubra</i> subsp. <i>rubra</i>	red fescue	grass/sedge/rush	yes	no	1	

Scientific Name	Common Name	Group	Voucher	Photo	Taxonomic confidence	Comments
<i>Fritillaria camschatcensis</i>	northern riceroot	herb	yes	yes	1	
<i>Galeopsis tetrahit</i>	hemp-nettle	exotic	no	no	1	
<i>Galium spurium</i>	false cleavers	exotic	yes	no	1	
<i>Galium trifidum</i>	small bedstraw	herb	yes	no	1	
<i>Galium triflorum</i>	sweet-scented bedstraw	herb	yes	no	2	no fruits
<i>Geum macrophyllum</i>	large-leaved avens	herb	no	no	1	
<i>Glaux maritima ssp. obtusifolia</i>	sea milkwort	herb	yes	yes	1	
<i>Gnaphalium uliginosum</i>	marsh cudweed	exotic	yes	no	1	
<i>Gymnocarpium disjunctum</i>	western oak fern	herb	yes	no	2	no sori present
<i>Heracleum maximum</i>	cow-parsnip	herb	no	no	1	
<i>Hieracium caespitosum</i>	meadow hawkweed	herb	Yes	no	1	
<i>Hieracium lachenalii</i>	European hawkweed	herb	Yes	no	1	
<i>Hierochloa hirta subsp. arctica</i>	common sweetgrass	grass/sedge/rush	yes	no	1	
<i>Honkenya peploides</i>	seabeach sandwort	herb	no	yes	1	
<i>Hylocomium splendens</i>	step-moss	hepatic	no	no	1	
<i>Hypogymnia sp.</i>	bone lichen	lichen	no	no	1	
<i>Impatiens capensis</i>	spotted touch-me-not	herb	yes	no	4	no flowers present
<i>Isoetecium myosuroides</i>	cat tail moss	hepatic	no	no	2	
<i>Juncus acuminatus</i>	tapered rush	grass/sedge/rush	yes	no	1	
<i>Juncus arcticus ssp. sitchensis</i>	arctic rush	grass/sedge/rush	yes	no	1	
<i>Juncus bufonius</i>	toad rush	grass/sedge/rush	yes	no	1	
<i>Juncus ensifolius</i>	dagger-leaf rush	grass/sedge/rush	yes	no	1	
<i>Juncus filiformis</i>	thread rush	grass/sedge/rush	yes	no	1	
<i>Juncus parryi</i>	Parry's rush	grass/sedge/rush	yes	no	1	
<i>Lathyrus japonicus</i>	beach pea	herb	yes	no	1	
<i>Leucanthemum vulgare</i>	oxeye daisy	exotic	no	no	1	
<i>Leucolepsia acanthoneuron</i>	palm tree moss	hepatic	no	no	1	
<i>Leymus mollis subsp. mollis</i>	dune wildrye	grass/sedge/rush	yes	yes	1	
<i>Ligusticum scoticum subsp. hultenii</i>	beach lovage	herb	yes	yes	1	
<i>Linaria vulgaris</i>	butter and eggs	exotic	yes	no	1	
<i>Lonicera involucrata</i>	black twinberry	shrub	no	yes	1	
<i>Lupinus nootkatensis</i>	Nootka lupine	herb	no	yes	1	
<i>Luzula parviflora</i>	small-flowered wood-rush	grass/sedge/rush	yes	no	2	lacking mature capsules

