

Information Sheet on Ramsar Wetlands (RIS) – 2009-2012 version

1. Name and address of the compiler of this form:

Markus Merkens
Natural Resource Management Specialist
Metropolitan Planning, Environment and Parks
Metro Vancouver
4330 Kingsway, Burnaby, BC, Canada V3N 2L8
Ph: 604-224-5739 Fax: 604-224-5841
Email: markus.merkens@metrovancouver.org

FOR OFFICE USE ONLY.

DD MM YY

--	--	--

Designation date

--	--	--	--	--	--

Site Reference Number

2. Date this sheet was completed/updated:

June 11, 2012

3. Country:

CANADA

4. Name of the Ramsar site:

Fraser River Delta

5. Designation of new Ramsar site or update of existing site:

This RIS is for:

- a) Designation of a new Ramsar site ; or
b) Updated information on an existing Ramsar site

6. For RIS updates only, changes to the site since its designation or earlier update:

The Ramsar site boundary and site area are unchanged:

or

If the site boundary has changed:

- i) the boundary has been delineated more accurately ; or
ii) the boundary has been extended ; or
iii) the boundary has been restricted**

and/or

If the site area has changed:

- i) the area has been measured more accurately ; or
ii) the area has been extended ; or
iii) the area has been reduced**

This nomination proposes the designation of the Fraser River Delta Wetland of International Importance (Ramsar Site) which will include the existing Alaksen Ramsar Site in a larger, more ecologically inclusive, Site as detailed in this RIS.

7. Map of site:

a) A map of the site, with clearly delineated boundaries, is included as:

- i) a **hard copy** (required for inclusion of site in the Ramsar List): ;
An overall map showing all Sub - components in relation to each other and individual maps for each component area included. (Figures 1-4)
ii) an **electronic format** (e.g. a JPEG or ArcView image) ;
iii) a **GIS file providing geo-referenced site boundary vectors and attribute tables** .

b) Describe briefly the type of boundary delineation applied:

Several provincially, regionally and municipally owned and managed areas in addition to wetlands owned by conservation organizations and leased to the provincial government have been included in this nomination for Ramsar designation. All six sub-components are located on the Fraser River delta. The areas include Burns Bog Ecological Conservancy Area (BBECA) and boundary parcels, Sturgeon Bank Wildlife Management Area, South Arm Marshes Wildlife Management Area, Boundary

Bay Wildlife Management Area, Serpentine Wildlife Management Area, and the Alaksen Ramsar Site, designated in 1982. Combined, these wetlands cover over 200 square kilometres (20,682 ha).

Sub – component	
Burns Bog	The boundary delineation consists of a combined outer boundary encompassing lands owned by 3 levels of government (provincial, regional and municipal). The core area has been designated (2004) as an Ecological Conservancy Area (ECA) and boundary parcels are slated to be added to the ECA once interagency agreements are finalized.
Sturgeon Bank	The boundary is the same as an existing provincial protected area (a Wildlife Management Area (WMA)) designated in 1998.
South Arm Marshes	The boundary is the same as an existing provincial protected area (a WMA) designated in 1991.
Boundary Bay	The boundary is the same as an existing provincial protected area (a WMA) designated in 1995.
Serpentine	The boundary is the same as an existing provincial protected area (a WMA) designated in 2009.
Alaksen	The boundary is the same as an existing national wildlife area (NWA) designated in 1973 and the George C. Reifel Migratory Bird Sanctuary, designated in 1967. The Alaksen sub-component was designated as a Ramsar Wetland of International Importance in 1982.

8. Geographical coordinates (latitude/longitude, in degrees and minutes):

The overall geographic centre of the nominated lands is: 49 deg 6 min North, 123 deg 03 min West

Sub - component	Approximate Centre
Burns Bog	49 deg 7 min North, 122 deg 58 min West
Sturgeon Bank	49 deg 10 min North, 123 deg 14 min West
South Arm Marshes	49 deg 6 min North, 123 deg 6 min West
Boundary Bay	49 deg 4 min North, 122 deg 57 min West
Serpentine	49 deg 5 min North, 122 deg 49 min West
Alaksen	49 deg 6 min North, 123 deg 10 min West

9. General location:

All sub-components of the nominated Ramsar site are located in the relatively densely (human) populated Metro Vancouver Region located in the south-west corner of the province of British Columbia, Canada. The area is home to an estimated 2.5 million people within 24 municipalities.

Sub - component	
Burns Bog	The centre of the Burns Bog Ecological Conservancy Area is 17 km south-east of the centre of the city of Vancouver, British Columbia (BC). It lies within the Corporation of Delta (a municipal government), BC, which has a population of just under 100,000 people (2009 estimate).
Sturgeon Bank	The centre of Sturgeon Bank Wildlife Management Area (WMA) is located at the mouth of the Fraser River along the western edge of the City of Richmond, BC, 7 km from the City of Vancouver. It forms the western border of Sea, Lulu and Iona islands. Richmond has a population of 193,000 (2009 estimate).
South Arm Marshes	South Arm Marshes Wildlife Management Area is located 17 km south of the centre of the city of Vancouver, BC. The islands of South Arm Marshes are at the mouth of the Fraser River located in the City of Richmond. A section of the WMA located on the mainland lies within the Corporation of Delta.
Boundary Bay	Boundary Bay Wildlife Management Area is 25 km south-east of the centre of the City of Vancouver, BC. It encompasses intertidal and near-shore subtidal provincial crown land bordered to the north and west by the Corporation of Delta, to the east by the City of Surrey (population 446,000 (2009 estimate)) and to the south by the US – Canada border.
Serpentine	Serpentine Wildlife Management Area is located within the City of Surrey, BC, and is 30 km south-east of Vancouver's city centre.
Alaksen	The Alaksen Ramsar Site is also located within the Corporation of Delta, BC, 17 km south of the centre of the City of Vancouver.

10. Elevation:

Sub - component	
Burns Bog	1.5 to 5 meters above sea level
Sturgeon Bank	0* to 5 m above sea level
South Arm Marshes	0* to 7 m above sea level
Boundary Bay	0* to 5 m above sea level
Serpentine	0* to 8 m above sea level
Alaksen	1 m below to 5 m above sea level.

*0 metres above sea level is taken to be sea level at the lowest low tide of the year.

11. Area:

Total area proposed for designation: 20,682 hectares (ha)

Sub - component	
Burns Bog	The BBECA and boundary parcels cover an area of 2,466 ha
Sturgeon Bank	5,152 ha
South Arm Marshes	937 ha
Boundary Bay	11,470 ha
Serpentine	71 ha
Alaksen	586 ha

12. General overview of the site:**Fraser River Delta Ecosystem**

Extensive wetlands existed throughout the Fraser River lowlands prior to the mid 1800s. Ecologically, the area was extremely productive and provided valuable habitat for large numbers of fish and wildlife. The area supported over a dozen First Nations groups and continues to provide seasonally abundant food and resources to them.

Draining and conversion of wetlands throughout the Fraser River lowlands for agriculture and urban development has resulted in an estimated loss of over 85% of historical wetlands. The effect of this has been to concentrate waterfowl and many other migratory birds in the estuary and remaining floodplain marshes. Today, the Fraser River estuary and tributary marshes are recognized as globally critical habitat for hundreds of thousands of migratory and over-wintering birds on the Pacific Flyway (mostly wintering and migrating shorebirds and waterfowl but also including high densities of wintering raptors as well as a variety of song birds; for a full list of species that are known to occur on the Fraser River estuary see Butler and Campbell 1986). Its productive estuarine habitats and nutrient rich waters provide the foundation for diverse and seasonally dense fish and wildlife populations and comprise the most important area of aquatic bird habitat in British Columbia.

The Fraser River is the largest single salmon-producing river system on the Pacific Coast of North America and supports healthy runs and some subpopulations that are of conservation concern. Whereas normal returns are typically less than 10 million, thirty-four million Sockeye (*Oncorhynchus nerka*) returned to the Fraser River in 2010. Five species of salmon (Chinook (*Oncorhynchus tshawytscha*), Chum (*Oncorhynchus keta*), Sockeye, Pink (*Oncorhynchus gorbuscha*), and Coho (*Oncorhynchus kisutch*)) as well as anadromous Steelhead Trout (*Oncorhynchus mykiss*) rely on the freshwater and brackish marshes at the mouth of the Fraser River as a critical life history transition to a life at sea by juvenile salmonids.

Many of the Fraser River delta wetlands are part of an area identified as Canada's most significant *Important Bird Area*, and are considered a critical migration stopover for shorebirds and waterfowl. Fifty shorebird species have been recorded in the area. Significant concentrations of Western Sandpiper (*Calidris mauri*), Dunlin (*Calidris alpina*) and Black-bellied Plovers (*Pluvialis squatarola*) occur annually. Large concentrations of American Wigeons (*Anas americana*), Northern Pintails (*Anas acuta*), Lesser Snow Geese (*Chen caerulescens caerulescens*), and Trumpeter Swans (*Cygnus buccinator*) gather on the delta annually during their wintering and winter migration periods. It is also frequented by gray whales and killer whales.

The Ramsar Site is made up of six sub-components located on the Fraser River Delta: Burns Bog, Sturgeon Bank, South Arm Marshes, Boundary Bay, Serpentine, and Alaksen. All of these remain ecologically and hydrologically connected to each other and the Fraser River.

Burns Bog

The Burns Bog Ecological Conservancy Area (BBECA) and boundary parcels are part of the remnant of a much larger raised bog located between the south arm of the Fraser River and Boundary Bay. Recognized as one of Canada's largest undeveloped natural areas retained within an urban area, the Bog is a unique ecosystem complex of global significance based on its chemistry (influenced by the nearby marine environment), form, location on a large estuarine delta, flora, and large size. It supports distinctive bog vegetation communities and regionally recognized rare and endangered plant and animal species. While not pristine, it is believed that the Bog has retained enough of its ecological integrity (wholeness) to allow its restoration over time.

The Bog exhibits the typical characteristics of a raised bog ecosystem: 1) a peat mound above the regional water table, 2) a persistent near-surface internal water mound, 3) acidic nutrient-poor water derived directly from rainfall, 4) a two-layered peat deposit consisting of an acrotelm and catotelm, and 5) a widespread peatland vegetation community dominated by peat moss (*Sphagnum* sp.) and plants belonging to the Heather family (Ericaceae).

Large numbers of waterfowl use shallow ponds within the BBECA as a stop-over and wintering site in combination with several nearby non-bog wetlands (Alaksen, Boundary Bay, Serpentine, South Arm Marshes). Waterfowl seek refuge in the somewhat protected wetland habitats of the Bog, particularly when twice daily high tides combine with winter storm events.

Sturgeon Bank

Sturgeon Bank Wildlife Management Area (WMA) is an intertidal coastal wetland located at the mouth of the Fraser River. Habitats found here include mudflats and intertidal marshes predominantly composed of sedge (*Carex* spp.), cattails (*Typha latifolia*) and bulrush (*Schoenoplectus americana* and *Scirpus* spp.), which are a critical source of food to the Fraser River estuary ecosystem. At low tides, large mudflats form in the bays and extensive eelgrass (*Zostera* spp.) beds are exposed. The marshes, mudflats and eelgrass beds provide foraging opportunities for hundreds of thousands of wintering and migratory waterfowl, shorebirds and other wildlife. Sturgeon Bank WMA, Alaksen sub-component, which has already been designated as a Ramsar Site, and South Arm Marshes WMA form an almost contiguous band of protected habitats within the Fraser River delta that are critical to survival of downstream migrant juvenile salmonids leaving the Fraser River.

South Arm Marshes

South Arm Marshes WMA encompasses a number of un-dyked intertidal islands (including Woodward, Duck, Barber) and several dyked, managed islands (Kirkland, Rose, Williamson and Gunn) in the south arm of the Fraser River and sections of adjacent mainland. The WMA is composed of brackish and freshwater intertidal wetlands, mudflats, flood-plain forests and agricultural fields. The WMA is an integral part of the delta as it contains 25% of the remaining marsh habitat in the estuary and lower Fraser River. The marshes contain critical foraging and roosting habitat for waterbirds, particularly during periods of dry or freezing weather or during winter storm events and twice-daily high tides which combine to force birds off of the delta front. The marshes are critical to juvenile salmonids leaving the Fraser River and for adult salmon returning to the river.

