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Cordova Shore
CONSERVATION STRATEGY

August 2010

Prepared for **CRD Regional Parks, Tsawout First Nation,**
and **Canadian Wildlife Service**

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SUMMARY

The purpose of the Cordova Shore Conservation Strategy is to improve the management of ecosystems, plant, fish, and wildlife species, and human activities in the Cordova Shore through collaborative conservation actions. This includes actions to restore ecological processes, recover species at risk, reduce recreation impacts, improve access to cultural resources, and celebrate the shore's unique character.

This strategy was developed through the Cordova Shore Conservation Partnership. The partnership is an informal, collaborative initiative between Capital Regional District (CRD) Regional Parks, Tsawout First Nation, and the District of Central Saanich. It is supported by the Canadian Wildlife Service.

Five main ecosystems make up the Cordova Shore: (1) marine ecosystems: beach, intertidal and shallow subtidal areas; (2) coastal wetland ecosystems: salt, brackish, and freshwater wetlands; (3) coastal sand ecosystems: sparsely-vegetated sand spit (ȾIX̲EN̲) and stable and semi-stable dunes; (4) rock outcrop ecosystems: sparsely-vegetated rock and forested or shrub-dominated; and (5) bluff ecosystems: unstable and forested sand bluffs.

There are five primary conservation issues: (1) disruption to hydrologic processes in the Tsawout Wetland complex; (2) impacts to vegetation and wildlife from recreation; (3) invasive plant establishment and spread; (4) disruption to coastal sediment transport processes; and (5) loss of ecosystems from development activities.

The overall conservation goal is *"to protect, restore, and celebrate the unique ecological and cultural values of Cordova Shore".* Ten strategies encompassing 59 actions are proposed:

Strategy 1. Manage collaboratively
Strategy 2. Recognize ecological boundaries
Strategy 3. Protect and restore ecological and physical processes
Strategy 4. Protect and restore cultural resources
Strategy 5. Control invasive plants and animals
Strategy 6. Manage recreation and access
Strategy 7. Address impacts from adjacent lands
Strategy 8. Contribute to species at risk recovery
Strategy 9. Promote education and research
Strategy 10. Celebrate ecological and cultural uniqueness

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The strategy was written by Nick Page (Raincoast Applied Ecology) with assistance from Glenn Bartley, Ian Walker (University of Victoria), and Patrick Lilley (Raincoast Applied Ecology).

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PART 1. INTRODUCTION

The purpose of the Cordova Shore Conservation Strategy is to improve the management of ecosystems, plant, fish, and wildlife species, and human activities in the Cordova Shore through collaborative conservation actions. This includes actions to restore ecological processes, recover species at risk, reduce recreation impacts, improve access to cultural resources, and celebrate the shore's unique character.

Cordova Shore is a unique coastal landscape composed of rich intertidal and subtidal marine areas, a sand spit and dunes, eroding bluffs, coastal wetlands, and rock outcrops. It supports species at risk such as the contorted-pod evening-primrose[1], Sand-verbena Moth, and silky beach pea that are found in coastal sand ecosystems, as well as abundant marine bird and shellfish populations. Cordova Shore is part of the Sidney Channel Important Bird Area (IBA) which is recognized internationally for its murrelets, auklets, cormorants, gulls and shorebirds in summer, winter seaducks, and migrating grebes, loons, brant, and shorebirds in spring (IBA Canada, 2010). It also has a rich cultural history for the Tsawout First Nation who rely on its plant, wildlife, and marine resources. Finally, Cordova Shore is a regionally important recreation area that is used by residents of, and visitors to, Central Saanich for natural experience and recreation. It is an ecologically and culturally rich landscape this is loved by many.

Cordova Shore is also under threat. Its ecosystems have been affected by historic activities such as drainage, diking, and agricultural use, and current stresses such as ecologically inappropriate recreation, land development, and the introduction of invasive plants. Some of the ecosystems in the Cordova Shore are changing rapidly as vegetation succession accelerates in drained wetlands and sand dunes are colonized by trees and shrubs.

Report Structure

This report is divided into five parts. Part 1 introduces the project and the boundaries and ownership of the Cordova Shore. Part 2 summarizes existing information and Part 3 describes the ecosystems of the study area. Part 4 discusses five important conservation issues for the Cordova Shore. Part 5 presents ten strategies for improving conservation management. References and appendices follow.

Boundaries

Cordova Shore is 437 ha in size (233 ha (53%) marine; 82 ha (19%) wetland; and 123 ha (28%) terrestrial), and is 6.5 km long and 1.2 km wide (see Figure 1). The Cowichan Head bluffs in northeast Saanich form its southern boundary and its northern boundary is the James Island dock. To the west it follows the crest of the eroding or stable bluffs, as well as the uplands of the developed portion of the Tsawout First Nation lands. Marine ecosystems form the eastern boundary and generally follow the indistinct transition from the intertidal to shallow subtidal zone.

[1] See Appendix 1 for a complete list of common and scientific names of species mentioned in this report.

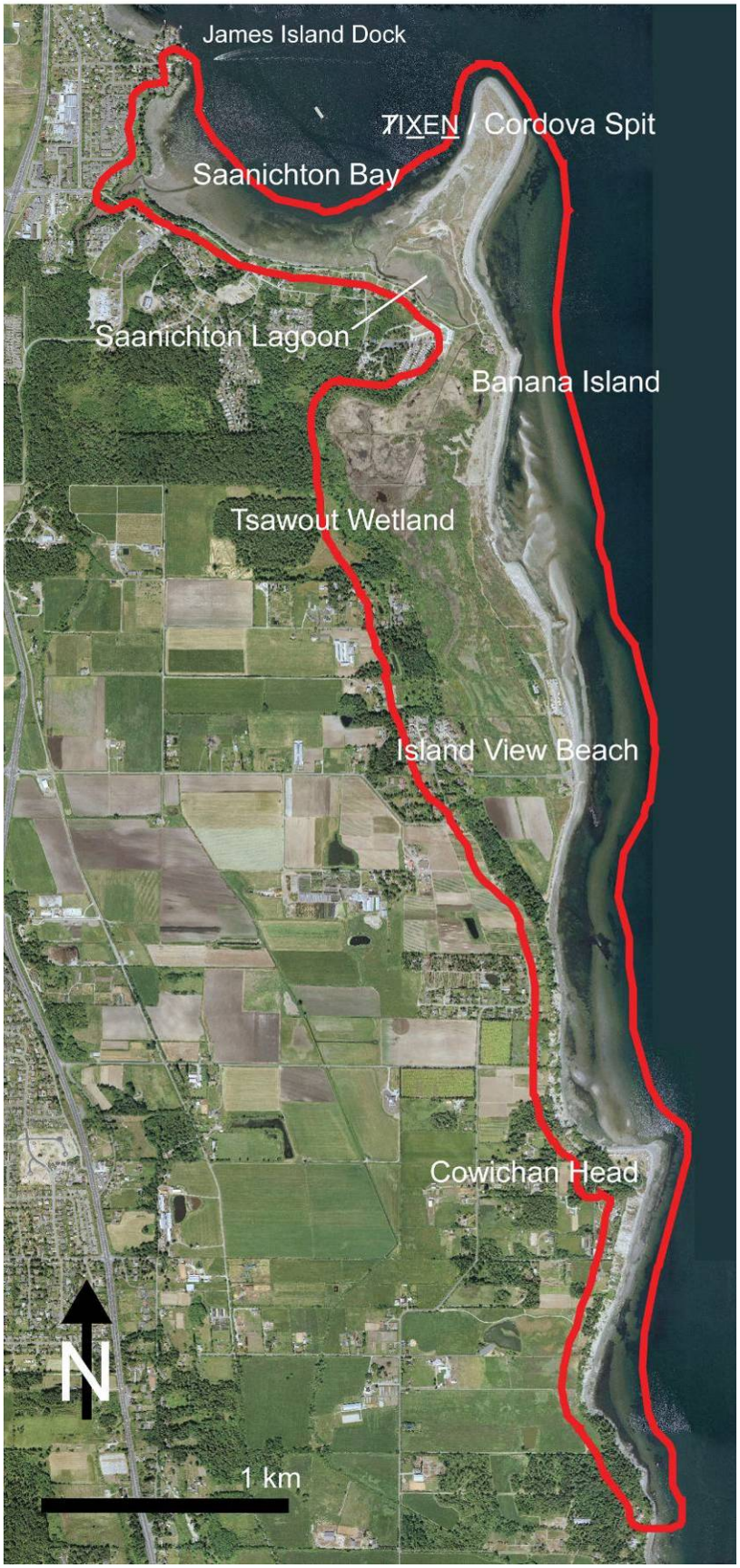


Figure 1. Boundary and important features of Cordova Shore. The eastern boundary is formed by the transition from the intertidal to subtidal zone; the western boundary primarily follows the crest of the bluff from Cowichan Head to Tsawout First Nation reserve. The background orthophoto is from 2007 (provided by CRD Regional Parks).

Names

This strategy uses the name *Cordova Shore* to describe the lowland area and adjacent bluffs that include and surround ȾIX̱EṈ (Cordova Spit), Island View Beach, Saanichichton Bay, Cowichan Head, and adjacent marine areas. ȾIX̱EṈ[2] is the Tsawout name for Cordova Spit in the SENĆOŦEN language[3]. The Esquimalt Harbour was originally named Cordova Bay in 1790 by the Spanish navigator Manuel Quimper after the viceroy of New Spain (Scott, 2009). The name was transferred around 1842 by the Hudson's Bay Company to the current section of coastline.

Participants

This strategy was developed through the Cordova Shore Conservation Partnership. The partnership is an informal, collaborative initiative between Capital Regional District (CRD) Regional Parks, Tsawout First Nation, and the District of Central Saanich. It is supported by the Canadian Wildlife Service and has also had active assistance from the BC Ministry of Environment, University of Victoria, Victoria Natural History Society, Habitat Acquisition Trust, and SeaChange Marine Conservation Society. Appendix 9 provides an initial description of conservation values, threats, and goals.

A workshop was held in November 2009 to discuss the purpose and structure of the conservation strategy and review specific proposed actions. It included participants from the following organizations (see acknowledgements section for individuals): CRD Regional Parks, Tsawout First Nation, Canadian Wildlife Service, District of Central Saanich, Peninsula Streams Society, SeaChange Marine Conservation Society, Parks Canada, and Nature Conservancy of Canada.

Land Ownership

Land ownership of Cordova Shore is split between five land types:

- Municipal Parkland: 16 ha (4%) is municipal parkland (Saanichton Bay Park, Cordova Spit Park, and Island View Park);
- Regional Parkland: 53 ha (12%) is in Island View Beach Regional Park including the parcel acquired in 2009;
- Tsawout First Nation: 59 ha (13%) (Certificate of Possession (CP) and common lands combined);
- Private Lands: 76 ha (17%) (including road rights-of way); and
- Province of BC: 232 ha (53%) (intertidal and subtidal areas).