Scientific Name	Common Name	Group	Voucher	Photo	Taxonomic confidence	Comments
<i>Luzula spicata</i>	spiked wood-rush	grass/sedge/rush	yes	no	1	
<i>Lycopodium clavatum</i> var. <i>clavatum</i>	running club-moss	herb	yes	no	1	
<i>Lysichiton americanum</i>	skunk cabbage	herb	no	yes	1	
<i>Maianthemum dilatatum</i>	false lily-of-the-valley	herb	no	yes	1	
<i>Maianthemum stellatum</i>	star-flowered false Soloman's-seal	herb	no	yes	1	
<i>Malus fusca</i>	Pacific crab apple	tree	no	yes	1	
<i>Matricaria discoidea</i>	pineapple weed	exotic	no	no	1	
<i>Medicago lupulina</i>	black medic	exotic	no	no	1	
<i>Mentha arvensis</i>	field mint	herb	yes	no	1	
<i>Menziesia ferruginea</i>	false azalea	shrub	yes	no	1	
<i>Minuartia stricta</i>	rock sandwort	herb	yes	yes	1	
<i>Myosotis laxa</i>	small-flowered forget-me-not	herb	yes	yes	1	
<i>Myrica gale</i>	sweet gale	shrub	no	yes	1	
<i>Nuphar polysepala</i>	yellow pond-lily	herb	no	yes	1	
<i>Oenanthe sarmentosa</i>	Pacific water-parsley	herb	yes	yes	1	
<i>Omalotheca sylvatica</i>	woodland cudweed	exotic	yes	no	1	
<i>Oplopanax horridus</i>	Devil's club	shrub	no	yes	1	
<i>Osmorhiza purpurea</i>	purple sweet-cicely	herb	yes	no	2	fruits immature
<i>Persicaria amphibia</i> var. <i>stipulacea</i>	water smartweed	herb	no	no	1	
<i>Persicaria maculosa</i>	lady's-thumb	exotic	yes	no	1	
<i>Phalaris arundinacea</i>	reed canarygrass	herb	yes	no	1	
<i>Phegopteris connectilis</i>	long beechfern	herb	yes	no	1	
<i>Philonotis fontana</i>	spring moss	hepatic	yes	no	1	
<i>Phleum pratense</i>	timothy	grass/sedge/rush	yes	no	1	
<i>Picea sitchensis</i>	Sitka spruce	tree	no	no	1	
<i>Plagiomnium insigne</i>	coastal leafy moss	hepatic	yes	no	1	
<i>Plagiothecium undulatum</i>	flat-moss	hepatic	yes	no	1	
<i>Plantago macrocarpa</i>	Alaska plantain	herb	yes	yes	1	
<i>Plantago major</i>	common plantain	exotic	no	no	1	
<i>Plantago maritima</i> ssp. <i>juncooides</i>	sea plantain	herb	yes	yes	1	
<i>Pleurozium schreberi</i>	red-stemmed feathermoss	hepatic	no	no	1	

Scientific Name	Common Name	Group	Voucher	Photo	Taxonomic confidence	Comments
<i>Poa eminens</i>	eminent bluegrass	grass/sedge/rush	yes	yes	1	
<i>Poa pratensis</i>	Kentucky bluegrass	grass/sedge/rush	yes	no	1	
<i>Poa stenantha</i> var. <i>stenantha</i>	narrow-flowered bluegrass	grass/sedge/rush	yes	no	1	
<i>Poa trivialis</i>	rough bluegrass	grass/sedge/rush	yes	no	1	
<i>Polytrichum juniperinum</i>	juniper haircap	hepatic	yes	no	1	
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>	black cottonwood	tree	no	no	1	
<i>Potamogeton natans</i>	floating pondweed	herb	yes	no	1	
<i>Potamogeton pusillus</i> ssp. <i>Tenuissimus</i>	small pondweed	herb	yes	no	1	
<i>Potentilla egedii</i>	coast silverweed	herb	no	yes	1	
<i>Racomitrium ericoides</i>	shaggy rock-moss	hepatic	yes	no	1	
<i>Ranunculus cymbalaria</i>	alkali buttercup	herb	yes	yes	1	
<i>Ranunculus occidentalis</i> var. <i>occidentalis</i>	western buttercup	herb	yes	no	1	
<i>Ranunculus uncinatus</i>	little buttercup	herb	yes	no	1	
<i>Rhizomnium glabrescens</i>	large leafy moss	hepatic	Yes	no	1	
<i>Rhytidiadelphus loreus</i>	lanky moss	hepatic	no	no	1	
<i>Rhytidiadelphus triquetrus</i>	electrified cat's-tail moss	hepatic	yes	no	1	
<i>Ribes bracteosum</i>	stink currant	shrub	no	yes	1	
<i>Ribes lacustre</i>	black gooseberry	shrub	no	no	1	
<i>Ribes laxiflorum</i>	trailing black currant	shrub	no	no	1	
<i>Rosa nutkana</i>	Nootka rose	shrub	no	no	1	
<i>Rubus parviflorus</i>	thimbleberry	shrub	no	no	1	
<i>Rubus spectabilis</i>	salmonberry	shrub	no	yes	1	
<i>Rumex acetosella</i>	sheep sorrel	exotic	no	no	1	
<i>Rumex crispus</i>	curled dock	herb	no	yes	1	
<i>Ruppia maritima</i>	widgeongrass	grass/sedge/rush	yes	yes	1	
<i>Salix lucida</i> ssp. <i>lasiandra</i>	Pacific willow	shrub	no	no	1	
<i>Salix prolixa</i>	Mackenzie's willow	shrub	no	no	1	
<i>Salix scouleriana</i>	Scouler's willow	shrub	yes	no	1	
<i>Salix sitchensis</i>	Sitka willow	shrub	yes	no	1	
<i>Sambucus racemosa</i>	red elderberry	shrub	no	yes	1	
<i>Sanguisorba canadensis</i>	sitka burnet	herb	yes	no	1	
<i>Saxifraga ferruginea</i>	Alaska saxifrage	herb	yes	no	1	