Boundary Bay

Boundary Bay WMA is an intertidal coastal wetland located on the southern front of the Fraser River delta. The bay receives freshwater from three small rivers - the Serpentine, Nicomekl and Campbell - as well as from surface water run-off from farmland along its northern edge. Habitats found here include mudflats, and intertidal marshes predominantly composed of sedge, glasswort (*Salicornia depressa*) and other grasses, which are critical to the Fraser River estuary ecosystem. At low tides, large mudflats form in the bays and extensive eelgrass beds are exposed. The marshes, mudflats and eelgrass beds provide foraging and loafing opportunities for hundreds of thousands of wintering and migratory waterfowl, shorebirds, raptors and other wildlife. One of the largest eelgrass meadows in Canada is found in the bay and supports an abundance of small fish and a productive crab fishery.

Serpentine

Despite its relatively small area, the Serpentine WMA supports wildlife populations that are surprising in both numbers and species richness. It is situated on a major intercontinental flyway for migratory waterfowl moving between Boundary Bay and the agricultural lands of the Serpentine and Nicomekl River floodplains. Before European settlement in the area, the floral communities of the lower Serpentine River floodplain were probably a heterogenous mix of grassland with freshwater and brackish marsh vegetation in low-lying areas and tree/woody shrub thickets wherever heights of land existed. Native vegetation communities no longer exist in their historical form since the area has been

both dyked and farmed. Currently, the Serpentine WMA is managed to create and maintain six basic habitat types: permanent or semi-permanent freshwater marsh, moist-soil seasonally flooded sites, agricultural fields, old-field, hedgerow/woodlot and saltmarsh. Management of the WMA is directed towards creating productive foraging areas for breeding and wintering waterfowl and wintering and migrating shorebirds.

Alaksen

The Alaksen sub-component has been previously designated as a Ramsar Site and will be incorporated into the Fraser River Delta Ramsar Site. Alaksen is situated on the northwestern corner of Westham Island and is comprised of 70% cultivated farmland, 15% freshwater and brackish tidal marsh wetlands, 5% woodland or grassland, and 5% built-up or barren shore flats. The site contains a microcosm of the habitats and wildlife presently found on the Fraser River delta. Soil-based agricultural use of the farmland provides much of the wildlife habitat seen today on the delta, consequently, farming the main management tool used on the Alaksen sub-component. Of the large numbers of birds dependent on deltaic habitats, the most abundant are waterfowl. Management has focused on three species that are particularly abundant and depend on agricultural lands for much of their food supply: snow goose (*Chen caerulescens*), Canada goose (*Branta canadensis*), and American Wigeon. For all three species, habitat management at the Alaksen site is intended to draw birds away from adjacent lands thereby helping to alleviate impacts to neighbouring agricultural lands.

13. Ramsar Criteria: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9

14. Justification for the application of each Criterion listed in 13 above:

This proposed Fraser River Delta Ramsar Site is composed of a network of sub-components whose overall ecological characteristics meet Criteria 1, 3, 4, 5, 6, 7 and 8 for identifying a Wetland of International Importance.

Criterion 1

The Fraser River delta is the most important remnant wetlands that support internationally and globally significant bird and fish populations on the west coast of Canada. The ecological importance of these remaining wetlands and the surrounding landscape has increased over time as an estimated 85% of the original Fraser River lowland wetland area has been lost to agricultural, urban and industrial development. Furthermore, migratory species (birds and fish) dependent on these wetlands are themselves important elements in provincial, national and international ecosystems hundreds or thousands of kilometres from the lower Fraser River.

Criterion 3

The Strait of Georgia and Puget Sound contain the largest and most biologically important estuaries of the region, forming unique coastal environments. The combination of rich and productive estuarine, floodplain and bog wetland elements within the proposed Ramsar site plays an important role in supporting high levels of biodiversity contained within the Strait of Georgia/Puget Lowland Ecological Region and the Strait of Georgia Estuarine Area. The Southern Strait of Georgia/San Juan Islands area has been identified as a Priority Conservation Area along the west coast of North America by the Commission for Environmental Cooperation of North America and Marine Conservation Biology Institute (Morgan *et al.* 2005). Priority Conservation Areas are defined on the basis of high biodiversity and continental uniqueness, incorporating aspects of ecological value, anthropogenic threat, and opportunities for conservation and habitat restoration.

Criterion 4

The proposed Ramsar site provides an internationally critical migratory stopover area for the Western Sandpiper, one of the most common shorebirds in the western hemisphere. On the Pacific coast of North America, they migrate in large flocks between breeding grounds in Alaska and coastal wintering areas from California to Peru. The primary Pacific coast migration route is defined by a chain of critical stopover sites, including Sturgeon Bank. Here, the northward migration is characterized by a peak in numbers from mid-April to early May. In comparison, the southward migration is less intense and spread over a longer period, late June to early October, because of sex- and age-segregated movements by the shorebirds. In either migration, an individual bird might spend several days on the delta.

During the late summer and early fall, the area is also very important for moulting grebes. Between 2,000 and 3,000 Western Grebes (*Podiceps occidentalis occidentalis*) are regularly present in Boundary Bay and as many as 2,500 Red-necked Grebes (*Podiceps grisegena*) have also been observed in the early fall.

Burns Bog provides some of the last breeding areas in the Lower Fraser Valley for the Sandhill Crane (*Grus canadensis*) and is also an important staging area for migrating Sandhill Cranes. The Lower Fraser Valley extends roughly 100 km upstream from the mouth of the Fraser River.

The Fraser River delta supports the highest density of wintering raptors in Canada. Favourable weather conditions and suitable marsh habitats also allow for significant winter concentrations of Short-eared Owls (*Asio flammeus*), Northern Harriers (*Circus cyaneus*) and, during particularly cold winters, Snowy Owls (*Bubo scandiacus*). Each of these species roosts communally in tall grass and other foreshore areas during winter months.

Criterion 5

The Fraser River estuary is a crucial staging area on the Pacific flyway for millions of migratory birds and supports the highest density of wintering waterbirds and raptors in Canada. It provides feeding and roosting sites to about 250,000 migrating and wintering waterfowl and 1 million shorebirds.

During the fall and early winter, one-day counts of greater than 100,000 waterfowl are made regularly within Boundary Bay. Some of the most abundant species include: American Wigeon, Northern Pintail, Mallard (*Anas platyrhynchos*) and Green-winged Teal. Although not as numerous, significant numbers of Trumpeter Swans (*Cygnus buccinator*) are also present during the winter. In the spring, thousands of Brant (mostly *Branta bernicla nigricans*) pass through the area. Wintering Brant numbers peak in April, with recent numbers typically between 1,250 and 3,300 individuals.

Snow Geese that breed on Wrangel Island in northern Russia winter on the Pacific coast of North America. About 100,000 stop on the delta front of the Fraser River estuary and most winter on the delta fronts of the estuaries of both the Fraser and Skagit Rivers. Geese that utilize the Fraser River estuary do so during the early part of winter (November through mid December) before moving to the Skagit River estuary 100 km to the south in Washington State, USA. Within the marshes of Sturgeon Bank and South Arm, snow geese feed primarily on the tubers and rhizomes of Bullrushes (*Schoenoplectus maritimus* and *S. americanus*). The Wrangel Island Snow Goose population has recovered from a population reduction in the 1970s and over the last 10 years as many as 100,000 Snow Geese have been counted on the deltas. Whereas the proportion of the Wrangel Island Snow Geese population that winters on the Fraser/Skagit deltas was ~25% during the 1970s, between 50 and 60% of the Wrangel Island population now winters on the Fraser and Skagit deltas.

For many species of shorebirds, the Fraser River estuary provides the most significant wintering and coastal migrating habitat in BC. The most numerous species are Western Sandpiper, Dunlin and Black-bellied Plover with annual counts, respectively, for the delta front approximating 0.5 -1 million, 62,000 and 2,300, respectively. During ground counts conducted in 1988-89, a peak of 14,000 Dunlin was recorded on Sturgeon Bank in January. Black-bellied Plovers are present on the estuary year-round, with a summer non-breeding population of approximately 200 and a winter population typically varying between 800-1,800 birds. Large numbers of Glaucous-winged Gulls (*Larus glaucescens*) are present in the winter with an average of 19,000 gulls (from 1992 to 1997) being recorded.

The BC Coastal Waterbird Survey (<http://www.bsc-eoc.org/volunteer/bccws/>), which was initiated in 1999 by Bird Studies Canada, is a monthly shoreline-based survey conducted by volunteers at over 240 sites along the BC coast. These surveys have documented maximum counts of congregatory waterfowl off Iona Island that range between 24,000 to 137,000 individuals each month between January and April in 2000 and November 2000 to April 2001.

Results of the monthly surveys conducted by the BC Coastal Waterbird Survey indicate that counts of congregatory waterbirds using some of the nominated WMAs exceeded 20,000 individuals during almost every month between October and April (2000-2010 inclusive). The greatest number of individuals recorded during this time period was 164,877 individuals for the Boundary Bay/Serpentine sub-components of the nominated wetland complex.

Alaksen surveys have also documented waterfowl occurrences of between 10,000 and 63,000 waterfowl of various species (other than Snow Geese), mostly American Wigeon and Mallard with significant numbers of Northern Pintail, Green-winged Teal, Canada Geese, and Trumpeter Swans.

Criterion 6

The proposed Ramsar site regularly supports the threshold of 1% of a population of a species or subspecies of waterbird. Wetlands International's waterfowl population estimates were used to

establish the 1% threshold criteria. Based on this, the following data show how five sites within the Fraser River Delta contain sufficient records to meet the 1% threshold. The threshold was exceeded for seventeen species (Table 1 and 2) and counts in recent years indicate that 30,000 to 40,000 birds (27-36% of the Wrangel Island population) have been supported at Alaksen. Formal survey results are not available for Burn's Bog.

Table 1. Number of counts recorded during the BC Coastal Waterbird Survey (monthly counts 1999 – 2010, 210 surveys in total) in which the number of individuals observed within the Sturgeon Bank and South Arm Marshes WMAs exceeded the 1% threshold for the species or subspecies population.

Species	Population	Highest count	1% Pop. Thresh.	Number of Counts >1%
Black-bellied Plover (<i>Pluvialis squatarola</i>)	Alaskan	500-2,000	500	14
Double-crested Cormorant (<i>Phalacrocorax auritus cininnatus</i>)	N.W. North America	200	110	2
Dunlin (<i>Calidris alpina pacifica</i>)	Pacific	18,000	5,500	>30
Greater Scaup (<i>Aythya marila mariloides</i>)	North America	6,900	5,600	1
Red-throated Loon (<i>Gavia stellata</i>)	North America	7,000	400	2
Snow Goose (<i>Chen caerulescens caerulescens</i>)	Wrangel Island	11,281	1,100	>22
Surf Scoter (<i>Melanitta perspicillata</i>)	N.W. North America	90,000	10,000	5
Thayer's Gull (<i>Larus thayeri</i>)	North America	623	100	7
Western Grebe (<i>Podiceps occidentalis occidentalis</i>)	North America	7,274	1,200	4
White-winged Scoter (<i>Melanitta fusca deglandi</i>)	N.W. North America	12,100	10,000	2

Table 2. Number of counts recorded during the BC Coastal Waterbird Survey (1999 – 2010, 700 surveys in total, approximately weekly) in which the number of individuals observed within the Boundary Bay and Serpentine WMAs exceeded the 1% threshold for the species or subspecies population.