Much of the Tsawout First Nation's lands (East Saanich Indian Reserve #2) are held by individual band members through a CP system. Under a CP, the Government of Canada retains legal title

[2] Phonentic pronuncation of ȾIX̱EṈ: Ⱦ - a "TS" sound, I – a long "E" sound, X̱ - a "XW" sound, E – a short "U" sound, Ṉ - an "NG" sound (from Claxton, 2003).
[3] SENĆOŦEN is a language spoken by Saanich peoples and is an essential part of their culture.

to the land, but the CP holder is entitled to the use of the land and revenue from rent or resource use, and rights are transferrable by sale or bequeath (Cowichan Tribes, 2009). CPs are issued by the band council with approval from the federal government.. The Oceanside RV park on the margin of the Tsawout Wetland was developed in 2007 on a CP parcel. Future land development of CP lands will be guided by the Tsawout First Nation's Land Code (Tsawout First Nation, 2006). The Land Code enables the Tsawout First Nation to better manage development of reserve lands including developing zoning, controlling development and occupation, regulating subdivision, and protecting parks.

The foreshore and seabed of Cordova Shore below the marine high water mark (under the Land Act referred to as "natural boundary"[4]) is owned by the Province of BC (Crown). Landowners of upland properties bordering the foreshore have riparian rights which include access to navigable waters, erosion protection, and ownership of accretion once it takes on upland characteristics. While the foreshore is often considered "public property" in a legal sense the public is able to access and use the foreshore as a privilege and the only legally enshrined rights are the right to land boats, the right to embark from the foreshore in cases of emergency, and the rights of navigation, anchoring, mooring, and fishing over those lands covered by water (Ministry of Agriculture and Lands, 2008). First Nations may acquire specific rights to foreshore uses through treaties. The Tsawout First Nation's successful legal challenge to the development of a large marina in Saanichton Bay (see Saanichton Marina Ltd. v. Tsawout Indian Band[5]) affirmed the rights granted under the Douglas Treaty included access to the foreshore for fishing and other activities.

Control of navigation and the management of fish and fish habitat are federal responsibilities. The Canadian Coast Guard manages navigation under the authority of the federal Navigable Waters Protection Act. Fisheries and Oceans Canada manages fish and fish habitat under the authority of the Federal Fisheries Act. The Province of BC, because of ownership of the foreshore, grants leases for shellfish aquaculture, log storage, moorage, and other activities.

Two water leases are located in Saanichton Bay, west of ȾIX̲EN̲ (Figure 2). The narrow one closest to the shore (6 ha in size in three units) does not appear be under tenure currently. The larger one (8 ha) in the subtidal area to the west is an industrial lease actively under tenure for the purposes of log handling and storage.

Private lands are considered in this strategy because of their ecological connections to reserve and park lands and adjacent waters. Management considerations beyond these ecological interactions are not considered in this strategy, and no expectations about any particular

[4] As defined in section 1 of the Land Act, natural boundary means the visible high water mark of any lake, river, stream or other body of water where the presence and action of the water are so common and usual, and so long continued in all ordinary years, as to mark on the soil of the bed of the body of water a character distinct from that of its banks, in vegetation, as well as in the nature of the soil itself.Is this a quote – should it be in quotation marks?

[5] See Saanichton Marina Ltd. v. Tsawout Indian Band at http://www.mandellpinder.com/pdf/pdf-our-firm/saanichton-marina.pdf [accessed January 25, 2010].

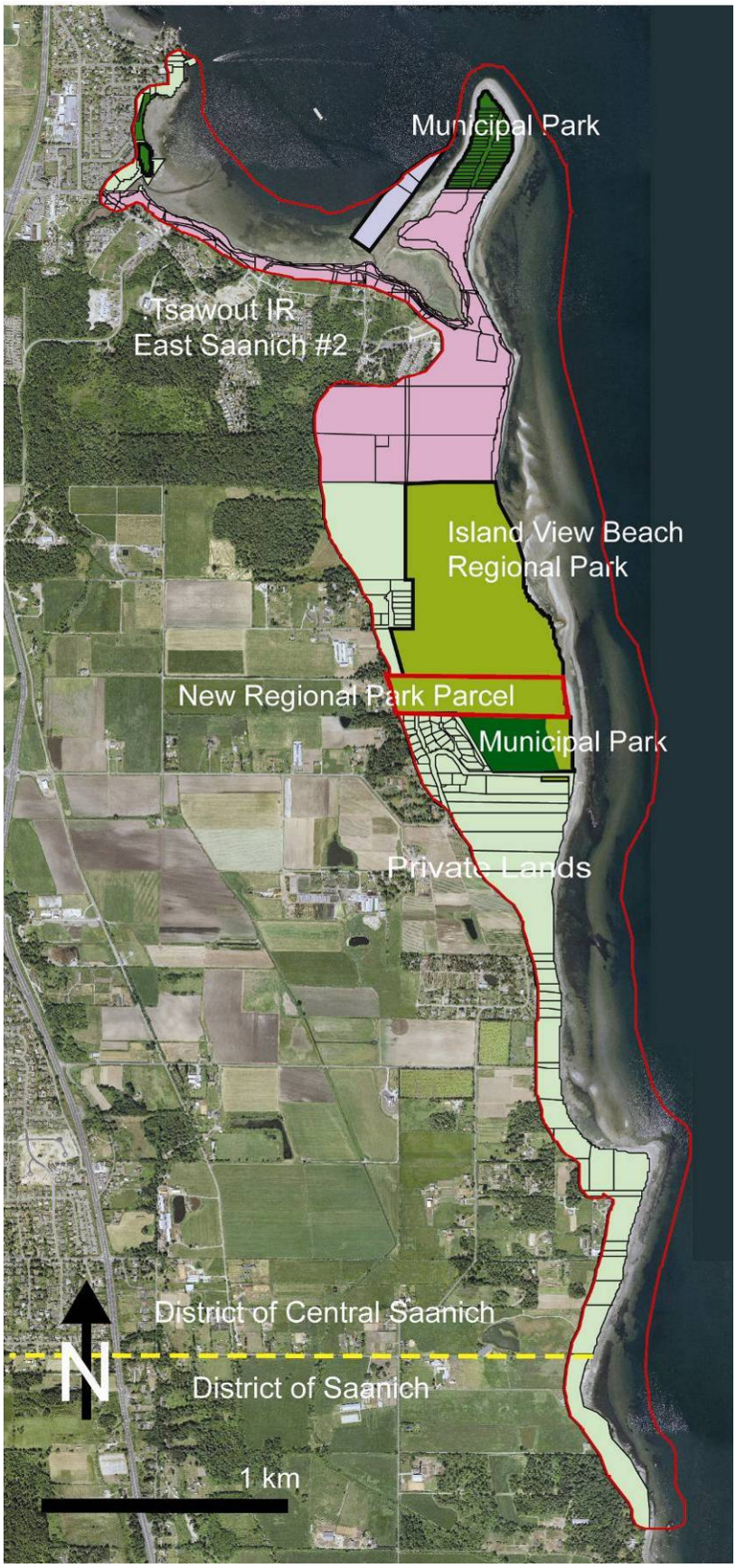


Figure 2. Land ownership and property boundaries in Cordova Shore. Dominant land ownership is the Tsawout First Nation (pink), CRD Regional Parks (Island View Regional Park (yellow-green; note newly acquired parcel outlined in red), municipal parks (dark green), and private property (light green). The intertidal area (Province of BC) is not shown with tone. The water leases in Saanichton Bay are shown light purple.

actions on the part of private landowners are implied. One of the recommended actions is to collaborate with private landowners on stewardship activities.

Regional Context

The lands of the Cordova Shore are part of a unique broader landscape in the southern part of the Strait of Georgia. This landscape-scale unit includes the sand bluffs, spits, dunes, coastal wetlands, and marine ecosystems of Cordova Shore, James Island, and Sidney Island (Figure 3).

These three areas have a shared geologic history (the largest area of glacially-deposited sand in the region) and are structured by similar ecological systems composed of coastal wetlands (salt marshes) enclosed by protective sand spits and closely tied to eroding sand bluffs. Many of the same species and ecological communities of conservation significance are found at all or most of these sites (see Table 1).

It is important to note that this landscape-scale unit also is also a culturally-defined region for the Tsawout First Nation and related groups from the Saanich Peninsula. While Saanichton Bay was the site of the Tsawout's winter village ("provided shelter from the prevailing southeast gales of winter, a year-round source of food, as well as playing an integral role in the Tsawout economic, societal, social, and spiritual life"; Tsawout First Nation, 2009) they had seasonal villages and resource sites throughout the region. The traditional territory of the Tsawout First Nation includes the Saanich Peninsula south to Mount Douglas, as well as the southern Gulf Islands (portions of Saltspring and Mayne islands). It also extended into what is now the San Juan Islands in Washington State as far north as Point Roberts (Tsawout First Nation, 2009). Resource use occurred throughout the area which is reflected in the location of middens, old village sites, and contemporary reserves (e.g., East Saanich Reserve #2; Pender Island). This region has been used by the Saanich people for as long as 10,000 years (Elliott Sr., 1983 in Bartley (2008)).

Parks and other conservation lands in Cordova Shore–James Island–Sidney Island include the Gulf Islands National Park Reserve (Sidney Spit, Hook Spit, Sidney Saltmarsh), recently designated private conservation areas on James Island which are protected and managed in a restrictive covenant held by Nature Conservancy of Canada, and the municipal and regional parks of Cordova Shore.

Figure 3. Sand bluffs, dunes, spits, and coastal wetlands in the Cordova Shore-James Island-Sidney Island area of southern Strait of Georgia. Feeder bluffs are shown in red, coastal sand ecosystems are shown in yellow, and coastal wetlands are shown in green. The prevailing direction of sediment transport is shown with white arrows (from the south and southeast).

PART 2. BACKGROUND INFORMATION

This section summarizes background information about the Cordova Shore that is relevant to the development of the Conservation Strategy.

Water and Sediment Quality

The Capital Regional District monitors water and sediment quality as part of region-wide stormwater quality monitoring program[6] (CRD, 2009). This includes water quality monitoring at the mouth of Tetayut Creek (CRD Discharge 412) and also at Tsawout Creek (CRD Discharge 407), the tidal "stream" which drains the Tsawout Wetland (see Figure 12). The results indicate that, with a few exceptions, both experience chronic high turbidity and have high concentrations of fecal coliform bacteria (see excerpted summaries below). Other data may be available from the Tsawout First Nation Fisheries Department or the Peninsula Streams Society.

"In 2008, all water quality measurements [from Tetayut Creek (CRD Discharge 412)] were of acceptable levels with the exception of fecal coliform concentrations. The winter and summer fecal coliform counts exceeded the BC shellfish harvesting standard. The summer result of 436 FC/100 mL also exceeded the Stormwater, Harbours and Watersheds Program (SHWP) guidelines. The fecal coliform concentrations in this creek have been consistently above the BC shellfish harvesting criteria since the start of the program. Fecal coliform counts in the past have occasionally exceeded the SHWP guidelines. In 2008, both of the turbidity measurements (6.3 and 4.4 NTU (Nephelometric Turbidity Unit)) were within the accepted guideline range. In the past, turbidity measurements have consistently exceeded the guideline since the start of the program (ranging from 10–45 NTU).