Scientific Name	Common Name	Group	Voucher	Photo	Taxonomic confidence	Comments
<i>Schedonorus pratensis</i>	meadow fescue	grass/sedge/rush	yes	no	1	
<i>Scirpus microcarpus</i>	small-flowered bulrush	grass/sedge/rush	yes	no	1	
<i>Solidago multiradiata</i>	northern goldenrod	herb	yes	no	1	
<i>Sonchus asper</i>	Prickly sow-thistle	exotic	yes	no	1	
<i>Sorbus scopulina</i>	western mountain-ash	shrub	no	no	1	
<i>Sorbus sitchensis</i>	Sitka mountain-ash	shrub	no	no	1	
<i>Sparganium angustifolium</i>	narrow-leaved bur-reed	herb	yes	no	1	
<i>Sphagnum girgensohnii</i>	common green sphagnum	hepatic	yes	no	1	
<i>Spiraea douglasii</i> ssp. <i>douglasii</i>	pink spirea	shrub	no	yes	1	
<i>Stachys chamissonis</i> var. <i>cooleyae</i>	Cooley's hedge-nettle	herb	yes	no	1	
<i>Stellaria borealis</i> ssp. <i>sitchana</i>	boreal starwort	herb	yes	no	1	
<i>Stellaria crispa</i>	crisp sandwort	herb	yes	no	3	no flowers
<i>Stellaria longipes</i> var. <i>longipes</i>	long-stalked starwort	herb	yes	no	1	
<i>Symphoricarpos albus</i>	common snowberry	shrub	yes	no	2	no flowers
<i>Symphyotrichum foliaceum</i> var. <i>foliaceum</i>	leafy aster	herb	yes	no	2	no flowers present
<i>Symphyotrichum subspicatum</i>	Douglas' aster	herb	yes	yes	2	no flowers present
<i>Tanacetum vulgare</i>	common tansy	herb	yes	no	4	
<i>Taraxacum officinale</i>	common dandelion	exotic	no	no	1	
<i>Tellima grandiflora</i>	fringecup	herb	no	no	1	
<i>Thuja plicata</i>	western redcedar	tree	yes	no	2	no cones
<i>Tiarella trifoliata</i> var. <i>trifoliata</i>	foamflower	herb	no	no	1	
<i>Trientalis europaea</i> subsp. <i>Arctica</i>	northern starflower	herb	no	yes	1	
<i>Trifolium repens</i>	white clover	exotic	no	no	1	
<i>Triglochin maritimum</i>	seaside arrow-grass	herb	no	no	1	
<i>Triglochin palustris</i>	marsh arrow-grass	herb	yes	yes	1	
<i>Trisetum spicatum</i>	spike trisetum	grass/sedge/rush	no	no	1	
<i>Tsuga heterophylla</i>	western hemlock	tree	no	no	1	
<i>Typha latifolia</i>	common cattail	herb	no	yes	1	
<i>Urtica dioica</i>	stinging nettle	herb	no	no	1	
<i>Usnea</i> sp.	beard lichen	lichen	no	no	1	
<i>Vaccinium alaskense</i>	Alaskan blueberry	shrub	no	no	1	
<i>Veratrum viride</i>	Indian hellebore	herb	no	yes	1	