Species	Population	Highest count	1% Pop. Thresh.	# of Counts >1%
American Wigeon (<i>Anas americana</i>)	North America	51,500	20,000	10
Black Brant (<i>Branta bernicula nigricans</i>)	Eastern Pacific	2,568	1,400	1
Black-bellied Plover (<i>Pluvialis squatarola</i>)	Alaskan	500-8,500	500	>30
Double-crested Cormorant (<i>Phalacrocorax auritus cininnatus</i>)	N.W. North America	120-150	110	2
Dunlin (<i>Calidris alpina pacifica</i>)	Pacific	5,000-105,000	5,500	>36
Glaucous-winged Gull (<i>Larus glaucescens</i>)	North America	20,000	5,700	1
Great Blue Heron (<i>Ardea herodias fannini</i>)	N.W. North America	68-150	65	18
Northern Pintail (<i>A. acuta</i>)	North America	37,000	20,000	5
Red-necked Grebe (<i>Podiceps grisegena hoboellii</i>)	North America	2,728	450	8
Red-throated Loon (<i>Gavia stellata</i>)	North America	487	400	1
Snow Goose (<i>Chen caerulescens caerulescens</i>)	Wrangel Island, Russia	3,000-20,000	1,100	>50
Thayer's Gull (<i>Larus thayeri</i>)	North America	320	100	1
Trumpeter Swan (<i>Cygnus buccinator</i>)	Pacific	470	240	6
Western Grebe (<i>Podiceps occidentalis occidentalis</i>)	North America	4,500	1,200	5

Criterion 7. The Fraser River forms the largest estuary along the Pacific Coast of North America. The mixing of fresh river water with saline marine water in estuaries creates an environment that supports a rich and diverse aquatic community. The variation in salinity from the marine waters at its mouth to freshwater farther upstream is a main contributor to the diversity of fish species found in the Fraser River estuary. At least 77 species of fish have been identified using the Fraser River estuary (Naito 2004) including 5 species of anadromous salmon ((Chinook Salmon, Chum Salmon, Coho Salmon, Pink Salmon and Sockeye Salmon and Steelhead Trout.

A number of Provincially and Federally listed fish species of concern can be found within the estuarine habitats provided on the delta, including:

- White Sturgeon (*Acipenser transmontanus*): provincially red-listed*, federally listed on Schedule 1 of the Species at Risk Act (SARA), Endangered (Committee on the Status of Endangered Wildlife in Canada (COSEWIC));
- Green Sturgeon (*Acipenser medirostris*): provincial red-list, SARA Schedule 1, Special Concern (COSEWIC);
- Eulachon (*Thaleichthys pacificus*): provincial blue list;
- Coho Salmon (*Oncorhynchus kisutch*), Interior Fraser Population: Endangered (COSEWIC);
- Cutthroat Trout (*Oncorhynchus clarkii clarkii*): provincial blue list*,
- Dolly Varden (*Salvelinus malma*): provincial blue list;
- Sockeye Salmon (*Oncorhynchus nerka*), Cultus Population: Endangered (COSEWIC); and,
- Brassy Minnow (*Hybognathus hankinsoni*): candidate for assessment by COSEWIC.

*Note: Provincial conservation listing - Red listed species are at the greatest risk, blue at moderate risk and yellow at the lowest risk.

A diversity of life history stages of salmon are supported by the Fraser River delta. Juvenile and adult salmon are found in estuarine waters of the delta as they adapt to environmental differences between freshwater and marine environments.

Criterion 8. The Fraser River delta's productive estuarine habitats and nutrient rich waters provide the foundation for diverse and seasonally dense fish populations. In particular, the Fraser River is the largest producer of salmon on the entire Pacific Coast of North America. Annually, millions of anadromous salmon migrate through the estuary upstream to spawn along numerous tributaries. Millions of young fish later descend to the estuary on their way out to oceanic habitats. The Sturgeon Bank, Alaksen, and South Arm Marshes sub-components form an almost contiguous band of protected habitats within the Fraser River delta that is important to survival of these juveniles leaving the Fraser River. Estuarine marsh, mudflats, floodplains, sloughs and river channels are all critical feeding and rearing areas for these during their transition between river and marine stages of their life cycle. One of the largest eelgrass meadows in Canada is found in Boundary Bay, which supports an abundance of small fish and shell fish.

15. Biogeography

a) biogeographic region:

Terrestrial Ecoregions of North America :
 Level 1 and 2 - Marine West Coast Forests
 Level 3 - Strait of Georgia/Puget Lowland

Marine Ecoregions of North America :
 Level 1 – Columbian Pacific
 Level 2 – Columbian Shelf
 Level 3 – Strait of Georgia Estuarine Area

b) biogeographic regionalisation scheme:

Ecoregions of North America

Since 1994, Canada, Mexico and the United States have collaborated in protecting North America's environment through the North American Agreement on Environmental Cooperation (NAAEC).

To assist in the goal of protecting the shared North American environment, a three level hierarchical scheme has been adopted for different levels of Terrestrial Ecological Regions across North America through the Commission for Environmental Cooperation (CEC). Level 1 is the coarsest level, dividing North America into 15 broad ecological regions. These highlight major ecological areas and provide the broad backdrop to the ecological mosaic of the continent, putting it in context at global or intercontinental scales. The 50 Level 2 ecological regions that have been delineated are intended to provide a more detailed description of the large ecological areas nested within the level 1 regions. Level 2 ecological regions are useful for national and sub-continental overviews of ecological patterns. At level 3, the continent currently contains 182 ecological regions. Because level 3 regions are smaller, they allow locally defining characteristics to be identified, and more specifically oriented management strategies to be formulated.

Within the Marine Ecoregions of North America, Level 1 captures ecosystem differences at the largest scale, defining large water masses and currents, large enclosed seas, and regions of coherent sea surface temperature or ice cover. This level is determined by processes that pertain to a whole ocean basin. The cross-shelf domain of Level 1 extends from the coasts to the deep oceans, although biogeographic patterns and processes in the deeper regions are still poorly understood. As a practical matter, the seaward boundary extends only to the jurisdictional limits of the Exclusive Economic Zone (EEZ), 200 nautical miles (370 km) offshore. The biogeographic regions themselves, however, may extend beyond the EEZ. Level 2 captures the break between neritic (near shore) and oceanic areas and is determined by large-scale physiography (continental shelf, slope, and abyssal plain, as well as areas of oceanic islands and major trenches, ridges and straits). This level reflects the importance of depth as a major determinant of benthic marine communities as well as the importance of major physiographic features in determining current flows and upwelling. Like Level 1, it extends from the coasts to the EEZ. Level 3 captures differences within the neritic realm and is based on more locally significant variables (local characteristics of the water mass, regional landforms, as well as biological community type). Level 3 is limited to the continental shelf, since only this area has sufficient information for finer-scale delineation.

Commission for Environmental Cooperation. 2009. Ecological Regions of North America. Commission for Environmental Cooperation. Montréal, Québec, Canada. Online : <http://www.cec.org/naatlas/>

Wilkinson T., E. Wiken, J. Bezaury-Creel, T. Hourigan, T. Agardy, H. Herrmann, Janishevski, C. Madden, L. Morgan, M. Padilla. 2009. Marine Ecoregions of North America. Commission for Environmental Cooperation. Montreal, Canada. 200 pp.

16. Physical features of the site:

Climate

The climate of the Fraser River delta is categorized as inshore marine and is strongly influenced by the surrounding mountains. During the winter, low pressure systems move in from the Pacific Ocean; the frontal lifting that occurs when these air masses meet the mountains results in precipitation. The mean annual precipitation for areas within the lower Fraser River delta is approximately 1,200 mm. About 75 percent of this precipitation occurs from October to March. Frequent long periods of warm, sunny weather occur from April to September due to large high pressure systems that extend over the area. Rainfall is relatively low during this period. The mean low temperature of 3.0°C occurs in January and the mean high of 17.2°C occurs in July. River flow increases during rainy periods but reaches a peak flow in June when snow melts in the coastal and interior mountains.

Burns Bog

The peat deposits of Burns Bog rest upon a 300-800 m thick complex of unconsolidated glacial outwash, till, marine sediments, and post-glacial deltaic sediments of sand, silt and clay which overlie deeply buried bedrock. The peat has developed over thousands of years and ranges between 1 and approximately 8 m in thickness at the rand and centre of the bog, respectively. This two-layered peat deposit consisting of the actively growing acrotelm and the underlying anoxic peat mound is strongly acidic.

Surface and shallow ground water are mostly ombrogenous (rain fed), low in dissolved nutrients and acidic in nature (pH 3.5-5.5). Water table levels are partially under tidal influence and range between 0.5 to 1.0 m below surface across the bog during summer months and at surface or just below surface (-20 cm) during winter. The bog exhibits winter recharge and summer discharge patterns.

Sturgeon Bank

Sturgeon Bank is located between the north and middle arms of the Fraser River and is strongly affected by the quantity, quality and timing of freshwater flow, and by the tides and the winds of the Strait of Georgia. Surface current patterns are strongly dominated by river flows. These freshwaters are less dense than the saline waters of the Strait of Georgia, and as a result, a halocline occurs within the Fraser River estuary. The halocline persists as the water column is not sufficiently mixed by tidal and wind action to adequately intergrade fluvial and marine waters.

The tides of the Strait of Georgia, and that of the Fraser River estuary, are of a mixed type. Tides exhibit diurnal and semidiurnal inequality which affects both the timing and the height of the tide. This occurs principally in the height and in the time of succeeding low tides. There is approximately a two week cycle in tidal ranges, as well as a seasonal cycle. The lowest tides occur near midnight during the winter months and near mid-day during the summer months.

The Fraser River estuary is classified as an open coast delta. Wind-generated waves, longshore and tidal currents (mean tidal range 2.6 m; extremes may exceed 5.4 m) are the main processes redistributing sediments on the tidal front and flats. Prevailing winds are from the northwest in summer and from the southeast in winter.

The intertidal and nearshore subtidal environments are divided into salt marsh and platform zones. The salt marsh occurs near the high tide level as a vegetated bank of flat to hummocky muddy sediment. The platform gently slopes for approximately 6 km from the salt marsh to the level of the most distinct, first break-in-slope (approximately 9 m below lowest normal tide level). This zone is mantled mainly with well-sorted 0.125 mm to 0.35 mm sand. It is generally featureless except for the presence of tidal channels and hydraulic bedforms (current and wave ripples).

Sturgeon Bank is covered almost entirely by sand-size sediment. A "lobe" of uniform, well sorted, medium sand extends from the mouth of the middle arm of the Fraser River to the edge of the platform. Sediments of this coarseness are discharged during the periods of higher river flow.

South Arm Marshes

The islands of the South Arm Marshes are primarily intertidal, which are flooded by daily tides and spring freshet. Dykes built in the mid-1920s (well before the designation of the WMA) to direct the main flow of the Fraser River north of the South Arm Marshes have had the greatest impact on the hydrology of the South Arm Marshes. The reduced flows as a result of a series of flow management decisions have increased silt deposition in the South Arm Marshes between 1860 and 1978, leading to a net increase of 622 ha in the size of the islands, and the formation of the 82 ha Ladner Marsh.

Four of the islands (Kirkland, Rose, Williamson and Gunn) are dyked. The dyked islands and adjacent tidal flats consist of deposits of alluvial sediments carried by the Fraser River. These deposits are composed of sands, silts and clays in various proportions. The islands are composed of sand with a layer of silt and clay at least 1 m thick.

Boundary Bay

Boundary Bay is a shallow marine bay formed from deltaic deposits from the former floodplain of the Fraser River, erosion of the Tsawwassen and White Rock (two neighbouring communities on the western and eastern edge of Boundary Bay, respectively) uplands and by sediments deposited by the Nicomekl and Serpentine Rivers. Sediments vary in texture from sands in the western portion of the Bay to silty clay materials in Mud Bay at the eastern extent of Boundary Bay near the mouth of the Serpentine and Nicomekl Rivers. The saltmarsh is underlain by silty and sandy peat.