"In 2008, all water quality measurements [from Tsawout Creek (CRD Discharge 407)] were of acceptable levels with the exception of the fecal coliform concentrations and turbidity. The 2008 winter fecal coliform concentration did not exceed the BC shellfish harvesting standard. The 2008 summer sample exceeded the BC shellfish harvesting standard, but not the SHWPG. Most of the samples collected in previous years have exceeded the BC shellfish harvesting standard. Only one sample has exceeded the SHWPG in the past. In 2008, the summer turbidity measurement of 8.95 NTU exceeded the guideline. Almost all of the historical turbidity measurements have exceeded the accepted guideline."

Conservation Assessments, Surveys, and Research

Sensitive Ecosystem Inventory Mapping. In 1998, Environment Canada and MOE completed a mapping project that identified the distribution of sensitive ecosystems on southeastern Vancouver Island (Ward et al., 1998). Eleven polygons were mapped in Cordova Shore (Figure 4) including sparsely vegetated sand dunes on the spit and adjacent dunes (SV:sd), seasonally flooded wet meadows in the Tsawout Wetland (FS/WN:wm), shrub thickets (HT:sh), a small

[6] Stormwater, Harbours and Watersheds Program (SHWP) (CRD).

woodland area (WD), and sparsely-vegetated coastal bluffs near Cowichan Head (CB/SV:cl). The mapping can be considered a coarser version of the recent TEM mapping. More information on the methods and results in provided in Ward et al. (1998).

Figure 4. Sensitive Ecosystems (shown in coloured tone) of Cordova Shore (from Sensitive Ecosystems Inventory of East Vancouver Islandand Gulf Islands (Ward et al., 1998) (March 2004 map update).

Terrestrial Ecosystem Mapping. The BC Ministry of Environment (BC Conservation Data Centre and Ecosystems Information) recently completed terrestrial ecosystem mapping (TEM) for 143 ha of the Cordova Shore (Stacey and Filatow, 2009). Twenty map units were mapped (61 polygons) including 16 natural ecosystems and four anthropogenic units. Eight of the natural ecosystems are red-or blue-listed in BC, and several other are of high conservation significant but are not yet formally described or ranked (see Table 2 and Figure 5). Anthropogenic threats noted in the report include introduced plant invasion, altered drainage, development, recreational activities and shoreline stabilization. The report is accompanied by a map, appendices describing ecological communities, and GIS files. It is a current and very useful tool for understanding the physical and ecological environment of Cordova Shore.

Resource Atlas for the District of Central Saanich. The District of Central Saanich compiled a comprehensive atlas of the District's physical and ecological resources. It included excellent overviews of bedrock and surficial geology, aquifers, vegetation, slopes, and soils written by a range of experts (DCS, 2000). The discussion of surficial geology is very useful for understanding the development of landforms in Cordova Shore. Vegetation mapping expands the Sensitive Ecosystem Inventory (SEI) mapping described above by incorporating ecosystems that have a moderate amount of disturbance (SEI, by intent, only included ecosystems that were relatively unmodified).

Spider Research. A recent Ph.D. thesis project focused on the spider community in dry dunes of Island View Beach Regional Park (Salomon, 2008). It focused on community structure but also provided data on the richness of spider species, and the abundance of native and non-native species. Georgia Basin Bog Spider, a rare but poorly understood species generally associated with peatlands, was captured once in 2-years of pitfall trapping (R. Bennett, pers. comm.).

Sidney Channel International Bird Area. The Sidney Channel IBA encompasses a 50 km^2 area surrounding Sidney and James Island, and includes a portion of the Cordova Shore (see Appendix 4 for species list). It is considered an important feeding and resting area for migrating seabirds which feed on sand lance that spawn in the sand substrates of the area. The IBA description states: "Of particular significance at this site are the large concentrations of Brandt's Cormorants during fall migration (just over 1% of the worlds estimated population), and Mew Gulls and Brant during spring migration (about 1% of the northeastern Pacific Mew Gull population, and 1–2% of estimated Pacific Brant population). During fall, winter, and spring, a large number of Pigeon Guillemots are also present (almost 3% of the estimated national population) and about 300 Brant over-wintered in 1996–1997. In addition, about 20 pairs of nesting Black Oystercatchers (about 2% of the estimated national population) nest on islets located in the area. About 50 Marbled Murrelets (listed as nationally threatened) are also regularly reported at this site." (IBA, 2010).

Saanich Shoreline Survey and Mapping. Between 2007–2009, SeaChange Marine Conservation Society in collaboration with the Saanich Inlet Protection Society and Peninsula Streams Society completed a shoreline inventory of the Saanich Peninsula (SeaChange, 2009). The purpose of

the inventory was to map natural and modified shoreline segments, wildlife habitat, backshore vegetation, and foreshore use.

Only the southern and northern portions of Cordova Shore were mapped (Appendix 6) (the inventory did not include the Tsawout First Nation reserve). The shoreline in Island View Beach Regional Park varied from low to moderate ecological rating. Similarly, the shoreline at the north end of Saanichton Bay was also rated as low to moderate. A small section south of the regional park was identified as high ecological rating. The shoreline south of the regional park was identified as sand lance spawning habitat, and sand lance eggs were found in one sample (M. Fuchs, pers. comm.). The portion of this shore section south of the Tsawout First Nation reserve boundary was also identified as having eelgrass present (presumedly Japanese eelgrass in the intertidal zone).

Species and Ecological Communities at Risk

Cordova Shore supports or formerly supported many species and ecological communities that are considered provincially or nationally rare. This section summarizes information on species and ecological communities at risk including their occurrence in different habitat units and current provincial and federal conservation designations. It also presents recovery planning information on five species that are currently listed under the federal Species at Risk Act (SARA) that are known to occur, or occurred historically, in Cordova Shore, as well as surveys or assessments that have focused on rare species or ecological communities.

Table1 summarizes information of known, historic, and unconfirmed species at risk in Cordova Shore including subnational (provincial)[7] and federal SARA[8] conservation designations. Some birds species are ranked separately for breeding occurrences (designated as a B in the provincial rank) and non-breeding occurrences (many of the marine bird species do not nest in Cordova Shore). Appendix 2 provides more information on species at risk in Cordova Shore including national (global) ranks. Table 2 lists ecological communities at risk that occur or may occur in the study area. Some of these ecological communities are unranked at this time. Note that ecological communities are ranked provincially but are not recognized under SARA. Part 3 of this report includes additional information on species and ecological communities at risk in the study area.

Recovery Planning for SARA-listed Species. Five of these species (two plants, one bird, and two moths) are currently designated by COSEWIC[9] as endangered or extirpated in Canada: contorted-pod evening primrose, Howell's triteleia, Streaked Horned Lark, Sand-verbena Moth,

[7] Subnational (provincial) designations: S1 (Critically Imperiled); S2 (Imperiled); S3 (Vulnerable). Red-listed species are Extirpated, Endangered, or Threatened in British Columbia. Blue-listed species are of Special Concern.
[8] SARA designations : Endangered species: a wildlife species that is facing imminent extirpation or extinction; Threatened species: a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction; Special concern species: a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats; Extirpated species: a wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
[9] Committee on the Status of Endangered Wildlife in Canada.

and Edward's Beach Moth (suspected but not confirmed from Cordova Shore). Two additional species, silky beach pea and Georgia Basin Bog Spider (both confirmed from Cordova Shore), are currently under assessment by COSEWIC and will likely be designated as endangered based on the small number of known populations.

As a requirement under the federal Species at Risk Act (SARA), recovery strategies and their associated actions plans must be developed for each species[10]. Current status of recovery planning for each species and their associated recovery goals are listed below. Critical habitat[11] is described where relevant.

Contorted-pod evening-primrose: A proposed recovery strategy has been developed (Fairbarns and Vennesland, in prep). The long-term recovery goal is to attain nine or more viable self-sustaining populations of contorted-pod evening-primrose in Canada. Proposed critical habitat includes an area on the northern boundary of Island View Beach Regional Park. Cordova Shore will likely be an important site for recovery of contorted-pod evening-primrose.

Howell's triteleia: A multi-species recovery strategy was developed for Howell's triteleia and four other species associated with Garry oak woodlands by Parks Canada Agency (2006). Long-term recovery goals for all species in the strategy are to: maintain existing populations at current levels of abundance or greater; restore species to their approximate historical area of occupancy and extent occurrence through reintroductions or translocations; and ensure long-term population viability. Critical habitat is not currently described.

Streaked Horned Lark: A recovery strategy has been developed for Streaked Horned Lark (Environment Canada, 2008). The recovery goal for this species is to re-establish a breeding population of at least 10 breeding pairs at a minimum of three sites within its historical breeding range in Canada (10 pairs in total). Critical habitat is not described.

Sand-verbena Moth: A recovery strategy was developed for Sand-verbena Moth (BC Invertebrates Recovery Team, 2008). The long-term recovery goal is to protect all Sand-verbena Moth locations in Canada. The short-term goal is to minimize the threats to Sand-verbena Moth at each known location, restore suitable habitat conditions at each location, and increase yellow sand-verbena patches at each location. Critical habitat is currently being described.

Edwards's Beach Moth: A recovery strategy and recovery goal for Edward's Beach Moth have not been developed. It is likely to be similar to the goal for Sand-verbena Moth. Critical habitat has not been described.

[10] The sequence is (1) COSEWIC status report, assessment, and statusing; (2) SARA listing; (3) development of Recovery Strategy; (4) development of Action Plan.
[11] Critical habitat is the habitat necessary for the survival or recovery of a listed endangered, threatened or extirpated species and is designated under SARA.

Table 1. Species at risk (SARA or red or blue listed) that currently occurred, historically occurred, or could occur in the Cordova Shore area. Note, that the table also includes bird species whose breeding occurrences are assigned a higher conservation rank (denoted with B) than other life-history phases (e.g., feeding, congregation). Y = presence recently confirmed; X = historically occurred; O = unconfirmed.