<b>Scientific Name</b>	<b>Common Name</b>	<b>Group</b>	<b>Voucher</b>	<b>Photo</b>	<b>Taxonomic confidence</b>	<b>Comments</b>
<i>Veronica beccabunga</i>	American brooklime	herb	no	no	2	
<i>Veronica serpyllifolia</i>	thyme-leaved speedwell	herb	yes	no	1	
<i>Viburnum edule</i>	highbush cranberry	shrub	no	no	1	
<i>Vicia nigricans ssp. gigantea</i>	giant vetch	herb	yes	no	1	
<i>Viola glabella</i>	stream violet	herb	no	no	1	
<i>Viola langsдорфii</i>	Alaska violet	herb	yes	yes	1	
<i>Viola palustris</i>	marsh violet	herb	yes	no	3	only leaf collected
<i>Woodsia oregana ssp. oregana</i>	Oregon cliff fern	herb	yes	no	2	no indusia present

### **3.2 Closure**

While the full range of ecosystem types present within the survey area were sampled adequately and in two seasons (spring, late summer), search efforts were not exhaustive and there remains potential for plant species at risk to occur. It is reasonable to assume that it is unlikely that there are widespread occurrences of rare plant species within the survey area.

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# APPENDIX B

## Plant Species Observed in the LSA

**Table B-1: Plant Species Observed in the LSA**

Common Name	Scientific Name
Alaska bentgrass	<i>Agrostis aequivalus</i>
Alaska plantain	<i>Plantago macrocarpa</i>
Alaska saxifrage	<i>Saxifraga ferruginea</i>
Alaska violet	<i>Viola langsdorfii</i>
Alaskan blueberry	<i>Vaccinium alaskaense</i>
Alaskan bunchberry	<i>Cornus unalaschkensis</i>
alkali buttercup	<i>Ranunculus cymbalaria</i>
amabilis fir	<i>Abies amabilis</i>
American brooklime	<i>Veronica beccabunga</i>
American bulrush	<i>Schoenoplectus pungens</i> var. <i>longispicatus</i>
American winter-cress	<i>Barbarea orthoceras</i>
arctic lupine	<i>Lupinus arcticus</i>
arctic rush	<i>Juncus arcticus</i>
Arctic rush	<i>Juncus arcticus</i> ssp. <i>sitchensis</i>
aster	<i>Asteraceae</i>
awl-fruited sedge	<i>Carex stipata</i> vvr <i>stipata</i>
Baltic rush	<i>Juncus balticus</i>
baneberry	<i>Actaea rubra</i>
beach lovage	<i>Ligusticum scoticum</i>
beach lovage	<i>Ligusticum scoticum</i> subsp. <i>hultenii</i>
beach pea	<i>Lathyrus japonicus</i>
beard lichen	<i>Usnea</i> sp.
bedstraw	<i>Galium</i> sp.
big western bittercress	<i>Cardamine occidentalis</i>
black cottonwood	<i>Populus trichocarpa</i>
black gooseberry	<i>Ribes lacustre</i>
black medi	<i>Medicago lupulina</i>
black twinberry	<i>Lonicera involucrata</i>
blue wildrye	<i>Elymus glaucus</i>
bluejoint reedgrass	<i>Calamagrostis canadensis</i>
bone lichen	<i>Hypogymnia</i> sp.
boreal starwort	<i>Stellaria borealis</i> ssp. <i>sitchana</i>
brachiolejeunea	<i>Brachiolejeunea</i> sp.
bracken fern	<i>Pteridium aquilinum</i>
brass buttons	<i>Cotula coronopifolia</i>
broad-leaved willowherb	<i>Epilobium latifolium</i>