Water circulation in Boundary Bay is driven mainly by diurnal tides that move in a counter-clockwise direction from Semiahmoo Bay (in Washington State, USA, immediately south and adjacent to Boundary Bay) to Boundary Bay. The ebb tide is concentrated along the western part of Boundary Bay. A clockwise drift at Point Roberts deposits sand from eroding sandstone cliffs along beach areas. Beaches and mudflats are uncovered twice a day by low tides. During very low tides, Mud Bay drains almost completely. Tidal gates (sea dams) are used in the Serpentine and Nicomekl Rivers to prevent saltwater intrusion and to protect the quality of irrigation water.

The main freshwater inputs to Boundary Bay are from the Serpentine, Nicomekl and Campbell Rivers at the eastern end of the Bay. All three rivers are tidally influenced for several kilometres upstream. Because of the influence of the Serpentine and Nicomekl Rivers, the salt content of the Bay increases in a westerly direction to salinities consistently above 1.5%. Other freshwater inputs are from three agricultural drainage ditches and from small creeks and stormwater run-off.

Serpentine

The substrates of the Serpentine WMA are of fluvial and glaciofluvial origin. The dyked farmlands and adjacent tidal flats of the Mud Bay lowlands are part of an alluvial plain with a maximum elevation of 15 m. This plain was formed by post-glacial tidal action between the 100 m high morainal deposits of Panorama Ridge to the north and the 45 m high morainal deposits of the Sunnyside Uplands to the south. The area is drained by the Nicomekl and Serpentine Rivers, the estuaries of which meet in Mud Bay. Before the area was dyked in the 19th century, the surrounding area formed part of the tidal salt-marsh of Mud Bay. The landform is flat to slightly undulating and is characterized by poorly drained, medium to moderately fine textured deltaic deposits, often overlain with 10 to 160 cm of peaty to well-decomposed organic soil. The organic soils are acidic, with a typical range of pH 4.2 to 4.5. The low pH is due to the build-up of organic matter caused by retarded oxidation, and from several 'veins' of peaty material that bisect the northern soils in the area. The soils are combinations of Rego, Orthic and Humic Gleysols where mineral soil is at the surface, or of Teric Humisols and Teric Mesisols in areas where deep organics occur.

After land in Serpentine was acquired by the BC Ministry of Transportation and Highways in 1961, farmers that leased the land created conditions for wet meadows to develop. The deep-water wetlands were created in 1973, 1980 and 1984, after the area was committed to the management of wildlife habitat values. The area officially became a Wildlife Management Area in 1999. Water is supplied by rainfall, pumping from the nutrient rich Serpentine River and a small artesian spring.

Water quality characteristics vary seasonally. Water temperature fluctuates with the ambient air temperature. Water pumped from the Serpentine River has a pH of 6.0 to 6.2, while the pH of the wetlands can vary between 6.3 in the spring and 7.0 in the summer. The water from the artesian spring is more alkaline, ranging from 8.0 (winter) to 8.5 (summer). Water conductivity is usually less than 0.6 mmhos, but can be higher where saltwater leakage occurs around culverts.

The water has high turbidity due to staining from organic soils and suspended particulate matter, resulting in light penetration of only 4 to 17 cm. The high nutrient levels contribute to algal blooms, which further increase the turbidity. High turbidity, combined with low pH, has hindered the development of rooted aquatic vegetation.

Alaksen

The salinity of the intertidal zone is low owing to the influence of the freshwater of the Fraser River, which flows into the area. The soils are saline Gleysols which have developed from the medium deltaic deposits.

Sloughs were originally tidal sloughs until the ends were blocked with fill to join the deltaic islands for farming. They have subsequently reverted to freshwater, although there is some salt intrusion through their sandy bottoms. With time, silt and organic deposits have begun to seal the bottoms from the underlying saline waters. In some cases, siltation and deposition of organic matter has significantly reduced channel depth and water flow.

17. Physical features of the catchment area:

In general, the area is underlain by unconsolidated glaciofluvial deposits, silty alluvium, silty and clayey marine sediments and glacial till. Bedrock outcrops of Mesozoic and Palaeozoic origin form rolling hills up to about 310 m above sea level. The Fraser River dominates this lowland. Gleysols, Mesisols, and Humisols are the dominant wetland soils in the region, while Eutric and Dystric Brunisols and some Podzols have developed on sandy to loamy outwash and glacial till in the uplands. The southern extent of the Coastal Mountain Range rises abruptly to the north and consists of granitic outcrops of Mesozoic origin draped in places by glacial deposits, colluvium and thin organic soils.

Burns Bog

The catchment area for the bog is the bog itself. Small sections of remnant lagg zone buffer the core of the bog from the influence of surface water run-off from surrounding uplands. Mineral rich neutral to basic water mixes with acidic bog water in this transition zone resulting in intermediate or transition waters.

Sturgeon Bank

As an intertidal coastal wetland with a dyke as the boundary between Sturgeon Bank and the upland areas of Lulu, Sea and Iona Islands, the catchment area is largely limited to the WMA itself. Sturgeon Bank does receive some run-off from ditches that drain Lulu, Sea and Iona Islands. About 45% of Lulu Island is urban residential, with most of it concentrated on the west side of the island. Another 45% is primarily agriculture with the remaining 10% composed of public parkland and other green space. About 75% of Sea Island is devoted to Vancouver International Airport. There is a small section of urban residential. The remainder is undeveloped old-field habitat managed as a conservation area created as compensation for habitat lost due to the recent expansion of the airport. Iona Island contains a primary sewage treatment facility operated by Metro Vancouver. The facility contains a plant, four sewage treatment lagoons and two wetlands. The remaining area is undeveloped. The geology, geomorphology and climate of Lulu, Sea and Iona Islands are identical to Sturgeon Bank.

South Arm Marshes

The catchment area of the South Arm Marshes is limited to the small area of dyked islands that remain above sea level at high tide.

Boundary Bay

The catchment area of Boundary Bay is limited to the Serpentine, Nicomekl and Campbell Rivers, plus a small area of uplands in Delta and Surrey drained by small ditches and run-off. The catchment area is primarily agricultural, urban residential and industrial.

Serpentine

Serpentine is primarily a set of artificial dyked wetlands that are irrigated using freshwater upstream of the sea dam on the Serpentine River. The Serpentine River extends eastward through farmland in several communities. The catchment area includes small forested fragments, urban and suburban developments and large agricultural areas. Water loss from Serpentine is either through losses to groundwater or evaporation.

Alaksen

Alaksen includes a number of natural and naturalized sloughs and ditches. Water movement is controlled by a system of water control structures constructed and managed under an agreement with Ducks Unlimited Canada. The sloughs are surrounded by maturing riparian areas and farmland.

They are about 2-3 m deep and are valuable wintering areas for waterfowl as well as potential feeding habitat for other birds and some species of herpetiles.

18. Hydrological values:

The water storage capacity of Burns Bog provides a reservoir that recharges over winter and discharges over the summer months. It provides water for the surrounding wetlands (lagg zone) and has provided irrigation waters for surrounding farms. The bog has sequestered significant carbon stores over its lifetime. Carbon sequestration continues within intact portions of the bog and will be restored in areas targeted for bog regeneration.

Sediment deposition is the primary hydrological value of Sturgeon Bank, South Arm Marshes, and Boundary Bay sub-components. These sediments provide a suitable substrate for marsh vegetation which is the basis for the productivity of the delta. As a constructed wetland, Serpentine is of limited hydrological value for flood control or as a source of groundwater recharge. The Alaksen sub-component consists of freshwater bodies, which are about 2-3 m deep and are valuable wintering areas which seldom freeze over for more than three weeks.

19. Wetland Types (as per the Ramsar “Classification System for Wetland Type”)

a) presence:

Marine/coastal: A B C D E F G H I J K Zk(a)

Inland: L M N O P Q R Sp Ss Tp Ts U Va •Vt W Xf Xp Y Zg Zk(b)

Human-made: 1 2 3 4 5 6 7 8 9 Zk(c)

b) dominance: (wetland types identified in a) above in order of their dominance (by area) in the Ramsar site)

Sub - component	
Burns Bog	Xp, U,7,Ts,Tp
Sturgeon Bank	H, G, B, A
South Arm Marshes	H, G, F
Boundary Bay	H, G, B, A
Serpentine	2, 4, H, Tp
Alaksen	F, G, K, Sp

20. General ecological features:

Burns Bog

The BBECA and boundary parcels contain 24 plant community types including forests, shrublands and sparsely vegetated ecosystems. Plant diversity is high with 188 species of trees, shrubs and herbaceous plants, 53 mosses including 12 *Sphagnum* species, 16 liverworts, 94 macrofungi and 26 lichens being found there. Remaining natural habitat along the margins of the raised bog area consist of western red cedar (*Thuja plicata*) forest with an understory of shrubs growing on peaty soil. Moving towards the centre of the bog a moderate to low growing forest community consisting primarily of Lodgepole pine (*Pinus contorta*) and birch (*Betula* sp.) has been expanding due to a lowering of the water table. Efforts are currently underway to restore the water table and manage the BBECA to return to its raised bog ecosystem origins. Undisturbed plant communities consisting of *Sphagnum* and low growing shrubs occur in the southern third and north-west sector of the bog. Large shallow ponds in the centre of the bog and towards the north provide refuge to wintering waterfowl as well as nesting sites for breeding waterfowl.

The bog contains a healthy source population of North American Beaver (*Castor canadensis*) and is home to Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*) and Black Bear (*Ursus americanus*). Other mammals found within the bog include a provincially red-listed Southern Red-backed Vole subspecies (*Myodes gapperi occidentalis*). The bog plays an important regional role in ecological and wildlife diversity by providing habitat for waterfowl, maintaining the largest extent of bog ecosystems in the lower BC mainland, and harbouring several plant species at the southern edge of their geographic range. The area contains important breeding habitat for the regional recovery of the local Sandhill Crane population, which is of provincial conservation concern (yellow list).

The bog currently contains significant carbon stores in the form of catotelm peat and has the capacity to continue to accumulate carbon once the peat forming process is restored within the context of the Burns Bog Management Plan (available at www.metrovancouver.org) to much of the bog.

Sturgeon Bank

Three elevation zones of vegetation are found within the floodplain of this sub-component: a low marsh dominated by bullrush; a middle marsh dominated by Lyngbye's sedge (*Carex lyngbyei*), sea-side arrow grass (*Triglochin maritime*) and bulrush; and a high marsh community of coastal grasses (*Agrostis exarta*, *Distichlis spicata*), and cattails. Fourteen species were identified within the two zones of which five Cyperaceae species: *Carex lyngbyei*, *Eleocharis palustris*, *Schoenoplectus americanus*, *Scirpus maritimus*, and *Scirpus validus*, encompassed 93 percent of the total area of marsh within the study area. *S. americanus* and *C. lyngbyei*, the dominant species within the upper and lower tidal zones, respectively, accounted for 70 percent of the total area of marsh.

The mud teems with tiny invertebrates – in some places over 1,000 invertebrates have been tallied in a 10 cm diameter core of mud. And on the surface, tiny diatoms and bacteria coat the mud in a greenish biofilm that Western Sandpipers dab from the surface with specialized tongues. In the marshes, Dowitchers probe for marine worms and yellowlegs dart after small fish. On the sandflats, Black-bellied Plovers and Dunlins pursue marine worms.

In Sturgeon Bank, the main channels of the Fraser River, off-channel habitat, dendritic channels, and shallow water mudflats provide important estuarine habitat to fish including 5 species of anadromous salmon (Chinook, Chum, Coho, Pink and Sockeye) and Steelhead Trout

South Arm Marshes

Vegetation zones in the South Arm Marshes are largely a result of elevational gradients. Four zones are recognized: low marsh, intermediate marsh, high marsh and backshore. Increases in elevation also correlate with increasing successional stage. Low marsh is intertidal and always submerged at high tide. It is characterized by bulrush, creeping spike-rush (*Eleocharis palustris*), and swamp horsetail (*Equisetum fluviatile*). Intermediate marsh is characterized by Lyngbye's sedge, tall fescue (*Festuca arundinacea*) and tufted hairgrass (*Deschampsia despitosa*). Well-drained high marsh sites support tall fescue, creeping bent grass (*Agrostis palustris*) and the non-native invasive purple loosestrife (*Lythrum salicaria*). When standing water is present, dense stands of cattail occur. Backshore areas, such as less frequently flooded levees, are composed of willow (*Salix sp.*) thickets, red-osier dogwood (*Cornus stolonifera*), red alder (*Alnus rubra*), western hemlock (*Tsuga heterophylla*) and other mixed shrubs. Where elevation, dykes or fill has eliminated tidal influence, black cottonwood (*Populus trichocarpa*) occurs. Agriculture occurs on the dyked islands as a source of food to lure waterfowl away from commercial growers.