Species	Habitat Type	Provincial Status*	COSEWIC Status	Cordova Shore
Plants				
yellow sand-verbena	Coastal sand	S3 (blue)		Y
contorted-pod evening-primrose	Coastal sand	S1 (red)	E	Y
beach morning glory	Coastal sand	S3 (blue)		Y
American glehnia	Coastal sand	S3 (blue)		Y
silky beach pea	Coastal sand	S2 (red)	In process	Y
black knotweed	Coastal sand	S3 (blue)		Y
fleshy jaumea	Salt marsh	S2S3 (blue)		Y
Howell's triteleia	Oak woodland	S1 (red)	E	Y
Invertebrates				
Pacific Sideband (land snail)	Moist forest	S3S4 (blue)		O
Moss' Elfin, *mossii* ssp.	Rock bluff	S2S3 (blue)		O
Vancouver Island Ringlet	Moist meadow	S1 (red)		Y
Western Branded Skipper, *oregonia* ssp.	Dry meadow	S2S3 (blue)	T	Y
Dun Skipper	Wetland	S3 (blue)		O
Blue Dasher (dragonfly)	Wetland	S3S4 (blue)		O
Georgia Basin Bog Spider	Wetland	Not assessed	In process	Y
Sand-verbena Moth	Coastal sand	S1 (red)	E	Y
Edward's Beach Moth	Coastal sand	S1 (red)	E	O
Birds (including breeding occurrences)				
Northern Goshawk, *laingi* ssp.	Forest	S2B (red)	T	O
Great Blue Heron, *fannini* ssp.	Generalist	S2S3B,S4N	SC	Y
Vesper Sparrow *affinis* spp.	Dry grassland	S1B (red)	E	O
Streaked Horned Lark *strigata* ssp.	Coastal sand	SXB, SNA (red)	E	O
Short-eared Owl	Moist meadow	S3B,S2N (blue)	SC	O
American Bittern	Wetland	S3B (blue)		O
Green Heron	Wetland	S3S4B (blue)		O
Common Nighthawk	Coastal sand	S4B (yellow)	T	Y
Peregrine Falcon, *anatum* ssp.	Generalist	S2B (red)	SC	Y
Barn Swallow	Generalist	S3S4B (blue)		Y
Band-tailed Pigeon	Generalist	S3S4B (blue)	SC	Y
Caspian Tern	Marine	S3B (blue)		O
Double-crested Cormorant	Marine	S3B (blue)		Y
Brandt's Cormorant	Marine	S1B,S4N (red)		Y
Marbled Murrelet	Marine	S2B, S4N (red)	T	Y
Common Murre	Marine	S2B,S4N (red)		Y
Ancient Murrelet	Marine	S2S3B,S4N (blue)	SC	X
Surf Scoter	Marine	S3B, S4N (blue)		Y
California Gull	Marine	S3B (blue)		X

Table 1 continued.

Birds (including breeding occurrences)				
Horned Grebe	Marine	S4B	SC	X
Western Grebe	Marine	S1B, S2N (red)		X
Hudsonian Godwit	Wetland	S2B (red)		X
Lewis's Woodpecker	Forest	S2B (red)	T	X
Long-billed Curlew	Wetland	S3B (blue)	SC	X
Short-billed Dowitcher	Wetland	S2S4B (blue)		X
Upland Sandpiper	Wetland	S1S2B (red)		X
Other Vertebrates				
Western Toad	Wetland	S4 (yellow)	SC	O
Sharp-tailed Snake	Dry grassland	S1 (red)	E	O
Keen's Myotis	Generalist	S1S3 (red)		O
Cutthroat Trout, *clarkii* ssp.	Stream	S3S4 (blue)		Y
Coho Salmon	Stream	S4 (yellow)	E	Y
Red-legged Frog	Wetland	S3S4 (blue)	SC	Y

Table 2. Ecological communities at risk (red or blue listed) that occur in Cordova Shore. Several unranked communities are included in the table because of their regional rarity.

Ecological Community	Habitat Type	Provincial Status*
American glasswort–sea-milkwort Herbaceous Vegetation	Coastal wetland	S2 (red)
Seashore saltgrass Herbaceous Vegetation	Coastal wetland	S2S3 (blue)
Unvegetated marine mudflat	Coastal wetland	unranked
Sitka willow–Pacific willow–skunk cabbage Vegetation	Coastal wetland	unranked
American searocket Sparse Vegetation	Coastal sand	unranked
Dune wildrye–beach pea Herbaceous Vegetation	Coastal sand	S1S2 (red)
Large-headed sedge Herbaceous Vegetation	Coastal sand	S1S2 (red)
Pacific wormwood–red fescue–Racomitrium moss	Coastal sand	S1 (red)
Silver burweed–Puget gumweed Herbaceous Vegetation	Coastal sand	unranked
Black knotweed–yellow sand-verbena Sparse Vegetation	Coastal sand	unranked

2007 Rare Plant Survey. Fairbarns (2007) surveyed for 33 rare plants (ranked S3 (vulnerable) or higher by the BC CDC) in the spit and dunes, rock knoll, and adjacent wetlands of the Tsawout First Nation Reserve, Island View Beach Regional Park, and Cordova Spit and Island View Municipal Parks. Field work was undertaken in May–June 2007. Eight rare species were recorded: American glehnia, beach morning glory, black knotweed, contorted-pod evening-primrose, fleshy jaumea, silky beach pea, Howell's triteleia, and yellow sand-verbena. Six of the eight species are found in coastal sand ecosystems; Howell's triteleia is associated with Garry oak meadows, and fleshy jaumea is found in salt marshes. General and species-specific management actions were proposed (see Action 44). Actions focus on improving management planning, reducing recreation impacts, and controlling invasive plants. The report also discusses

methods for augmenting small populations to avoid demographic collapse.

Coastal Sand Ecosystem Status Report and Action Plan. Parks Canada and MOE have recently initiated a new recovery team to coordinate recovery planning and implementation for an expanding group of species at risk in coastal sand ecosystems (sand beaches, spits, and dunes).The intent of the Coastal Sand Ecosystem Recovery Team (CSERT) is to undertake ecosystem-based recovery planning which benefits multiple species at risk. Through its members, the recovery team will coordinate new initiatives, acquire funding, and implement actions to recover species at risk in coastal sand ecosystems. As part of the new initiative, a status report characterizing the ecology, biodiversity, conservation significance, and threats to species and ecological communities in coastal sand ecosystems has been developed (Page et al. in prep.). A multi-species action plan that integrates the recovery planning information for four of the species listed above, plus pink sand-verbena which is found on the west coast of Vancouver Island, is also under development (Parks Canada, in prep.). More species in coastal sand ecosystems are expected to be designated as at-risk in the future, particularly plants, moths, and ground-based arthropods such as beetles and spiders.

Recovery Planning for Contorted-pod Evening-primrose in CRD Regional Parks. Fairbarns (2004) described contorted-pod evening-primrose populations in Island View Beach and Witty's Lagoon Regional Parks, and made management recommendations. He noted: "populations of Contorted-pod Evening-primrose appear to be declining at both Witty's Lagoon and Island View Beach due to habitat conversion for recreational purposes, trampling by people and pets, and invasion by non-native species. Eighteen recommendations were made, involving: (1) improving the protection of the existing populations of Contorted-pod Evening-primrose in CRD Regional Parks; (2) encouraging awareness of conservation values, with an emphasis on plant species at risk, at Witty's Lagoon and Island View Beach; (3) monitoring the populations of rare sand dwelling plants in Witty's Lagoon and Island View Beach Regional Parks as well as their habitat, and park use; and, (4) restoring degraded habitat and encourage the establishment of new subpopulations of contorted-pod evening-primrose or expansion of existing ones".

Sand-verbena Moth Habitat Restoration Pilot Project. In 2003, Nick Page (Raincoast Applied Ecology) undertook a small-scale project to restore sparsely-vegetated habitat in the north part of Island View Beach Regional Park for Sand-verbena Moth (Page, 2004). Three 10 x 10 m plots were established and different methods for removing Scotch broom and non-native grasses were tested. A similar test was conducted at Goose Spit near Comox. The research found that mature Scotch broom plants were killed by ground-level pruning or brush-cutting, shallow tilling removed grass and moss cover but increased Scotch broom germination, and salt spray application had little effect on vegetation. At Goose Spit, further tests indicated the best method for restoring sparsely-vegetated habitat was cutting of Scotch broom plants combined with surface scalping of mosses, grasses, and their associated seedbank. Soil, vegetation, and seedbank characteristics were also measured.

Park Management, Conservation Zoning, and Bylaws

Island View Beach Regional Park Management. Three documents guide the management of Island View Beach Regional Park. At the broadest level, the CRD Regional Parks Master Plan (CRD, 2000) provides strategic direction on park management that is system-wide in scope. It does not examine park-specific issues, but "provides a vision and a purpose for CRD Regional Parks" and "gives direction for achieving the highest standards of public service and stewardship in protecting the natural environment and providing opportunities for outdoor experiences and activities". It states that regional parks have two purposes: "(1) to establish and protect a network of regional parks in perpetuity that represent and help maintain the diverse range of natural environments in the Capital Regional District; and (2) to provide opportunities for outdoor experiences and activities that foster appreciation and enjoyment of, and respect for, the region's natural environments". Island View Beach Regional Park is classified in the Master Plan as a Regional Conservation Area, which signifies occurrences of regionally significant natural environments with sensitive and threatened ecosystems, including rare or endangered plant and animal species. Park planning prioritizes of protection of the natural environment. Permitted outdoor activities are intended to have little impact on environmental values. The current Master Plan covered the years 2000-2009. A new Regional Parks Strategic Plan for the years 2010–2019 is currently in development and due to be completed later in 2010.

Early management of the regional park was guided by the 1989 Island View Beach Regional Park Management Plan (CRD, 1989). Most of the park was zoned Nature Appreciation with the southern portion zoned for Outdoor Recreation. This recognized the conservation importance of the park, but also that beach-related activities during summer account for the largest number of park visitors. The purpose of Nature Appreciation parks is "to provide opportunities for visitors to increase their awareness and knowledge of these special protected landscapes and the natural environments of the Capital Regional District in general that they represent". This management approach emphasizes the interpretation and appreciation of natural history and human resources. Development of the management plan was accompanied by a public consultation process summarized in a document entitled "Island View Beach Regional Park Draft Management Plan: Results of Public Participation" (CRD, no date). A process to develop an updated management plan is planned for initiation in the near future. Public consultation will again be an important part of this process.

The 1989 Management Plan was supported by the development of the Island View Beach Regional Park Interpretive Plan in 1992 (CRD, 1992). The plan "addresses five major problems: the themes for IVBRP's natural resources; the approaches that would best interpret those themes based on a consideration of the park's setting, planning status, objectives, and clientele; the text and graphic concepts that are part of the overall approach; the cost of this approach; and its location within the park". It describes several themes that are important to convey as part of park interpretation: "the building of an accretion beach; colonizing the beach; surviving in the beach; the world behind the beach; the multiple habitats; the rare plants in a

beach and marine environment, and threats to a fragile beach environment".

CRD Regional Parks Bylaws. Two bylaws regulate activities in CRD regional parks (CRD, 2010a; CRD, 2010b). The Capital Regional District Parks Regulation Bylaw (CRD Bylaw No. 3682) regulates or prohibits animals in regional parks, the use of firearms, hunting, motor vehicles, and damage or disturbance to natural features, wildlife, and park features. The Capital Regional District also recently updated their ticketing and fee bylaw (CRD Regional Parks CRD Bylaw No. 3675) which provides a legal basis for issuing tickets for prohibited activities in Bylaw No. 3682. These bylaws provide a regulatory basis for the management of recreation-related activities and impacts in Island View Beach Regional Park.

Municipal Park Management. None of the three Central Saanich parks are developed parks and all lack management plans. The Tsawout First Nation considers Cordova Spit Park to be part of the East Saanich Indian Reserve #2. Several existing or potential beach access points are discussed in a report of beach access in Central Saanich (DCS, 2001). They focus on access points supported by the road network and in the Cordova Shore area including (from north to south) Saanichton Bay Park, Lamont Road, Island View Road, Martindale Road (undeveloped), and Campion Road (undeveloped).