Common Name	Scientific Name
bulrush	<i>Scirpus</i> sp.
bunchberry	<i>Cornus canadensis</i>
butter and eggs	<i>Linaria vulgaris</i>
buttercup	<i>Ranunculus</i> sp.
Canada goldenrod	<i>Solidago canadensis</i>
Canada thistle	<i>Cirsium arvense</i>
cat tail moss	<i>Isoetes myosuroides</i>
clad lichens	<i>Cladonia</i> sp.
clasping twistedstalk	<i>Streptopus amplexifolius</i>
cleavers	<i>Galium aparine</i>
coast silverweed	<i>Potentilla egedii</i>
coastal leafy moss	<i>Plagiomnium insigne</i>
common cattail	<i>Typha latifolia</i>
common dandelion	<i>Taraxacum officinale</i>
common green sphagnum	<i>Sphagnum girgensohnii</i>
common horsetail	<i>Equisetum arvense</i>
common orache	<i>Atriplex patula</i>
common plantain	<i>Plantago major</i>
common snowberry	<i>Symphoricarpos albus</i>
common spike-rush	<i>Eleocharis palustris</i>
common sweetgrass	<i>Hierochloë hirta</i>
common sweetgrass	<i>Hierochloë hirta</i> ssp. <i>arctica</i>
common tansy	<i>Tanacetum vulgare</i>
common timothy	<i>Phleum pratense</i>
contorted pogonatum moss	<i>Pogonatum contortum</i>
Cooley's hedge-nettle	<i>Stachys chamissonis</i> var. <i>cooleyae</i>
cow-parsnip	<i>Heracleum maximum</i>
creeping bentgrass	<i>Agrostis stolonifera</i>
crisp starwort	<i>Stellaria crispa</i>
curled dock	<i>Rumex crispus</i>
curly heron's-bill moss	<i>Dicranum fuscescens</i>
currant or gooseberry	<i>Ribes</i> sp.
dagger-leaf rush	<i>Juncus ensifolius</i>
deer fern	<i>Blechnum spicant</i>
deer paintbrush	<i>Castilleja cervina</i>
devil's club	<i>Oplopanax horridus</i>
Dewey's sedge	<i>Carex deweyana</i>

Common Name	Scientific Name
Dewey's sedge	<i>Carex deweyana</i> var. <i>leptopoda</i>
dock	<i>Rumex</i> sp.
Douglas' aster	<i>Symphotrichum subspicatum</i>
Douglas maple	<i>Acer glabrum</i>
Douglas maple	<i>Acer glabrum</i> var. <i>douglasii</i>
Douglas' water-hemlock	<i>Cicuta douglasii</i>
dune wildrye	<i>Leymus mollis</i>
dune wildrye	<i>Leymus mollis</i> subsp. <i>Mollis</i>
eastern eyebright	<i>Euphrasia nemorosa</i>
edible thistle	<i>Cirsium edule</i> var. <i>macounii</i>
electrified cat's-tail moss	<i>Rhytidiadelphus triquetrus</i>
eminent bluegrass	<i>Poa eminens</i>
enchanter's-nightshade	<i>Circaea alpina</i>
European hawkweed	<i>Hieracium lachenalii</i>
false azalea	<i>Menziesia ferruginea</i>
false cleavers	<i>Galium spurium</i>
false lily-of-the-valley	<i>Maianthemum dilatatum</i>
false Solomon's-seal	<i>Maianthemum racemosum</i>
few-flowered shooting star	<i>Dodecatheon pulchellum</i>
few-seeded bittercress	<i>Cardamine oligosperma</i>
field chickweed	<i>Cerastium arvense</i>
field mint	<i>Mentha arvensis</i>
fire moss	<i>Ceratodon purpureus</i>
fireweed	<i>Epilobium angustifolium</i>
five-leaved bramble	<i>Rubus pedatus</i>
flat-moss	<i>Plagiothecium undulatum</i>
floating pondweed	<i>Potamogeton natans</i>
foamflower	<i>Tiarella</i> sp.
Foamflower	<i>Tiarella trifoliata</i> var. <i>trifoliata</i>
fringecup	<i>Tellima grandiflora</i>
giant vetch	<i>Vicia nigricans</i> ssp. <i>gigantea</i>
goatsbeard	<i>Aruncus dioicus</i>
great northern aster	<i>Canadanthus modestus</i>
green alder	<i>Alnus viridis</i>
grey sedge	<i>Carex canescens</i>
hair bentgrass	<i>Agrostis scabra</i>
haircap moss	<i>Polytrichum</i> sp.