Boundary Bay

Most of Boundary Bay is marine influenced. The estuarine areas in Mud Bay at the mouth of the Serpentine, Nicomekl and Little Campbell Rivers are exceptions.

Boundary Bay has four major habitat zones: high intertidal saltmarsh, intertidal mudflats, low intertidal eelgrass beds, and deep water areas below low tide. The saltmarsh zone is one of the major sources of organic detritus and nutrients for lower intertidal areas. The saltmarsh is characterized by salt tolerant vegetation such as maritime glasswort, sea plantain (*Plantago maritima*), seashore salt grass, arrow grass and sand spurry (*Spergularia salina*). The intertidal mudflats, which extend 1 to 2 km at low tide, are characterized by a network of dendritic tidal channels. The mudflats support a diverse assemblage of marine invertebrates and algae that are utilized by shorebirds, waterfowl and gulls. The extensive eelgrass beds occur at and below the mean low tide mark. Eelgrass is a primary food for migrating and wintering Brant and an important food for American Wigeon, Mallard and Northern Pintail. Eelgrass also provides nursery and spawning areas for species such as Pacific Herring (*Clupea pallasii*) and Dungeness Crab (*Metacarcinus magister*). Subtidal areas provide feeding areas for marine mammals, diving ducks, loons, grebes, Great Blue Herons (*Ardea herodias*), Bald Eagles (*Haliaeetus leucocephalus*) and Peregrine Falcons (*Falco peregrinus*).

Serpentine

Serpentine, composed of dyked wetlands, is currently managed to create and maintain six basic habitat types: permanent or semi-permanent freshwater marsh, moist-soil seasonally flooded sites, agricultural fields, old-field, hedgerow/woodlot and saltmarsh. Four of the marshes are allowed to draw-down during the summer to encourage growth of submergent and emergent vegetation (smartweed (*Polygonum sp.*), *Juncus sp.*, cattails and round-stem bulrush) and provide mudflat habitat to migrating shorebirds. Moist-soil fields are tilled every three years to encourage growth of annuals, such as smartweed, *Juncus sp.*, bentgrass and reed canary grass. The precise species mix depends on the frequency of tillage and the timing and duration of flooding. The agricultural fields are managed to provide forage for grazing waterfowl (mainly Canada Geese and American Wigeon) and

cereal crops (corn, winter wheat, oats, and barley), which are left unharvested as forage for waterfowl and other wildlife. These crops help to lure waterfowl away from commercial crops. Old-field habitat is developing in wet meadows that are no longer being tilled and on infrequently mowed dyke slopes. Shrubs and trees have either recruited naturally, or have been planted along fence lines, field perimeters, dyke toes and other unmanaged areas to provide hedgerows. Formerly dyked land inside an oxbow of the Serpentine River now lies outside the dyke. Breaches in the dyke allow brackish water to flood the area on high tides. The saltmarsh supports halophytic plants such as salt grass, arrow grass and glasswort.

Alaksen

The three main vegetational types on the intertidal zone are cattail, sedge and bulrush communities. The cattail community comprises cattail (*Typha* spp.), Lyngbye's sedge and water plaitain (*Alisma plantago-aquatica*). The sedge community comprises Lyngbye's sedge in association with bent grasses, *Agrostis* spp., and round-stemmed bulrush (*Scirpus validus*). The bulrush community, which is completely submerged at high tide is dominated by three-square bulrush (*Scirpus americanus*) with some round-stem bulrush. In addition to the commercial crops, there are grasses such as bent grasses, velvet grass (*Holcus lanatus*), Canada blue grass (*Poa compressa*) and smartweed. These grasslands and the crop remnants provide food for waterfowl especially in winter when the fields are semi-flooded. On higher and well-drained sites are red alder, willow, and black cottonwood, with shrub communities of snowberry (*Symphoricarpos albus*), salmon berry (*Rubus spectabilis*) and blackberry (*Rubus* sp.). These thickets provide good habitat for pheasants and passerines.

21. Noteworthy flora:

A number of plant species of conservation concern in the province are known to occur in one or more of the Ramsar site sub-components. These occurrences, plus the conservation ranking of these species at the global (G) and provincial (S) level (using NatureServe nomenclature, <http://www.natureserve.org/explorer/>) are given in Table 3. Provincial rankings are based on a three level system (red, blue and yellow), which indicates the level of risk that these species may become extirpated from the province, from highest risk to lowest risk, respectively.

Table 3. Plant species and communities of conservation concern present in Fraser River Delta Ramsar site.

Species or Community	Nature Serve Ranks	Species at Risk Act Listing (Federal)	Provincial Status
Field Dodder (<i>Cuscuta campestris</i>)	G5, S2S3	Not listed	Blue list
Henderson's Checker-mallow (<i>Sidalcea hendersonii</i>)	G3, S3	Not listed	Blue list
'Henderson's checker-mallow -Tidal Marsh Community'	G1, S1	N/A	Red list
Joe-pye weed (<i>Eutrochium maculatum</i> var. <i>Bruneri</i>)	G5T4T5Q, S1	Not listed	Red list
Needle-leaved Navarretia (<i>Navarretia intertexta</i>)	GNR, S2	Not listed	Red list
Small Spike-rush (<i>Eleocharis parvula</i>)	G5, S2S3	Not listed	Blue list
Vancouver Island Beggartick (<i>Bidens amplissima</i>)	G3, S3	Not listed	Blue list

22. Noteworthy fauna:

A number of federally and provincially listed animal species of conservation concern are known to occur in one or more of the six sub-components. These occurrences, plus the conservation ranking of these species at the global (G) and provincial (S) level (using NatureServe nomenclature, <http://www.natureserve.org/explorer/>) are given in Table 4. Federal listings under the Species at Risk Act are noted where applicable. Provincial rankings are based on a three level system (red, blue and yellow), which indicates the level of risk that these species may become extirpated from the province. Red listed species are at the greatest risk, blue at moderate risk and yellow at the lowest risk. Species listed federally through the Species at Risk Act range from Endangered to Threatened to Special Concern.

Table 4. Animal species of conservation concern present in Fraser River Delta Ramsar site.

Species	Nature Serve Ranks	Species at Risk Act Listing (Federal)	Provincial Status
American Avocet (<i>Recurvirostra americana</i>)	G5, S2B	N/A	Red List
American Bittern (<i>Botaurus lentiginosus</i>)	G4, S3B	N/A	Blue List
Barn Owl (<i>Tyto alba</i>)	G5, S3	N/A	Blue List
Cutthroat Trout (<i>Oncorhynchus clarki</i>)	G4, T4, S3S4	N/A	Blue List
Dolly Varden (<i>Salvelinus malma</i>)	G5, S3S4	N/A	Blue List
Eulachon (<i>Thaleichthys pacificus</i>)	G5, S2S3	N/A	Blue List
Great Blue Heron (<i>Ardea herodias fannini</i>)	G5T4, 2S3B, S4N	Schedule 1 - special concern	Blue List

Green Heron (<i>Butorides virescens</i>)	G5, S3S4B	Schedule 1 - special concern	Blue List
Green Sturgeon (<i>Acipenser medirostris</i>)	G3, S1N	Schedule 1 - special concern	Red List
Pacific Water Shrew (<i>Sorex bendirii</i>)	G4, S1S2	Schedule 1 - endangered	Red List
Peregrine Falcon (<i>Falco peregrinus anatum</i>)	G4T4, S1	Schedule 1 - threatened	Red List
Short-eared Owl (<i>Asio flammeus</i>)	G5, S3B, S2N	N/A	Blue List
Southern Red-backed Vole (<i>Myodes gapperi occidentalis</i>)	G5T5, S1	N/A	Red List
White Sturgeon (<i>Acipenser transmontanus</i>)	G4T2Q, S2	N/A	Blue/Red

23. Social and cultural values:

Burns Bog

First Nation communities have historically used the bog ecosystem to hunt for and gather critical food supplies seasonally. There is some evidence that First Nations used fire around the periphery of the bog to affect succession and stimulate berry production. The Tsawwassen First Nation has access to collect Labrador Tea (*Ledum groenlandicum*) from the bog.

Between the 1930s and 1980s peat harvesting drastically altered the ecological nature of the bog. One of the oldest human settlements in the Pacific Northwest dating back 9000 years ago is located about one kilometre away on the banks of the Fraser River.

Sturgeon Bank

A commercial salmon gill net fishery currently operates off Sturgeon Bank from July to November. A crab and shrimp fishery also occurs off Sturgeon Bank. Pilings from old canneries are still visible on the foreshore of Sea and Lulu Islands. The canneries operated between the late 1890s and the late 1920s.

Historic Musqueam villages apparently did not exist within the area bounded by the WMA, however, villages did occur on the uplands of Sea and Lulu islands. These villages were located on Garry Point, Terra Nova, McDonald Slough and the Middle Arm. Although sites have not been identified within the WMA, there is still a possibility of encountering archaeological remains in this area. Iona Regional Park, within the sub-component, is a popular birding area.

South Arm Marshes

Aside from its value as wildlife habitat, a recreational boating destination, and wildlife viewing, South Arm Marshes have limited social or cultural value. Waterfowl hunting is allowed in the WMA and some fields on the Kirkland and Rose Islands are farmed specifically and exclusively for waterfowl forage production.

Boundary Bay

The large area and abundant resources support a number of human activities. Swimming and beach activities occur at the five parks with beaches. Two marinas and a public dock at Crescent Beach support recreational boating in the Bay.

A number of fisheries occur in the Bay. Sport fishing occurs in the Bay and along the Serpentine and Nicomekl Rivers. A limited amount of commercial salmon fishing occurs. Crabs are harvested both commercially and recreationally. Interest in harvesting marine plants and kelp is growing. *Salicornia* sp. (sea asparagus) is harvested for local markets under permit.

A number of archaeological sites along the shore of the Bay, particularly at Crescent Beach, indicate the area has a long history of occupation by the Semiahmoo and Tsawwassen First Nations. It is one of Canada's premier sites for bird watching and photography.

Serpentine

Due to its small size and strict limits on permissible activities, such as hunting, the value of the WMA is limited to wildlife habitat conservation and bird watching.

Alaksen

The area is one of the few remaining wetland and tidal zone areas accessible to the major urban population of the Vancouver region. It promotes major public education programs at the George C. Reifel Migratory Bird Sanctuary. The trails in Alaksen are open to the public for wildlife viewing and walking during normal business hours.

24. Land tenure/ownership:

a) within the Ramsar site:

Sub - component	
Burns Bog	The BBECA is jointly owned by provincial, regional and municipal governments. The federal government holds a conservation covenant on most of the lands within the BBECA. The boundary lands are owned by the Corporation of Delta.
Sturgeon Bank	The entire WMA consists of provincial crown land.
South Arm Marshes	Kirkland, Rose, Williamson and Gunn Islands (267.9 ha) are owned by the Nature Trust of BC and Ducks Unlimited Canada and leased to the BC Ministry of Environment. The remaining area is provincial crown land. The Kirkland Island Waterfowl Society manages the agricultural fields on Kirkland and Rose Islands. During this time public access to these islands is restricted.
Boundary Bay	The majority of the Boundary Bay WMA is provincial crown land. One land parcel of 31.45 ha near Grauer Beach is owned by the Nature Trust of BC and leased to the BC Ministry of Environment. Another parcel of 58.7 ha in Mud Bay is owned by the BC Ministry of Environment, The Nature Trust of BC and the Nature Conservancy of Canada.
Serpentine	The entire WMA consists of provincial crown land.
Alaksen	The site comprises 586 ha, 300 ha of which includes the Alaksen NWA owned by the Government of Canada. An adjacent part is the George C. Reifel Migratory Bird Sanctuary, 280 ha of which is provincial crown land, 11 ha federal crown land which in part overlaps with the Alaksen NWA; and 11 ha of federal crown land owned by Transport Canada but also designated and managed as migratory bird sanctuary land. The George C. Reifel Migratory Bird Sanctuary is managed by the British Columbia Waterfowl Society.

b) in the surrounding area:

Land surrounding the sites is owned by private individuals, as well as municipal, provincial and federal governments.