Conservation Zoning. The District of Central Saanich's Official Community Plan (OCP) (DCS, 2008) states that: "The eastern shore of Central Saanich lies on Cordova Channel and Haro Strait and includes Cordova Spit and Island View Beach Park, a regionally significant park. The beaches to the south of Cordova Spit have been created by natural processes of erosion, transport and build-up from bluffs lying further south. Rocky beaches characterize the shoreline north of Cordova Spit. Cordova Spit is called 'Tixen' by the Tsawout First Nation. The spit is significant as it contains one the best intact examples of the extremely rare coastal dune ecosystem on Vancouver Island and provides vital habitat to a variety of plants and animals that are at-risk in BC, including several dozens of species of migratory birds".

The District of Central Saanich OCP includes several objectives and related policies to protect sensitive environmental areas, features, and values. It designates several areas of the Cordova Shore as development permit areas (DPAs) which regulate or guide appropriate development activities. They include: (1) Riparian Development Permit Areas as Riparian Areas or as Sensitive Aquatic Ecosystems; (2) Marine Shoreline Development Permit Areas; and (3) Sensitive Terrestrial Ecosystems. Maps (Schedules E and F) provide the boundaries of the DPAs (see excerpted maps in Appendix 7). In Cordova Shore, the portion of the shoreline, wetland complex, and dune areas outside the Tsawout Indian Reserve are designated DPAs. The DPA guidelines for shoreline protection are progressive and emphasize approaches which sustain natural processes.

The bluffs and shoreline within the District of Saanich are also considered sensitive ecosystems. They are not designated as specific DPAs but the OCP includes broad policies for protection (DCS, 2008).

The Tsawout First Nation has developed several regulatory approaches for controlling the development of on-reserve lands including protecting or managing natural environment features. The primary tool is a Land Code (Tsawout First Nation, 2006) which provides a legal basis for zoning reserve lands, regulating subdivision and development activities, and designating parks. It is guided by a Lands Advisory Committee. More recently the Tsawout First Nation developed a Comprehensive Community Plan (Tsawout First Nation, 2010). The plan identifies and maps a number of important environmental features on their Saanich reserve including the entire shoreline, as well as mature forest, old forest, wetlands (marsh), and woodlands based on the CRD Natural Areas Atlas (see Appendix 8). Waterfowl areas in Saanichton Lagoon and Tetayut Creek are also mapped. The community plan has an objective to "To preserve all environmentally sensitive areas on IR No.2 and create a connected ecological and recreational system where wildlife can thrive and people can access those areas through trails and appreciate nature". Policies to increase community involvement, designate no-development buffer zones around wetlands and riparian areas, require environmental assessments, preserve the shoreline, and encourage retention of natural vegetation are described.

Mosquito Management

The fresh, brackish, and salt marsh wetlands of Cordova Shore support several species of mosquitoes including the Summer Saltmarsh Mosquito which is often abundant in tidal marshes along the Pacific coast (D.G. Regan and Associates (DGRA), 2008). It is considered the most important annoyance mosquito in the Cordova Shore because of its aggressive biting behaviour and dispersal ability (1.9 km mean dispersal distance (Kramer et al., 1995)). Summer Saltmarsh Mosquito is the focus of an ongoing annual mosquito control program in Central Saanich in a co-operative effort between the Tsawout First Nation, the CRD and the District of Central Saanich (DGRA, 2008). Summer Saltmarsh Mosquito requires periodic inundation from tidal waters, precipitation, seepage, or surface water run-off to sustain its lifecycle (Darsie and Ward, 1981). Mosquito management is important for the Conservation Strategy because any changes to wetland hydrology may affect mosquito populations. As well, the use of larvicide has the potential to affect other non-target species in the Tsawout Wetland.

During the 2008 and 2009 mosquito control programs, DGRA found that mosquitoes are a source of annoyance to residents surrounding Cordova Shore. They noted that: "the most productive development sites in Central Saanich are the permanent ponds, ditches and temporarily flooded depressions occurring within an old salt marsh and adjacent farm fields located in the north-eastern area of the District of Central Saanich". Salt Marsh Mosquito was the most commonly collected mosquito species in Cordova Shore (DGRA, 2008). Summer Saltmarsh Mosquito is a vector for Western Equine Encephalitis Virus (WEE) and West Nile Virus (WNV) (Walter Reed Biosystematics Unit, 2009). Belton (no date) ranked Summer Saltmarsh Mosquito has having a high competence (ranked 3 on a scale of 0 to 4) for transmitting West Nile Virus.

The mosquito control program in Central Saanich focuses on removing breeding habitats such as standing water in containers and ponds, and the use of larvicide (VectoBac 200G (PCP # 18158)). This is a granular larvicide composed of BTi, a bacterium that is ingested by larval mosquitoes causing damage to the gut. DGRA (2008) state that salt marsh habitats located within the East Saanich (Tsawout) Indian Reserve required treatment with a total of 263 kg of VectoBac 200G (48% of the larvicide applied in Central Saanich in 2008). This was increased to 1127.7 kg in 2009 including sites in Island View Beach Regional Park (DGRA, 2009).

DGRA has also undertaken elevational mapping of the Tsawout Wetland to identify areas that are regularly flooded and provide habitat for Summer Saltmarsh Mosquito (N. Doerksen, pers. comm.)

Ethnoecology and Cultural Values

Cordova Shore has been home to the Tsawout First Nation and their ancestors for thousands of years (Simonsen et al., 1995; Suttles, 1974). Its combination of marine and terrestrial resources, freshwater, and protected beaches made it suitable for year-round use. Saanichton Bay was an ideal spot for a winter village because of it is protected from winter storms and is adjacent to rich intertidal and marine resources. Burial mounds are found on ȾIX̱EN̲ (G. Underwood and B. Claxton, pers. comm.). Other archaeological sites including middens are also present (Simonsen et al., 1995).

A more thorough description of ethnoecological uses of different ecosystems found in Cordova Shore is described in Part 3 of this report. In summary, the Tsawout relied more on marine resources including intertidal shellfish, fish, invertebrates such as crabs, and marine mammals such as seals (Jenness, 1935) than terrestrial resources. However, the terrestrial and wetland areas were an important source of plants for food, medicine, and technology (Jenness, 1935; Turner and Bell, 1971, Turner and Hebda, in prep.), and for some wildlife. The Tsawout Wetland may have been used for harvesting of Pacific silverweed. ȾIX̱EN̲ is still important for plants such as barestem desert-parsely which is used to treat respiratory problems (E. Claxton and J. Williams, pers. comm.) and other ailments. Hunting of deer, elk, and waterfowl also occurred throughout the Cordova Shore although these species are now more rare (elk is extirpated from the Saanich Peninsula). Waterfowl hunting still occurs on Saanichton Lagoon and a duck hunting blind is found on the inner part of ȾIX̱EN̲.

Marine resources were particularly important for the Tsawout. ”As did their predecessors, the Tsawout Band rely on the ocean water resources, particularly on the waters and resources of Saanichton Bay. For as long as anyone can remember, the Tsawout Indians have carried on an important stationary crab fishery in the location of the proposed marina basin. Although some crabbing is done by boat, the most convenient and often used method of harvesting crabs is to wade at low tide into that location, and use the traditional raking method. Clams and other shellfish have, in the past, been and remain an important part of the diet of the Tsawout. They

are gathered at various places around the bay including in and around the proposed marina site. Salmon were obtained both from the larger traditional territory and from the confines of Saanichton Bay and continue to be important. Spring salmon are fished only in and around the bay where they come to feed. Coho, herring and smelt have been relied upon in the past and are looked to as a food source at the present time. Bottom fish such as cod, flounder, skate and halibut are taken from the bay as food. Several species of trout and in particular cutthroat trout are also harvested from the bay for food." (from Claxton v. Saanichton Marina Ltd. judgment[12]).

Saanichton Bay and adjacent areas of Cordova Shore is still used extensively by the Tsawout First Nation for shellfish harvesting, and some traditional plant harvesting. The annual seafood festival is one way for the community to celebrate their connection to the land, and to educate visitors about the important of a healthy marine environment in sustaining the community.

[12] See Saanichton Marina Ltd. v. Tsawout Indian Band at http://www.mandellpinder.com/pdf/pdf-our-firm/saanichton-marina.pdf [accessed January 25, 2010].

PART 3. ECOSYSTEMS OF CORDOVA SHORE

This section describes five main ecosystems that make up the Cordova Shore:

- Marine ecosystems (233 ha): beach (below high water mark), intertidal and shallow subtidal areas;
- Coastal wetland ecosystems (82 ha): salt, brackish, and freshwater wetlands;
- Coastal sand ecosystems (33 ha): sparsely-vegetated sand spit and stable and semi-stable dunes (but excluding sand beach ecosystems below the high water mark);
- Rock outcrop ecosystems (1.2 ha): sparsely-vegetated rock and forested or shrub-dominated; and
- Bluff ecosystems (88 ha): unstable and forested sand bluffs.

Figure 5 shows the ecosystems of Cordova Shore and Figure 6 shows terrestrial ecosystem mapping (TEM) of rare ecological communities in the study area (from Stacey and Filatow, 2009).

Note that the ecosystems or communities that make up the Tsawout Wetland occur on a gradient of declining marine influence from north to south. They range from Saanichton Lagoon which is composed of intertidal (e.g., mud flats, gravel bars) and some salt marsh areas, to the north central part of the wetland which is salt marsh, to periodically inundated brackish marsh further south, and finally to developed wet meadow areas around Island View Road which are used for agriculture. The most southern areas have been most affected by reduced tidal flooding and increased drainage and have fewer wetland species such as Pacific silverweed and seashore saltgrass.