Common Name	Scientific Name
Hardhack	<i>Spiraea douglasii</i>
hemlock	<i>Tsuga</i> sp.
hemp-nettle	<i>Galeopsis tetrahit</i>
highbush-cranberry	<i>Viburnum edule</i>
horsetail	<i>Equisetum</i> sp.
Indian hellebore	<i>Veratrum viride</i>
irregular polypody	<i>Polypodium amorphum</i>
juniper haircap	<i>Polytrichum juniperinum</i>
Kamchatka rockcress	<i>Arabidopsis lyrata</i> ssp. <i>kamchatica</i>
Kellogg's sedge	<i>Carex lenticularis</i> var. <i>lipocarpa</i>
Kentucky bluegrass	<i>Poa pratensis</i>
kneeling angelica	<i>Angelica genuflexa</i>
lady fern	<i>Athyrium filix-femina</i>
lady fern	<i>Athyrium filix-femina</i> subsp. <i>cyclosorum</i>
lady's thumb	<i>Persicaria maculosa</i>
lamb's-quarters	<i>Chenopodium album</i>
lanky moss	<i>Rhytidiadelphus loreus</i>
large leafy moss	<i>Rhizomnium glabrescens</i>
large-awned sedge	<i>Carex macrochaeta</i>
large-leaved avens	<i>Geum macrophyllum</i>
leafy aster	<i>Symphyotrichum foliaceum</i> var. <i>foliaceum</i>
leafy moss	<i>Mnium</i> sp.
leafy moss	<i>Plagiomnium</i> sp.
licorice fern	<i>Polypodium glycyrrhiza</i>
Lingbye's sedge	<i>Carex lyngbyei</i>
little buttercup	<i>Ranunculus uncinatus</i>
long beechfern	<i>Phegopteris connectilis</i>
long-leaved aster	<i>Symphyotrichum ascendens</i>
long-stalked starwort	<i>Stellaria longipes</i> var. <i>longipse</i>
Lyngbye's sedge	<i>Carex lyngbyei</i> ssp. <i>cryptocarpa</i>
Mackenzie's willow	<i>Salix proluxa</i>
many-flowered sedge	<i>Carex pluriflora</i>
marsh arrow-grass	<i>Triglochin palustris</i>
marsh cinquefoil	<i>Comarum palustre</i>
marsh cudweed	<i>Gnaphalium uliginosum</i>
marsh fern	<i>Thelypteridaceae</i>
marsh peavine	<i>Lathyrus palustris</i>

Common Name	Scientific Name
marsh violet	<i>Viola palustris</i>
meadow barley	<i>Hordeum brachyantherum</i>
meadow fescue	<i>Schedonorus pratensis</i>
meadow hawkweed	<i>Hieracium caespitosum</i>
meadow horsetail	<i>Equisetum pratense</i>
Merten's sedge	<i>Carex mertensii</i>
milkwort	<i>Polygalaceae</i>
mint	<i>Mentha</i> sp.
mountain arnica	<i>Arnica latifolia</i>
mountain sweet-cicely	<i>Osmorhiza berteroi</i>
narrow beech fern	<i>Phegopteris connectilis</i>
narrow-flowered bluegrass	<i>Poa stenantha</i> var. <i>stenantha</i>
narrow-leaved bur-reed	<i>Sparaganium angustifolium</i>
nodding trisetum	<i>Trisetum cernuum</i>
nodding wood-reed	<i>Cinna latifolia</i>
Nootka lupine	<i>Lupinus nootkatensis</i>
Nootka rose	<i>Rosa nutkana</i>
northern goldenrod	<i>Solidago multiradiata</i>
northern holly fern	<i>Polystichum lonchitis</i>
northern rice-root	<i>Fritillaria camschatcensis</i>
northern starflower	<i>Trientalis europaea</i> subsp. <i>arctica</i>
oak fern	<i>Gymnocarpium dryopteris</i>
orache	<i>Chenopodiaceae</i>
Oregon beaked-moss	<i>Eurhynchium oregana</i>
Oregon cliff fern	<i>Woodsia oregana</i> ssp. <i>oregana</i>
ostrich fern	<i>Matteuccia struthiopteris</i>
oval-leaved blueberry	<i>Vaccinium ovalifolium</i>
oxeye daisy	<i>Leucanthemum vulgare</i> <sup>a</sup>
Pacific crab apple	<i>Malus fusca</i>
Pacific hemlock-parsley	<i>Conioselinum gmelinii</i>
Pacific water-parsley	<i>Oenanthe sarmentosa</i>
Pacific willow	<i>Salix lucida</i>
Pacific willow	<i>Salix lucida</i> ssp. <i>lasiandra</i>
palm tree moss	<i>Leucolepsis acantheonueron</i>
Parry's rush	<i>Juncus parryi</i>
pearly everlasting	<i>Anaphalis margaritacea</i>
peat-moss	<i>Sphagnum</i> sp.