25. Current land (including water) use:

a) within the Ramsar site:

Sub - component	
Burns Bog	The BBECA is currently designated as an Ecological Conservancy Area. The only use is for conservation and restoration of the raised bog ecosystem. Research is allowed as long as it is consistent with the Scientific Research and Monitoring Strategy developed for the BBECA. Some access to accommodate utility corridors will be maintained as long as the rights of way are in place.
Sturgeon Bank South Arm Marshes Boundary Bay Serpentine	Current use of lands and water within the four sub-components is limited entirely to wildlife and wildlife habitat conservation. In South Arm Marshes and Serpentine, these uses include agricultural crops grown as food (i.e. lure crops) for wildlife. Some areas of the sub-components are open to hunting and fishing.
Alaksen	The farmland portion is protected by dykes and produces crops of potatoes, hay, barley, cabbage, and turnips. Control of water levels, agricultural practices, and public access is carried out by Alaksen NWA Staff. Crops are grown for waterfowl use under cropping agreements with local farmers.

b. in the surroundings/catchment:

Sub - component	
Burns Bog	The predominant land use surrounding the BBECA is farming. Areas close to the bog are used in cranberry production and further areas are used in vegetable and dairy production. Other land uses include industrial lands, landfills, transportation corridors and residential communities.
Sturgeon Bank	Land use surrounding Sturgeon Bank is primarily urban residential and industrial, with some industrial and urban parkland. Vancouver International Airport occupies over 75% of the upland on Sea Island. The remaining upland is a conservation area created as compensation for the recent expansion of the airport and First Nation reserve land. The majority of the Iona Island upland is used as a primary sewage treatment facility operated by Metro Vancouver. Sewage is discharged from a deep-water outflow located 7.5 km off-shore.
South Arm Marshes	Shipping and navigation is the primary use of the water surrounding South Arm Marshes. Land use surrounding the WMA is primarily agricultural, with a significant portion of urban residential and some industrial and urban parkland.

Boundary Bay	Land use surrounding the WMA is primarily agricultural, with a significant portion of urban residential and some industrial and urban parkland.
Serpentine	Land use surrounding the WMA is primarily agricultural, with a significant portion of urban residential and some industrial and urban parkland.
Alaksen	Farmland and urban development surround this area.

26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

a) within the Ramsar site:

Sub - component	
Burns Bog	<ul style="list-style-type: none"> • Prior to the purchase of the BBCEA by government, fundamental changes to bog hydrology have occurred as a result of increased drainage from the bog. Draining of the bog to: 1) facilitate conversion to agricultural uses, and 2) provide irrigation water to surrounding landscape and peat harvest from the early 1900s to the late 1980s resulted in significant adverse effects to the sites ecological character. The lowering of the water table has impacted bog function and allowed sand forests to expand towards the centre of the bog. • The development of a new irrigation system for Delta farmers will bring water from the Fraser River and reduce water drawn from the bog for irrigation purposes. Local governments and proponents of the irrigation system are working together to avoid and/or mitigate any potential impacts on the bog. • Stripping of the acrotelm to facilitate peat harvest and conversion to cranberry production has altered the critical living skin of the bog. Restoration of the acrotelm is necessary in many areas of the bog so that bog function can be re-established. • The loss of lagg zones along much of the circumference of the bog has compromised a critical transition zone between acidic ombrogenous wetlands and neutral to basic surrounding marsh and fen habitats • The construction of a new road system along the northern margin of the bog is currently being monitored to detect any impacts on bog function
Sturgeon Bank	<ul style="list-style-type: none"> • Construction of jetties, piers, causeways and dredging of the Fraser River has resulted in reduction of sediment supply to the delta front and increased erosion. This has reduced the size of the intertidal marshes and eel grass beds. • The presence of the Iona Island sewage treatment facility had a significant impact on water quality, although this impact was eliminated after the sewage discharge was moved further off-shore to a deep water site in 1988. • Various climate change models have been used to predict potential impacts driven by sea level rises and coastal squeeze. According to these models, mudflats will be reduced in size due to inundation and some will be subject to erosion. The hard line imposed by coastal protection measures (dykes) will prevent mudflats from expanding inland.
South Arm Marshes	<ul style="list-style-type: none"> • Decommissioning of Delta's wastewater treatment plant and conversion of the treatment ponds to saltwater marsh (now Ladner Marsh) has increased wildlife habitat. • Historical construction of dykes near the South Arm Marshes has reduced the area of salt marsh on the Fraser River delta and altered the flow regime of the Fraser River, with resulting changes in deposition rates. • Periodic dredging of navigation routes continues to affect deposition rates and may result in sediment/land loss. • Recent breaching of some dykes within the South Arm Marshes has increased the area of salt marsh.
Boundary Bay	<ul style="list-style-type: none"> • Future construction of jetties, piers, and causeways could alter the hydrology of the Bay, altering sediment deposition and increase erosion. This could reduce the size of the intertidal marshes and eel grass beds. • Boundary Bay receives run-off from upland areas developed for agricultural, residential, commercial and industrial uses. This has the potential to adversely impact water quality, however recent monitoring has shown that regional (Metro Vancouver) ambient water quality objectives are being met. • Various climate change models have been used to predict potential impact driven by sea level rise and coastal squeeze. According to these models, mudflats will be reduced in size due to inundation and some will be subject to erosion. The hard line imposed by coastal protection measures (dykes) will prevent mudflats from expanding inland

Serpentine	<ul style="list-style-type: none"> • Construction of the sea dam has reduced the influence of tides on the WMA. • Dykes built within Serpentine eliminated its function as natural flood plain. Habitat management has artificially replaced this function. • Agriculture has eliminated many native plants.
Alaksen	<ul style="list-style-type: none"> • Loss of soil based agriculture in the surrounding landscape puts more intense pressure on lands for wildlife.

b) in the surrounding area:

Sub - component	
Burns Bog	<ul style="list-style-type: none"> • Surrounding land use (agriculture, industry, road and utility corridor development) has historically impacted the bog by contributing to the flow of mineral- and nutrient-rich waters into the raised bog ecosystem. Efforts are underway to restore Burns Bog and mitigate any influx of non-bog water and excessive efflux of ombrogenous water. • Historical development adjacent to the bog in combination with the lowering of the water table has increased the frequency and magnitude of fires affecting Burns Bog. The most recent fire damaged the acrotelm of a significant area of the bog and released Lodgepole Pine and Birch trees over much of the area. These dense young mixed forests are a concern for bog management.
Sturgeon Bank	<ul style="list-style-type: none"> • Conversion of the adjacent uplands from agriculture to suburban, urban and industrial uses, plus agricultural intensification limits wildlife access to upland areas during high tides and inclement weather. • Aviation safety concerns require wildlife control at Vancouver International Airport.
South Arm Marshes	<ul style="list-style-type: none"> • Storm water retention ponds constructed by the Corporation of Delta has created adjacent wetlands and improved the quality of discharged stormwater. • Conversion of the adjacent uplands from agriculture to suburban, urban and industrial uses, plus agricultural intensification limits wildlife access to upland areas during high tides and inclement weather.
Boundary Bay	<ul style="list-style-type: none"> • Agricultural practices have shifted from grass-based crop rotations to intensive crop production. Land use practices still allow valuable wintering habitat for waterfowl however shifts in land use policy could impact the availability of these lands to wildlife. • Conversion of the adjacent uplands from agriculture to suburban, urban and industrial uses, plus agricultural intensification limits wildlife access to upland areas during high tides and inclement weather.
Serpentine	<ul style="list-style-type: none"> • Agricultural practices have shifted from grass-based crop rotations to intensive crop production. Land use practices still allow valuable wintering habitat for waterfowl however shifts in land use policy could impact the availability of these lands to wildlife. • Conversion of the adjacent uplands from agriculture to suburban, urban and industrial uses, plus agricultural intensification (i.e. green-houses) limits wildlife access to upland areas during high tides and inclement weather.
Alaksen	<ul style="list-style-type: none"> • Loss of surrounding farmland to urbanization remains a major source of impacts

27. Conservation measures taken:

a) List of national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

Management of the un-dyked portion of the entire Fraser River delta is within the framework of the multilateral/intergovernmental Fraser River Estuary Management Program (FREMP) which is aimed at sustaining the delta's natural productivity.

A portion of the delta has already been designated as a Ramsar Wetland of International Importance (Alaksen sub-component).

Burns Bog has been designated as an Ecological Conservancy Area within the Metro Vancouver Regional Parks System.

The Fraser River delta, including all six sub-components, is designated as an Important Bird Area by Bird Life International. Alaksen, Boundary Bay, Sturgeon Bank and South Arm Marshes also partly make up the Fraser River Delta Hemisphere Shorebird Reserve under the Western Hemisphere Shorebird Reserve Network Program.

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Sub - component	
Burns Bog	Ia <input checked="" type="checkbox"/> ; Ib <input type="checkbox"/> ; II <input type="checkbox"/> ; III <input type="checkbox"/> ; IV <input type="checkbox"/> ; V <input type="checkbox"/> ; VI <input type="checkbox"/>
Sturgeon Bank	Ia <input type="checkbox"/> ; Ib <input type="checkbox"/> ; II <input type="checkbox"/> ; III <input type="checkbox"/> ; IV <input checked="" type="checkbox"/> ; V <input type="checkbox"/> ; VI <input type="checkbox"/>
South Arm Marshes	Ia <input type="checkbox"/> ; Ib <input type="checkbox"/> ; II <input type="checkbox"/> ; III <input type="checkbox"/> ; IV <input checked="" type="checkbox"/> ; V <input type="checkbox"/> ; VI <input type="checkbox"/>
Boundary Bay	Ia <input type="checkbox"/> ; Ib <input type="checkbox"/> ; II <input type="checkbox"/> ; III <input type="checkbox"/> ; IV <input checked="" type="checkbox"/> ; V <input type="checkbox"/> ; VI <input type="checkbox"/>
Serpentine	Ia <input type="checkbox"/> ; Ib <input type="checkbox"/> ; II <input type="checkbox"/> ; III <input type="checkbox"/> ; IV <input checked="" type="checkbox"/> ; V <input type="checkbox"/> ; VI <input type="checkbox"/>
Alaksen	Ia <input type="checkbox"/> ; Ib <input type="checkbox"/> ; II <input type="checkbox"/> ; III <input type="checkbox"/> ; IV <input checked="" type="checkbox"/> ; V <input type="checkbox"/> ; VI <input type="checkbox"/>

c. Does an officially approved management plan exist; and is it being implemented?:

Sub - component	
Burns Bog	The Burns Bog Ecological Conservancy Area Management Plan was adopted in 2007 and is currently being implemented.
Sturgeon Bank	The draft management plan has yet to be approved.
South Arm Marshes	The draft management plan has yet to be approved.
Boundary Bay	The draft management plan has yet to be approved.
Serpentine	The draft management plan has yet to be approved.
Alaksen	The Alaksen National Wildlife Area Management Plan has been in place since 2002 and is currently being implemented. An updated Plan is expected to be drafted by mid-2012.

d. describe any other current management practices:

Once a WMA has been designated, the land and water within it are protected by provincial statute. Consumptive uses of wildlife (e.g. hunting) may be allowed or prohibited under the management plan, but safety concerns regarding the discharge of firearms may preclude hunting. Hunting is not allowed in Serpentine. Hunting is allowed in Boundary Bay and South Arm Marshes where municipal discharge of firearms by-laws are not in effect. Sturgeon Bank is open to hunting, but the discharge of firearms is prohibited by municipal by-laws. Active management within the WMAs include control and removal of invasive species, control of domestic animals, habitat improvement, cultivation of forage crops, prohibition of motorized vehicles, etc.