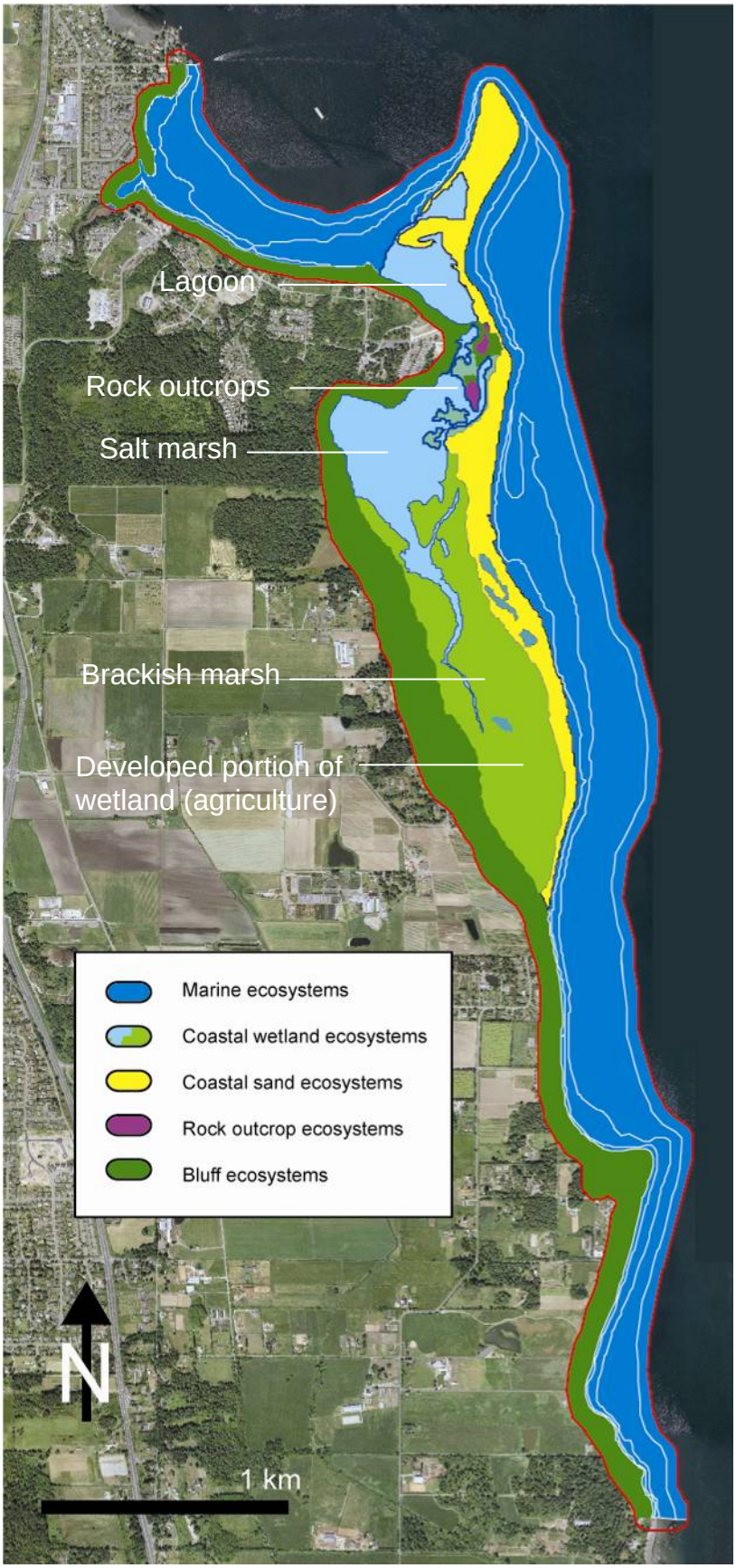


Figure 5. Ecosystems of Cordova Shore. Note that Saanichton Lagoon and the salt marsh area are shown in light blue and the south portion of the Tsawout Wetland is shown in light green. The vegetation communities that make up the Tsawout Wetland occur on a gradient of declining marine influence from north to south; these units are less distinct in the field. The southern end of the brackish marsh (surrounding Island View Rd) has been drained and diked for agriculture; it is no longer a natural wetland.

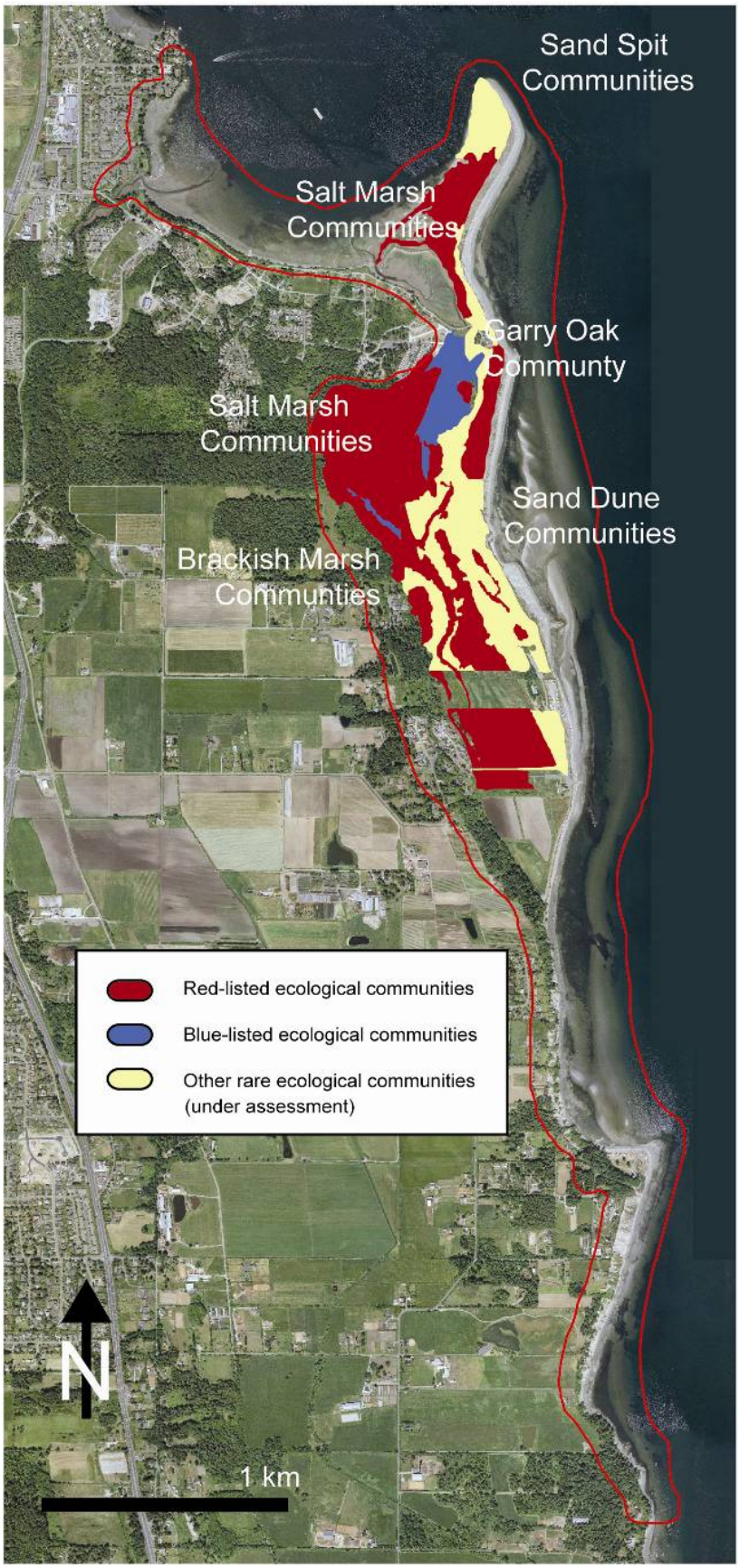


Figure 6. Status of ecological communities in Cordova Shore from TEM mapping (Stacey and Filatow, 2009). Ecosystems described as ”other rare ecological communities” have not yet been described or ranked by the BC Conservation Data Centre.

Marine Ecosystems

Marine ecosystems are an essential component of Cordova Shore (Figure 7). They also increase the complexity of conservation management because of their dynamic ecological processes, poorly defined boundaries, and complex jurisdictional issues. The boundary of Cordova Shore is formed by the transition from the intertidal to the shallow subtidal zone. The intertidal zone encompasses an elevation band that ranges from the higher water mark[13] which is generally marked by a band of wood debris and the start of terrestrial vegetation such as beach wild rye and beach pea, to the lower extent of exposure during normal low tides. The subtidal zone remains wet under all normal tides and supports species that cannot tolerate even infrequent exposure.

a

b

Figure 7. Representative shoreline habitats of Cordova Shore: (a) lower intertidal sandy-gravel shoreline on south side of ȾIXEN that is rich in algae growth; and (b) exposure of organic layer in the intertidal alongside Island View Beach Regional Park. Photos by N. Page.

Ecological communities in the intertidal and subtidal portion of Cordova Shore have not been formally described or mapped in detail, although the SeaChange Conservation Society has recently mapped shoreline sensitivity and some aspects of shoreline ecology outside of the Tsawout First Nation's reserve (SeaChange, 2009; Appendix 6). The marine ecosystem of Cordova Shore encompasses four broad units (from south to north): (1) sand beach, intertidal sand flats, and shallow subtidal zone between Cordova Head and the tip of ȾIXEN; (2) the mud flats and salt marsh of the Saanichton Lagoon; (3) sand-gravel-cobble beach and silty sand flats in Saanichton Bay; and (4) the rocky shoreline on the north side of the bay, extending to the James Island dock. These should be considered general units with indistinct boundaries.

Most of the intertidal zone of Cordova Shore, particularly in the higher energy environment south of the spit, is dominated by medium sand in a broad and gently sloping intertidal shelf.

[13] The lower boundary of the terrestrial backshore and the upper boundary of the intertidal zone is defined by the high water mark. This is the average elevation of high tides over an extended period of time. Storm surges and large waves may infrequently inundate areas above the high water mark.

Occasional cobble or boulders exist and silty organic deposits are occasionally exposed along the north shore of Island View Beach Regional Park. Shallow wave forms in the sand surface increase habitat diversity. Because of the dynamic nature of the substrate, the most common organisms are invertebrates that remain buried, particularly shellfish. Detailed sampling has not been undertaken in Cordova Shore, but dominant species in sandy intertidal environments in the southern part of Georgia Strait include butter clam, Pacific littleneck clam, varnish clam, basket cockle, white sand macoma, and bent-nose macoma which are shallow burrowing species, and horse clam and Pacific gaper clam which are deep-burrowing species (Ricketts et al. 1985). The coarse sand substrates of the intertidal and subtidal areas is important for Pacific sand lance spawning (SeaChange, 2009). Schweigert et al. (2008) examined the distribution of medium coarse sand substrates at a depth of 20–50 m (habitats suitable for Pacific sand lance in the Strait of Georgia). The found that the most promising sites were located around James Island near Cordova Shore, but field sampling was needed. As noted previously, rich seabird communities are associated with Pacific sand lance resources.

The protected waters of Saanichton Bay and Saanichton Lagoon are a distinctive intertidal unit within the broader marine ecosystem of Cordova Shore that generally has finer sediments, less exposure from prevailing southeast winds and waves, and freshwater and sediment inflows from Tetlayut (Sandhill) Creek. It is composed of an assemblage of mudflats, saltmarsh, and gravel beaches depending upon substrate, exposure, and depth. Isolated cobble and boulders also occur on the beach. Saanichton Lagoon is included as the northern end of the Tsawout Wetland (see Figures 4 and 12) but it is also mainly a marine ecosystem that is flooded twice per day by normal tides. It is a productive environment for shellfish, crabs, and waterfowl that depends on the trapping of organic rich fine sediments. However, Tsawout elders have observed a change in sediment in some parts of Saanichton Bay (E. Claxton, Jr. pers. comm.); where before intertidal sediment was primarily sandy, finer sediments have accumulated in recent times reducing access and changing the intertidal community. An increase in fine sediment from Tetlayut (Sandhill) Creek is the suspected cause (D. Claxton, pers. comm.).

Eelgrass is an important component of lower intertidal and shallow subtidal ecosystems in low energy sites including Saanichton Bay. It may also occur in other areas Cordova Shore, however, detailed mapping has not been completed (N. Wright, pers. comm.). Eelgrass is a perennial marine plant that grows from rhizomes. It forms dense, meadow-like beds in sand-silt substrates that are biologically-rich ecosystems used by invertebrates (crabs), fish (species). Observations of the Tsawout First Nation indicate the extent and abundance of eelgrass beds has declined in Saanichton Bay in the past two decades (D. Claxton, pers. comm.). This is co-incident with an increase in fine sediments described above.

There is a short section of rock shoreline at the north end of Saanichton Bay that forms the boundary of the study area. This area has not been assessed in detail. Rocky shorelines in the southern Georgia Strait support a rich community of algae and invertebrates. Rockweed and barnacle often form a structurally dominant intertidal community on stable substrates.