Common Name	Scientific Name
piggy-back plant	<i>Tolmiea menziesii</i>
pineapple weed	<i>Matricaria discoidea</i>
pink spirea	<i>Spiraea douglasii</i> ssp. <i>douglasii</i>
pink wintergreen	<i>Pyrola asarifolia</i>
plantain	<i>Plantago</i> sp.
prickly sow-thistle	<i>Sonchus asper</i>
purple sweet-cicely	<i>Osmorhiza purpurea</i>
purple-leaved willowherb	<i>Epilobium ciliatum</i>
queen's cup	<i>Clintonia uniflora</i>
red alder	<i>Alnus rubra</i>
red bearberry	<i>Arctous ruber</i>
red clover	<i>Trifolium pratense</i>
red columbine	<i>Aquilegia formosa</i>
red elderberry	<i>Sambucus racemosa</i>
red fescue	<i>Festuca rubra</i> ssp. <i>rubra</i>
red huckleberry	<i>Vaccinium parvifolium</i>
red raspberry	<i>Rubus idaeus</i>
red-osier dogwood	<i>Cornus stolonifera</i>
red-stemmed feathermoss	<i>Pleurozium schreberi</i>
redtop	<i>Agrostis gigantea</i>
reed canarygrass	<i>Phalaris arundinacea</i>
reed canarygrass	<i>Phalaris canariensis</i>
rock sandwort	<i>Minuartia stricta</i>
rough bluegrass	<i>Poa trivialis</i>
rough-moss	<i>Claopodium crispifolium</i>
running club-moss	<i>Lycopodium clavatum</i> var. <i>clavatum</i>
saline orache	<i>Atriplex subspicata</i>
salmonberry	<i>Rubus spectabilis</i>
saxifrage	<i>Saxifraga</i> sp.
scarlet paintbrush	<i>Castilleja miniata</i>
Scouler's harebell	<i>Campanula scouleri</i>
Scouler's willow	<i>Salix scouleriana</i>
sea milkwort	<i>Glaux maritima</i> ssp. <i>obtusifolia</i>
sea plantain	<i>Plantago maritima</i>
sea plantain	<i>Plantago maritima</i> ssp. <i>juncooides</i>
seabeach sandwort	<i>Honkenya peploides</i>
seacoast angelica	<i>Angelica lucida</i>