National Wildlife Areas (i.e. Alaksen) are managed for the purposes of wildlife research, conservation, and interpretation. Regulated hunting is permitted in some locations, however not in the Alaksen sub-component. Environment Canada's Canadian Wildlife Service uses an ecosystem approach to manage and plan for NWAs. This approach requires the cooperation of public and private institutions to manage landscapes with a common goal of habitat protection.

28. Conservation measures proposed but not yet implemented:

Sub - component	
Burns Bog	Additional important neighbouring lands are to be added to the BBECA as they become available and will be included in the Ramsar Site. An updated RIS will be presented after new lands are added to reflect the expanded boundaries. Restoration of bog ecosystem function is a primary goal of the Management Plan and a recently approved Scientific Research Strategy.
Sturgeon Bank	A draft management plan has been prepared.
South Arm Marshes	A draft management plan has been prepared.
Boundary Bay	A draft management plan has been prepared.
Serpentine	A draft management plan has been prepared.
Alaksen	An updated Management Plan is expected to be drafted by mid-2012.

Metro Vancouver Regional Government has set a target of protecting all wetlands identified as endangered by Metro Vancouver by 2015. They are currently completing an up-to-date inventory on lower mainland wetlands and developing strategies and tactics to provide a wide range of protection options, which may also complement the activities outlined above.

29. Current scientific research and facilities:

Sub - component	
Burns Bog	A Research Strategy to support the BBECA Management Plan has been approved for implementation. Current research in the bog includes water level monitoring, water balance model development, vegetation monitoring and wildlife monitoring.
Sturgeon Bank South Arm Marshes Boundary Bay Serpentine Alaksen	Research on the wildlife values present in all sub-components is encouraged as long as the potential benefits of the research greatly exceed the potential risks. Sturgeon Bank and Boundary Bay are frequently used by faculty and staff at the two local universities, University of British Columbia and Simon Fraser University, as well as federal and provincial biologists, to conduct field research on the foraging, migratory and behavioural ecology of waterfowl and waders. Bird Studies Canada's Coastal Waterbird Survey has been running continuously for over a decade to monitor waterbirds on the delta. Pacific Wildlife Foundation has documented whales in Boundary Bay for over two decades. Since 1972, the Pacific and Yukon Canadian Wildlife Service office has been located on the Alaksen NWA from which on-going bird research and monitoring is conducted.

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

Sub - component	
Burns Bog	Web sites exist within Metro Vancouver Regional Government and Corporation of Delta (municipal government) (http://www.metrovancouver.org/services/parks_lscr/regionalparks/Pages/BurnsBog.aspx) (http://www.burnsbog.ca/)
Sturgeon Bank	Nature trails along the dyke forming the eastern boundary of the Bank. The site offers some of Canada's best birding opportunities.
South Arm Marshes	A brochure has been produced by British Columbia Wildlife Watch, a provincial wildlife viewing program.
Boundary Bay	Walking trails along the dyke forming the north and west boundary of the Bay are used extensively and provide excellent opportunities to view wildlife. Some signage is in place. The Bay is a prime birding location in Canada. Interpretive signage has been installed at various locations along the dyke.
Serpentine	Trails and viewing towers are open year round and provide tremendous opportunities to observe and learn about coastal habitats and wildlife. The marsh and surrounding agriculture complex plays host to Project Webfoot classes, an award-winning wetland education program offered by Ducks Unlimited Canada. Annually more than 1200 local Grade 4 children tour the marsh, learning about wetland values and their importance as waterfowl and wildlife habitat.
Alaksen	A public education and interpretation facility is located on the George C. Reifel Migratory Bird Sanctuary operated by the British Columbia Waterfowl Society, a non-governmental organization. The sanctuary area includes trails, artificial ponds and an observation tower.

31. Current recreation and tourism:

Sub - component	
Burns Bog	The BBECA does not offer any public access. Bog ecosystem elements may be viewed in the nearby Delta Nature Reserve, which is expected to become part of the core BBECA in the near future.
Sturgeon Bank	Sturgeon Bank is used for low-impact recreation including walking, wildlife viewing, jogging, photography, cycling and picnicking. Water uses include boating and shipping in navigable waters. No data on the frequency or intensity are available.
South Arm Marshes	South Arm Marshes is largely inaccessible except by boat, but local marinas and public use boat launches provide access. No data on the frequency or intensity are available.
Boundary Bay	Boundary Bay is used for low-impact recreation including walking, wildlife viewing, jogging, photography, cycling and picnicking. Water uses include boating and shipping in navigable waters. No data on the frequency or intensity are available.
Serpentine	Serpentine is used for low-impact recreation including walking, wildlife viewing, jogging, photography and cycling. No data on the frequency or intensity are available
Alaksen	The Alaksen Ramsar Site is used for low-impact recreation. Nature trails provide access through the National Wildlife Area (NWA) that complements public trails and facilities in the George C. Reifel Migratory Bird Sanctuary.

32. Jurisdiction:

Sub - component	
Burns Bog	A federal conservation covenant registered on title of the BBECA lands limits activities and ensures that the ecological integrity of the Bog is conserved. Metro Vancouver has operational jurisdiction over the BBECA and the Corporation of Delta has management responsibility for hydrology and fire management within the BBECA.
Sturgeon Bank South Arm Marshes Boundary Bay Serpentine	The Province of British Columbia has territorial jurisdiction over the sub-components, while the BC Ministry of Environment shares functional jurisdiction for conservation purposes with Environment Canada (migratory birds) and Fisheries and Oceans Canada (marine and anadromous fisheries).
Alaksen	The NWA portion of Alaksen is under the management authority of Environment Canada, while the foreshore portion of the Alaksen site is a Migratory Bird Sanctuary on provincial crown land. Fish and fish habitat within both portions of the Alaksen site are under the jurisdiction of Fisheries and Oceans Canada.

33. Management authority:

Sub - component	Agency with Management Responsibility	
Burns Bog	Mitch Sokalski Area Manager Metro Vancouver Parks 4330 Kingsway, Burnaby, BC Canada V5H 4G8	George V. Harvie, Chief Administrative Officer The Corporation of Delta 4500 Clarence Taylor Crescent Delta, BC Canada V4K 3E2
Sturgeon Bank South Arm Marshes Boundary Bay Serpentine	Jennifer McGuire Regional Manager BC Ministry of Natural Resource Operations Suite 200, 10470 152 nd Street Surrey, BC Canada V3R 0Y3	
Alaksen	Canadian Wildlife Service Environmental Conservation Branch Pacific and Yukon Region, Environment Canada R.R. #1, 5421 Robertson Road Delta, BC Canada V4K 3N2	

34. Bibliographical references:

- Ages, A. and A. Woollard. 1976. The tides in the Fraser Estuary. Pacific Marine Science Report 76-5. Institute of Ocean Sciences, Department of Fisheries and Oceans, Victoria, B.C.
- Armstrong, J.E. 1984. Environmental and Engineering Applications of the Surficial Geology of the Fraser Lowlands, British Columbia, Geological Survey of Canada. Paper 82-3. Minister of Supply and Services Canada, Ottawa, ON.
- Bird Studies Canada 2010. British Columbia Coastal Waterbirds Survey. Online database. <http://www.birdscanada.org/birdmon/default/datasets.jsp?code=BCCWS> .
- Boyd, W.S. 1994. Abundance patterns of Trumpeter and Tundra Swans on the Fraser River delta, British Columbia. In Butler, R.W. and K. Vermeer (eds). 1994. The abundance and distribution of estuarine birds in the Strait of Georgia, B.C. Occasional Paper No. 83. Canadian Wildlife Service, Environment Canada, Ottawa, ON. 78pp.
- Butler, R.W. and K. Vermeer (eds.). 1994. The abundance and distribution of waterbirds in estuaries in the Strait of Georgia, British Columbia. Canadian Wildlife Service Occasional Paper Number 83, Ottawa. 78pp.
- Butler, R. W. 2009. Foreword to symposium: Twenty years on: advances in ecological understanding of globally important birds in the Strait of Georgia, British Columbia, and Puget Sound, Washington. Marine Ornithology 37.
- Butler, R.W. and R.W. Campbell. 1986. The birds of the Fraser River delta: populations, ecology and international significance. CWS Occasional Paper No. 86, Ottawa.
- Clague, J.J. and B.D. Bornhold. 1980. Morphology and littoral processes of the Pacific Coast. In: McCann, S.B. (ed) Coastlines of Canada Geological Survey Paper 80-10:339-380.

- Commission for Environmental Cooperation. 2009. Ecological Regions of North America Commission for Environmental Cooperation. Montréal, Québec, Canada Online: <http://www.cec.org/naatlas/>
- Fry, K. 1984. Migratory bird use of upland areas during spring migration, Alaksen NWA. B.C. Canadian Wildlife Service, Environment Canada, British Columbia. Unpublished. 28pp.
- Fry, K. 1984. A comparison of spring bird use of a foreshore marsh, pastures and intensively managed fields at Alakssen NWA, B.C. Canadian Wildlife Service, Environment Canada. Delta, British Columbia. Unpublished. 34pp.
- Greer, G.L., C.D. Levings, R. Harbo, B. Hillaby, T. Brown and J. Sibert. 1980. Distribution of fish species on Roberts and Sturgeon Banks recorded in seine and trawl surveys. Canadian Manuscript Report of the Fisheries and Aquatic Sciences 1596. 51pp.
- Habitat Group. 1978. Fraser River Estuary Study – Habitat Report. Fraser River Estuary Study Steering Committee, Government of Canada and the Province of British Columbia. 181pp.
- Hebda, R.J., K. Gustavson, K. Golinski, and A.M. Calder. 2000. Burns Bog Ecosystem Review Synthesis for Burns Bog, Fraser River Delta, South-western British Columbia, Canada. Environmental Assessment Office, Victoria, B.C.
- Hoos, L.M. and G.A. Packman. 1974. The Raser River Estuary – Status of Environmental Knowledge to 1974. Estuary Working Group Req. Brd., Pacific Region, Environment Canada, Special Estuary Series, Report No. 1. 517pp.
- Keller, R.A. 1981. Vegetation of the Alaksen NWA, B.C. Canadian Wildlife Service, Environment Canada. Delta, British Columbia. Unpublished. 17pp.
- Kragh, W.D. 1983. Fall migration and resident birds of the Alaksen NWA, B.C. Canadian Wildlife Service, Environment Canada. Delta, British Columbia. Unpublished. 44pp.
- Luternauer, J.L. 1980. Genesis of morphological features on the western delta front of the Fraser River, British Columbia - status of knowledge. In: McCann, S.B. (ed) Coastlines of Canada Geological Survey of Canada Paper 80-10:310-396.
- Luttmerding, H.A. 1980. Soils of the Langley-Vancouver Map Area, RAB Bulletin No. 18. Ministry of Environment, Terrestrial Studies Branch, Kelowna.
- Ministry of Environment. 1982. A Living River by the Door: a Proposed Management Program for the Fraser River Sanctuary. British Columbia Ministry of Environment, Surrey, British Columbia. 62pp.
- Morgan, L., S. Maxwell, F. Tsao, T.A.C. Wilkinson, and P. Etnoyer. 2005. Marine Priority Conservation Areas: Baja California to the Bering Sea. Commission for Environmental Cooperation of North America and the Marine Conservation Biology Institute. Montreal.
- Naito, Brian. 2004. Fish of Richmond, BC. In: Klinkenberg, Brian and Rose Klinkenberg. The Biodiversity of Richmond, British Columbia. Online: <http://www.geog.ubc.ca/richmond/city/fish.html> Compiled October 1, 2004.
- North, M.E.A., M.W. Dunn, and J.M. Teversham. 1979. Vegetation of the southwestern Fraser lowland, 1858-1880[cartographic material]; edited by M.A. Ward; drafted by L.A. Decker; base map compiled by M.W. Dunn and L.A. Decker. Vancouver, B.C. Environment Canada, Lands Directorate, 1 map :col. ;56 x 85 cm., on sheet 92 x 113 xm
- Smith, D.W., K. Moore, K. Fry, D. Buffett, J. Komaromi, and M. Porter, 2000. Winter Waterfowl Use of Westham Island : 1995-1997. Canadian Wildlife Service, Pacific and Yukon Region, unpublished, 16 pages.
- Vermeer, K. and R.W. Butler. 1994. The international significance and the need for environmental knowledge of estuaries. Pp. 75-76 In: Butler, R.W. and K. Vermeer (eds.). The abundance and distribution of waterbirds in estuaries in the Strait of Georgia, British Columbia. Canadian Wildlife Service Occasional Paper Number 83, Ottawa.
- Weber, W.C. 1982. Spring migrant and breeding birds of the Alaksen NWA, B.C. Canadian Wildlife Service, Environment Canada. Delta, British Columbia. Unpublished 108pp.