Rare Ecological Communities. Unlike terrestrial ecosystems, marine ecological communities of conservation importance are not well described. Several communities from coastal wetlands (salt and brackish marsh) are described in the Coastal Wetland Ecosystems section. These communities are transitional between marine and wetland ecosystems.

Mudflats: Stacey and Filatow (2009) mapped and described an unvegetated mudflat community ("flat, non-vegetated plain-like areas with fine sediment") from most of the Saanichton Lagoon and the southeastern side of Saanichton Bay. Mudflats are considered marine wetlands. Its conservation significance is unranked in B.C., but it is critically important for shorebirds, waterfowl, marine invertebrates, and juvenile fish.

Wildlife. The marine unit supports a rich community of waterfowl, shorebirds, invertebrates (shellfish, crabs, etc), and some marine mammals (river otter, occasional porpoises and whales). Bartley (2008) recorded 18 shorebird species, 8 marine bird species, 6 gull species, and 17 species of ducks and geese during transects undertaken in 2007 (Appendix 5). Most were associated with the intertidal and subtidal marine ecosystems. River otters are regularly seen foraging in Saanichton Bay and Lagoon.

As described previously, Cordova Shore is part of the Sidney Channel Important Bird Area (IBA, 2010). Large numbers of seabirds and shorebirds congregate around Sidney and James islands to feed on Pacific sand lance. IBA (2010) states that "Sidney Channel is noted for the variety of marine birds that occur at the site throughout the year. Although most places along the south coast of the Strait of Georgia have relatively few birds in summer, the channel and lagoon on Sidney Island are well known for the presence of murrelets, auklets, cormorants, gulls and shorebirds. During winter, seaducks are spread throughout the channel, and during the spring they are joined by migrating grebes, loons, brant, and shorebirds". Of the approximately 102 bird species surveyed by Bartley (2008), 40 were from marine areas (Saanichton Lagoon, shoreline, and open water).

Species at Risk. The following species have been recorded in the marine portion of Cordova Shore. It is important to note that many of the marine birds including Caspian Tern, Double-crested Cormorant, Brandt's Cormorant, Common Murre, and Western Grebe are only considered "at risk" at breeding sites (note "B" in subnational conservation rank below).

Double-crested Cormorant *(Phalacrocorax auritus)*: commonly found off-shore; conservation status: G5[14], S3B (breeding colonies only), Blue.

Marbled Murrelet *(Brachyramphus marmoratus)*: small seabird commonly found off in relatively small numbers (<50) in Sidney Channel area in summer; less common in Cordova Shore; conservation significance: G3G4, S2B (breeding colonies only), S4N, Red, Threatened.

[14] Global ("G") ranks are similar to subnational "S" ranks, but denote conservation significance at a global scale: G1 (Critically Imperiled); G2 (Imperiled); G3 (Vulnerable); G4 (Apparently Secure).

Brant *(Branta bernicla)*: common in groups on ȾIXEN and lagoon; conservation status: G5, S3M, Blue.

Great Blue Heron, *fannini* subspecies *(Ardea herodias fannini)*: commonly observed feeding along shoreline or in lagoon and roosting in adjacent trees; no records of breeding colonies in area; conservation status: G5T4, S2S3B (breeding colonies), S4N, Blue.

Common Murre *(Uria aalge)*: common offshore, especially in late summer; conservation status: G5, S2B (breeding colonies), S4N, Red.

Brandt's Cormorant *(Phalacrocorax penicillatus)*: found in large congregations offshore (may occasionally be found in Cordova Shore unit) in fall; conservation status: G5, S1B, S4N, red.

Caspian Tern *(Hyroprogne caspia)*: found along shoreline and feeding in lagoon; common offshore; conservation status: G5, S3B (breeding colonies only), Blue.

Recreation Values. Recreation activities that occur in marine ecosystems of Cordova Shore include beach walking, dog walking, horseback riding, bird watching, swimming, kayaking, boating, and picnicking. Most occur in the upper intertidal zone which is dry and accessible most of the year. Activities in the lower intertidal and subtidal zones occur less frequently, and are concentrated during the summer. The highest use areas are within the intertidal zone at Island View Beach Regional Park, including the boat ramp. Beach walking and dog walking are the most common recreation activities during the fall, winter, and spring.

Cultural Values. Marine ecosystems sustained the Tsawout First Nation historically, and are still critical for food and culture, as follows:

Shellfish: Pacific littleneck clam, butter clam, basket cockle, varnish clam (recent introduction), Olympia oyster (native), and horse clam were harvested from throughout the intertidal zone of Cordova Shore; basket cockle are more common in the shallow sand troughs on the wide intertidal shell on the southern side of ȾIXEN (E. Claxton Jr, pers. comm.); Pacific littleneck clams and butter clams were more common or more abundant in Saanichton Bay; geoducks were harvested in the shallow subtidal zone south of the spit during very low tide (D. Claxton, pers. comm.).

Invertebrates: crabs were harvested from Saanichton Bay; their population is rebounding after being overfished in the 1990s (D. Claxton, pers. comm.).

Fish: Migrating salmon are frequently caught from the tip of ȾIXEN. Other species are sometimes fished within Saanichton Bay.

Waterfowl: ducks (Mallard, American Widgeon, teal species, Surf Scoter ("black duck"), and

Canada geese are traditionally hunted by the Tsawout First Nation in the Saanichton Lagoon (D. Claxton, pers. comm.). There is an old blind on the inner side of the lagoon. Bartley (2008) described: “In addition to gathering seafood, the area has also been used to hunt waterfowl. Saanich elders recall huge flights of ducks, geese and swans that would migrate along the Saanich peninsula during their annual migrations. John Elliot Sr. describes ’thousands of ducks [that] came in those days, so many would come that they would darken the sky. They would blot out the sun like a big, dark cloud' (Elliott Sr., 1983 p.44). Traditionally these waterfowl species were hunted using large nets hung between two poles where flocks of birds were known to regularly pass (Suttles, 1990). One of the most sought after species was the ”black duck’ (Surf Scoter - *Melanitta perspicillata*) that was used to make duck soup.”.

The annual Seafood Festival provides an opportunity for the Tsawout to celebrate their culture and allow people to experience a range of marine foods including salmon, crab, prawns, and other shellfish, cooked using traditional methods such as pit-cooking (see cover photo).

Threats. Excessive harvesting of shellfish, recreation disturbance to shorebirds and waterfowl, water quality impacts (fecal coliforms, contaminated sediment) from stormwater runoff (Tetlayut Creek), sediment deposition (loss of eelgrass).

Coastal Wetland Ecosystems

Wetlands are transitional between terrestrial and aquatic ecosystems, and have distinctive soils and plant communities adapted to frequent or infrequent inundation by salt or freshwater. The Tsawout Wetland is one of the largest coastal wetlands on southern Vancouver Island, and encompasses the large complex of mudflats, marsh, wet meadow, shallow open water, and shrub communities on the west side of Cordova Shore, as well as Saanichton Lagoon (Figure 8).

a

b

Figure 8. Representative photos of coastal wetland ecosystems of Cordova Shore: (a) Pacific silverweed-dominated brackish marsh in Island View Beach Regional Park; and (b) shallow open water area in seashore saltgrass-dominated saltmarsh in the northwest side of the wetland. Photos by N. Page.

The Tsawout Wetland, like many coastal wetlands, developed in a protected, low-energy

environment where fine sediment and organic matter are brought in with the daily inflow of nutrient and sediment-rich marine waters. Over time, sediment accumulation has gradually raised the elevation of the wetland and led to reduced tidal inflow and the establishment of terrestrial vegetation, particularly along the wetland margins. The southern portion of the wetland was converted to agriculture during European settlement of Saanich and only retains limited wetland functions and values. More information on the effects of hydrologic disturbance on the Tsawout Wetland is presented in Part 4 of this report. Smaller coastal wetlands isolated from the main wetland complex are found in Island View Beach Regional Park.

High salinity precludes the establishment of most species found in freshwater wetlands, and leads to the distinctive plant communities dominated by a limited group of salt-tolerant wetland plants. American glasswort, seashore saltgrass, and Pacific silverweed are the dominant species in the portion of the Tsawout Wetland still inundated by marine waters.

Fish community characteristics of the Tsawout Wetland are not well known; threespine stickleback have been observed in drainage channels in the northern (E. Claxton, pers. comm.) and southern portion of the wetland (M. Fuchs, pers. comm.).

Rare Ecological Communities. Two communities described for salt marshes of the B.C. coast are found in the Tsawout Wetland (including the Saanichton Lagoon). As well, a mudflat community and a shrub swamp were also mapped and described by Stacey and Filatow (2009).

American glasswort–sea-milkwort Herbaceous Vegetation: “estuary ecosystem occurring in the lowest intertidal zone with daily, prolonged tidal flooding. Vegetation diversity is low and dominated by American glasswort and seashore saltgrass. Significant cover of tufted hairgrass and fleshy jaumea” (Stacey and Filatow, 2009); conservation significance: G2G3, S2, Red.

Seashore saltgrass Herbaceous Vegetation: “estuary ecosystem occurring in the lowest vegetated tidal zone on imperfect to poorly-drained, fine sand to silt textured marine sediments. These sites are flooded daily for prolonged periods. Vegetation is typically dominated by seashore saltgrass but high cover of coast silverweed and common orache occurs on some sites in the study area” (Stacey and Filatow, 2009); conservation significance: GN5, S2S3, Blue.

Sitka willow–Pacific willow–skunk cabbage: “closed canopy of shrubs and low trees dominated by Sitka willow and Pacific willow with some alder and a lush understory with skunk cabbage and lady fern”; occurs at the base of the forested bluff where it is sustained by freshwater seepage; conservation significance: GN5, S2, Red.

Mudflat: “flat non-vegetated plain-like areas with fine sediments. Exposed at low tide”; occurs in the Saanichton Lagoon and adjacent areas of Saanichton Bay; conservation significance: undescribed (not applicable because of lack of vegetation).

Species at Risk. One rare plant, one butterfly, and a rare spider have been observed in wetland ecosystems in Cordova Shore. Additional rare birds such as Short-eared Owl, American Bittern, and Green Heron may also occur, but have not been conclusively identified. Peregrine Falcon (subspecies unknown) was observed hunting teal in October 2009. Dun Skipper (a rare butterfly) and Blue Dasher (a rare dragonfly) may also occur in the Tsawout Wetland but their presence in unconfirmed. Note that graceful arrowgrass was recorded from Cordova Shore historically but is no longer considered a unique species[15].

Fleshy jaumea *(Jaumea carnosa)*: succulent-like plant found in high saltmarsh areas often in the transition between glasswort communities and grass areas; considered rare in B.C. but locally abundant at northern edge of Saanichton Lagoon, as well as in salt marshes on James and Sidney islands; conservation status: G4G5, S2S3, Blue.

Vancouver Island Ringlet *(Coenonympha californica insulana)*: subspecies of the Common Ringlet is associated with wet meadows with bentgrasses and other low-growing grasses; formerly very abundant in Saanich but declined to <20 populations on southeastern Vancouver Island; observed in wet meadow areas on Tsawout Reserve and Island View Beach Regional Park; population status unknown; conservation status: G5T3T4, S1, Red.