Common Name	Scientific Name
seacoast bluish	<i>Bolboschoenus maritimus</i> var. <i>paludosus</i>
seacoast bulrush	<i>Bolboschoenus maritimus</i>
seaside arrow-grass	<i>Triglochin maritima</i>
sedge	<i>Carex</i> sp.
shaggy rock-moss	<i>Racomitrium ericoides</i>
sheep sorrel	<i>Rumex acetosella</i>
single delight	<i>Moneses uniflora</i>
Sitka alder	<i>Alnus viridis</i> ssp. <i>sinuata</i>
Sitka burnet	<i>Sanguisorba canadensis</i>
Sitka mountain-ash	<i>Sorbus sitchensis</i>
Sitka sedge	<i>Carex sitchensis</i>
Sitka spruce	<i>Picea sitchensis</i>
Sitka willow	<i>Salix sitchensis</i>
skunk cabbage	<i>Lysichiton americanus</i>
small bedstraw	<i>Galium trifidum</i>
small pondweed	<i>Potamogeton pusillus</i> ssp. <i>tenuissimus</i>
small-flowered bulrush	<i>Scirpus microcarpus</i>
small-flowered forget-me-not	<i>Myosotis laxa</i>
small-flowered wood-rush	<i>Luzula parviflora</i>
smooth alumroot	<i>Heuchera glabra</i>
snake liverwort	<i>Conocephalum conicum</i>
speedwell	<i>Veronica</i> sp.
spike bentgrass	<i>Agrostis exarata</i>
spike trisetum	<i>Trisetum spicatum</i>
spiked wood-rush	<i>Luzula spicata</i>
spiny wood fern	<i>Dryopteris expansa</i>
spotted touch-me-not	<i>Impatiens capensis</i>
spring moss	<i>Philonotis fontana</i>
star-flowered false Solomon's-seal	<i>Maianthemum stellatum</i>
starwort	<i>Stellaria</i> sp.
step moss	<i>Hylocomium splendens</i>
stinging nettle	<i>Urtica dioica</i>
stink currant	<i>Ribes bracteosum</i>
stream violet	<i>Viola glabella</i>
swamp horsetail	<i>Equisetum fluviatile</i>
swamp smartweed	<i>Persicaria amphibia</i> var. <i>emersa</i>
sweet gale	<i>Myrica gale</i>

Common Name	Scientific Name
sweet-scented bedstraw	<i>Galium triflorum</i>
sword fern	<i>Polystichum munitum</i>
tall mannagrass	<i>Glyceria elata</i>
tapered rush	<i>Juncus acuminatus</i>
thick-headed sedge	<i>Carex pachystachya</i>
thimbleberry	<i>Rubus parviflorus</i>
thistle	<i>Cirsium</i> sp.
thread rush	<i>Juncus filiformis</i>
three-leaved foamflower	<i>Tiarella trifoliata</i>
thyme-leaved speedwell	<i>Veronica serpyllifolia</i>
toad rush	<i>Juncus bufonius</i>
trailing black currant	<i>Ribes laxiflorum</i>
trailing cinquefoil	<i>Potentilla angelica</i>
tree moss	<i>Climacium dendroides</i>
tufted hairgrass	<i>Deschampsia cespitosa</i>
twinflower	<i>Linnaea borealis</i>
Unalaska paintbrush	<i>Castilleja unalascensis</i>
wall lettuce	<i>Mycelis muralis</i>
water meadow-foxtail	<i>Alopecurus geniculatus</i>
water mudwort	<i>Limosella aquatica</i>
water sedge	<i>Carex aquatilis</i>
water smartweed	<i>Piersicaria amphibia</i> var. <i>stipulacea</i>
water-milfoil	<i>Myriophyllum</i> sp.
western buttercup	<i>Ranunculus occidentalis</i> var. <i>occidentalis</i>
western dock	<i>Rumex occidentalis</i>
western hemlock	<i>Tsuga heterophylla</i>
western mountain-ash	<i>Sorbus scopulina</i>
western oak fern	<i>Gymnocarpium disjunctum</i>
western rattlesnake-root	<i>Prenanthes alata</i>
western redcedar	<i>Thuja plicata</i>
western tansy mustard	<i>Descurainia pinnata</i>
white clover	<i>Trifolium repens</i>
white mountain-avens	<i>Dryas octopetala</i> ssp. <i>alaskensis</i>
white sweet-clover	<i>Melilotus alba</i>
widgeongrass	<i>Ruppia maritima</i>
willowherb	<i>Epilobium</i> sp.
winter cress	<i>Barbarea</i> sp.

Common Name	Scientific Name
woodland cudweed	<i>Omalotheca sylvatica</i>
yarrow	<i>Achillea millefolium</i>
yellow marsh-marigold	<i>Caltha palustris</i>
yellow pond-lily	<i>Nuphar polysepala</i>
yellow willowherb	<i>Epilobium luteum</i>

**NOTE:**

<sup>a</sup> Synonym = *Chrysanthemum leucanthemum*