White, K. 1984. The insects of the Alaksen NWA, B.C. Canadian Wildlife Service, Environment Canada. Delta, British Columbia. Unpublished.

Wilkinson T., E. Wiken, J. Bezaury-Creel, T. Hourigan, T. Agardy, H. Herrmann, Janishevski, C. Madden, L. Morgan, M. Padilla. 2009. Marine Ecoregions of North America. Commission for Environmental Cooperation. Montreal, Canada. 200pp.

Please return to: **Ramsar Convention Secretariat, Rue Mauverney 28, CH-1196 Gland, Switzerland**
Telephone: +41 22 999 0170 • Fax: +41 22 999 0169 • e-mail: ramsar@ramsar.org

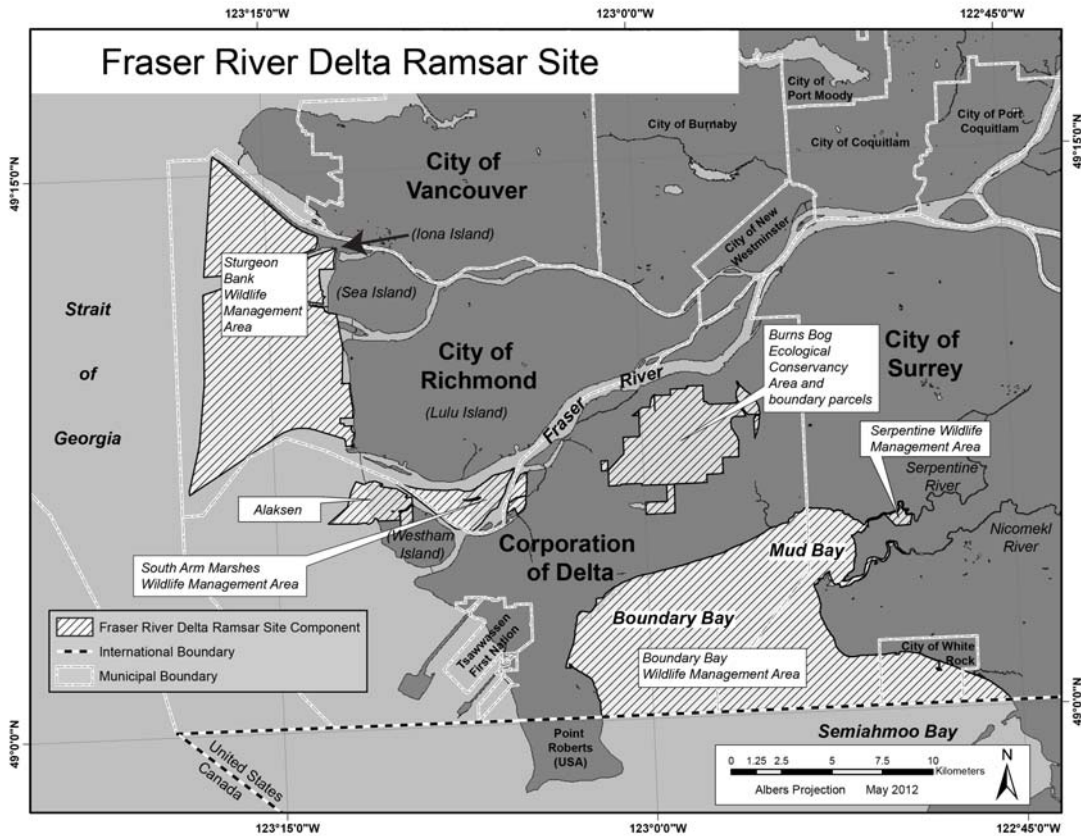


Figure 1. Fraser River Delta Ramsar Nomination Site. Nominated areas are outlined.

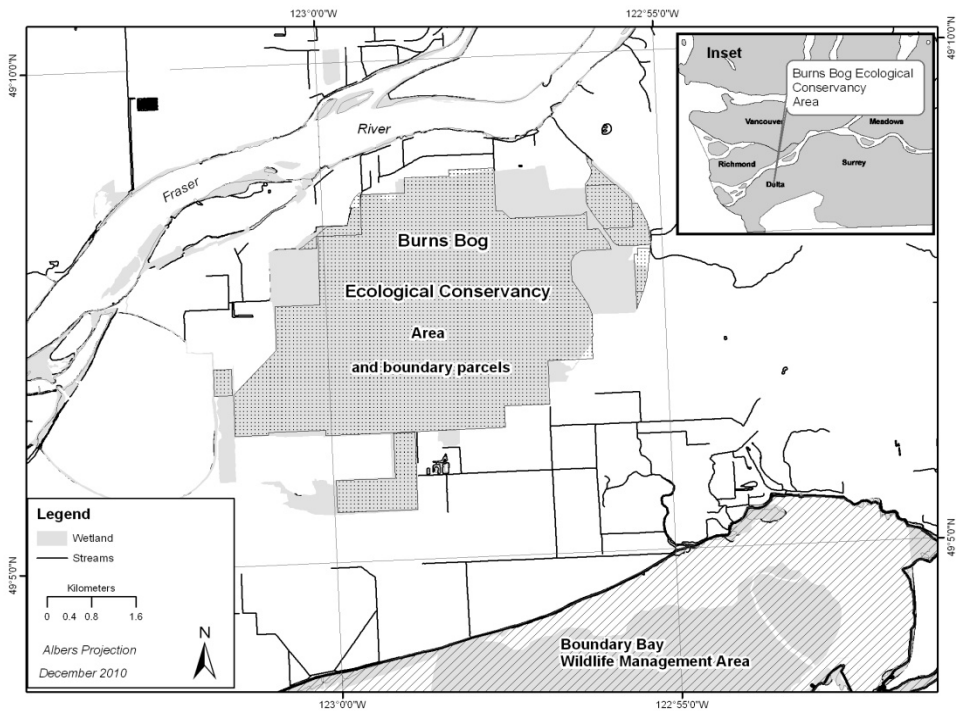


Figure 2. Burns Bog Ecological Conservancy Area and Boundary Parcels sub-component of the Fraser River Delta Ramsar Nomination (dotted area).

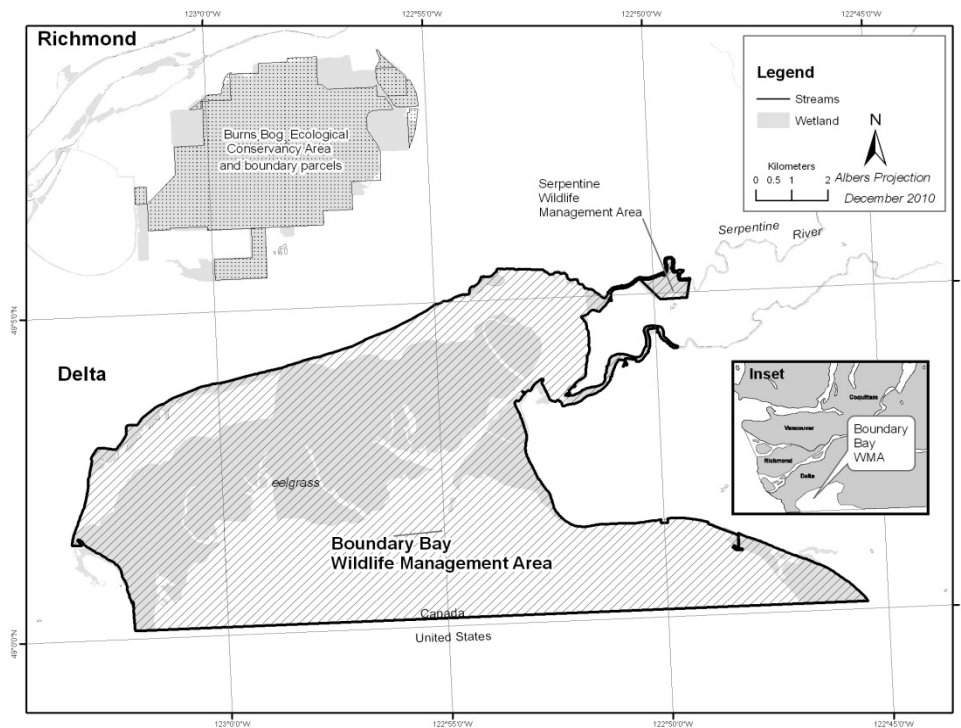


Figure 3. Burns Bog, Boundary Bay and Serpentine sub-components of the Fraser River Delta Ramsar Nomination (hatched areas).

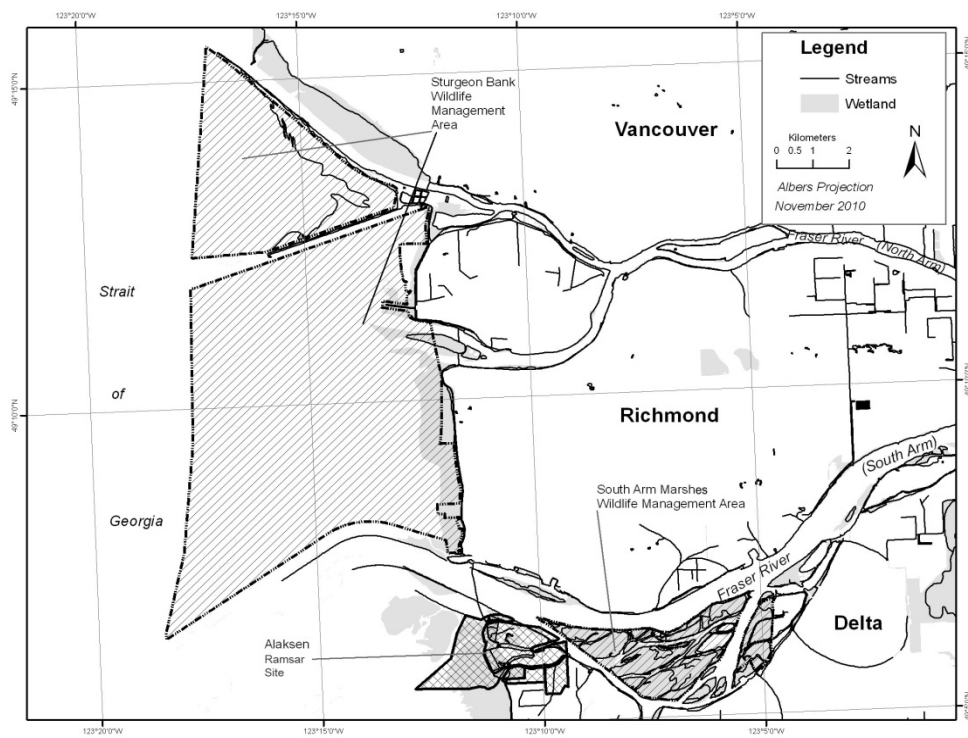


Figure 4. Alaksen, Sturgeon Bank and South Arm Marshes sub-components of the Fraser River Delta Ramsar Nomination (hatched areas).