Georgia Basin Bog Spider *(Gnaphosa snohomish)*: this rare spider was captured once in 2-years of pitfall trapping at Island View Beach Regional Park (R. Bennett, pers. comm.); it is likely associated with wetlands such as the Pacific silverweed community; a COSEWIC status report is currently underway; conservation status: not currently ranked at any level.

Recreation Values. The wetlands are less used for recreation compared to other ecosystem types in the Cordova Shore; seasonal flooding, mosquitoes, and lack of defined trails limit use. A network of smaller ("dogwalking") trails follow the shrub margins through the southern portion of the wetland and may be used by professional dogwalkers to avoid more heavily used areas of the park. A trail from the Oceanside RV Park on the Tsawout Reserve crosses the saltmarsh to access the largest rock knoll (Belly-rising Up) and the adjacent dune and beach area.

Cultural Values. The Tsawout Wetland was used for hunting of waterfowl and deer by the Tsawout First Nation (waterfowl hunting continues in the Saanichton Lagoon). The wetland may also have been used for harvesting the roots of Pacific silverweed, springbank clover, and other plant materials.

Threats. Drainage, filling, reduced flow, vegetation succession, intensive recreation such as

[15] Until recently raceful arrowgrass *(Triglochin concinna)* was considered to be distinct from the more common maritime arrowgrass, and rare in BC (ranked S2; red). Taxonomic review has amalgamated the two species. The Flora of North America notes: "examination of the *T. maritima* complex throughout the Americas, however, reveals continuous variation from small, widely spaced plants with 2-lobed ligules to large, tufted plants with unlobed ligules, including plants with all combinations of those characters".

unauthorized trail development, invasive species such as feral cats and European rabbits, conversion to agriculture.

Coastal Sand Ecosystems

Coastal sand ecosystems encompass the terrestrial portion of beaches[16], spits, and dunes in which sand is the dominant substrate. They contain sparsely-vegetated or herbaceous ecological communities (Figure 9). Coastal sand ecosystems occur at the intersection of marine and terrestrial realms where ecological patterns are structured by marine-related disturbance processes (e.g., sand movement, tides, storm surges, ocean spray), soil development, local climate, and vegetation succession. This section focuses on the terrestrial zone and excludes the intertidal zone (see previous section), which is inundated by tidal waters daily and is ecologically distinct. In Cordova Shore, coastal sand ecosystems occur throughout ƛIXEN and the dunes and sand flats south of the spit to the parking area in Island View Beach Regional Park. Some of the areas that were historically sand ecosystems have been developed or stabilized by vegetation.

a

b

Figure 9. Representative photos of coastal sand ecosystems of Cordova Shore: (a) black knotweed and yellow sand-verbena in sparsely-vegetated dune on Tsawout Reserve; and (b) Sand-verbena Moth, an endangered species that lives in association with yellow sand-verbena. Photos by N. Page.

Ecological Communities. Seven ecological communities occur in sandy areas of Cordova Shore ((see Page et al., 2009; Stacey and Filatow, 2009).

American searocket Sparse Vegetation: common and widespread sparsely-vegetated community found in the lower beach; European searocket is also common; conservation status: unranked in BC.

Dune wildrye–beach pea Herbaceous Vegetation: the dominant native beachgrass community

[16] The portion of beaches below the high water mark (the upper extent of normal tides) are considered marine ecosystems for the purpose of this report; the upper portion of sand beaches (backshore) support perennial vegetation and are included in this section on coastal sand ecosystems.

on many coastal sites including sand and gravel beaches and some estuary sites; more common in the Georgia Basin than west coast Vancouver Island sites; rarely floristically diverse and often only with dune wildrye and beach pea present; conservation status: GNR, S1S2, Red.

Large-headed sedge Herbaceous Vegetation: species-poor community on upper and mid elevation beach sites and dunes throughout coastal BC; often only with large-headed sedge present; conservation status: G1G2, S1S2, Red.

Scotch broom / sweet vernal grass Shrubland Vegetation: shrubland community on Georgia Basin dunes and spits; open shrub community dominated by non-native shrubs, with grass understorey dominated by sweet vernal grass and other non-native grasses; some wildflowers present depending on density of Scotch broom; conservation status: unranked in BC.

Pacific wormwood–red fescue–Racomitrium moss Herbaceous Vegetation: the dominant sparsely-vegetated community on dunes or spits in the Georgia Basin; highly variable in terms of species composition (for example some sites lack Pacific wormwood); this community encompasses both sparsely-vegetated sites as well as bryophyte-dominated sites with high cover of *Racomitrium* moss; conservation status: G1, S1, Red.

Two previously undescribed ecological communities mapped and described by Stacey and Filatow (2009): Silver burweed–Puget gumweed Herbaceous Vegetation community and a Black knotweed–yellow sand-verbena Sparse Vegetation community. Both are found on sand flats and dunes at Cordova Shore. More sampling and analysis work is needed to better describe these communities; they also need to be ranked by the BCCDC.

Species at Risk. The following rare vertebrate, invertebrate, and plant species occur, or historically occurred, in Cordova Shore.

Vertebrates

Streaked Horned Lark (*Eremophila alpestris strigata*): not currently known to occur or breed in Canada. Historically bred in both dune and grassland habitats in Canada, with breeding records concentrated in the Fraser Delta, although it probably also bred on southeastern Vancouver Island. Recorded from large coastal sand ecosystems (>10 ha in size) on the outer coast of Washington. Currently confined to small breeding populations in Washington and Oregon (Environment Canada, 2007). Conservation status: G5T2; SX; Red; listed as Endangered by COSEWIC; a joint recovery strategy for Streaked Horned Lark and Coastal Vesper Sparrow is available (Environment Canada, 2007.

Band-tailed Pigeon (*Patagioenas fasciata*): observed historically in the Cordova Shore area (but uncommon); recently assessed as Special Concern in Canada due to steady population declines since the 1960s; conservation status: G4, S3S4B (breeding occurrences only), Blue.

Invertebrates

Sand-verbena Moth (*Copablepharon fuscum*): rare moth that is endemic to large coastal sand sites along the Salish Sea (Figure 9); dependent on yellow sand-verbena as its sole host plant; in Canada, found at Goose Spit, Sandy Island, ȾIXEN, and James Island (2 sites); conservation status: G1G2, S1, Endangered.

Edward's Beach Moth *(Anarta edwardsii* syn. *Trichoclea edwardsii):* rare moth associated with coastal sand beaches from California to B.C. In B.C., it has been found at 6 coastal sand sites in BC (2 localities); never been found at ȾIXEN but suspected to occur there; conservation status: no national or provincial rank, recently designated as Endangered by COSEWIC (May 2009); see status report COSEWIC (2009).

Western Branded Skipper, *oregonia* subspecies *(Hesperia colorado oregonia)*: a small population occurs in dry, sandy grassland at the base of ȾIXEN (J. Miskelly, pers. comm.; Miskelly, 2009); considered to be more rare than current conservation ranking indicates; usually associated with Garry oak grasslands and open meadows; conservation status: G5T3T4, S2S3, Blue.

Plants

Contorted-pod evening primrose *(Camissonia contorta):* diminutive and annual plant found in open sand; designated as Endangered by COSEWIC; confined to southern Strait of Georgia sites (7 extant populations and one extirpated population in Canada); extirpated from ȾIXEN but small population in the northern part of Island View Beach Regional Park; conservation status: G5, S1, E); see status report and recovery strategy (COSEWIC, 2006; Fairbarns and Vennesland, in prep.).

Silky beach pea (Grey beach peavine) *(Lathyrus littoralis):* distinctive glaucous, hairy pea found in dunes and some beaches; two small subpopulations on ȾIXEN; considered very rare and a candidate species for COSEWIC assessment (status report underway); nine populations known at present in B.C.; conservation status: G5, S2, Red (COSEWIC status report under development).

Beach bindweed (beach morning glory) *(Convolvulus soldanella (Calystegia soldanella):* sprawling, long-lived perennial found on sand beaches and dunes; locally abundant on the central and northern part of ȾIXEN and a small population near Island View Beach; conservation status: G5, S3, Blue.

American glehnia *(Glehnia littoralis* ssp. *leiocarpa):* long-lived perennial carrot characteristic of dunes and some upper beaches; in Georgia Basin (observed at Sidney Spit and ȾIXEN); conservation status: G5T5, S3, Blue.

Black knotweed *(Polygonum paronychia):* long-lived low shrub that is a characteristic species in dunes both in Georgia Basin and west coast; sometimes found in more terrestrial environments; found at ʔIXEN and in Island View Beach Regional Park; conservation status: G5, S3, Blue.

Recreation Values. ʔIXEN and the dune area that extends to Island View Beach Regional Park are used primarily for passive recreation including walking and dog walking. Off-road vehicle use (mainly trucks) was considered a recreation activity on ʔIXEN until recently. Fencing and other access barriers constructed by the Tsawout First Nation have prevented or reduced access to the sensitive dune areas on the reserve. Fencing has also been installed at Island View Beach Regional Park to protect some of the rare plants from trampling.

Cultural Values. Coastal sand ecosystems are important for First Nations as sources of plant resources and other materials, and as sites for social gatherings, spiritual activities, and habitation. Coastal sand sites contain important plant resources that are not available elsewhere. Bartley (2008) summarizes a range of information on cultural values of ʔIXEN.

S. Niscak (pers. comm.) has suggested that many coastal sand ecosystems in the Georgia Basin were richer in plant resources and more important for Coast Salish groups than has previously believed. The co-occurrence of barestem desert-parsely *(Lomatium nudicaule)* and Hooker's onion *(Allium acuminatum)* in coastal sand ecosystems may have been a product of First Nation management similar to camas meadows. Both species were used for food by the Coast Salish. Bartley (2008a, 2008b) recently documented the cultural importance of ʔIXEN to the Tsawout First Nation with emphasis on the rare coastal sand ecosystem, as well as the bird community.

Hooker's onion *(Allium acuminatum):* commonly harvested by Coast Salish peoples and used as a food (often mixed with other plants because of its strong taste) (Turner and Bell, 1971); bulbs are often small (<1 cm in diameter).

Barestem desert-parsely (Indian-consumption plant) *(Lomatium nudicaule):* Turner and Bell (1971) stated that "this was one of the most powerful medicines of the Salish of southern Vancouver Island". The Saanich, Songish, and Cowichan chewed the seeds for colds and sore throats, and burned them to fumigate houses or "drive away ghosts". Seeds were swallowed for "some internal complaints" and may have been traded to west coast groups.

Dune wildrye grass *(Leymus mollis):* coarse leaves used in basketry and for twine and basket straps; the Saanich Salish used it in the ravels of reef nets (Turner and Bell, 1971, E. Claxton, pers. comm.); rhizomes were important as a rub after bathing by Makah people and its harvesting may have been a form of cultivation (K. Anderson, pers. comm.).

Yarrow (*Achillea millefolium*): used a poultice for nervous disorders (J. Williams, pers. comm.).

Pacific crabapple (*Malus fusca*): crabapples were harvested from isolated plants on ʔIXEN (E.

Claxton, pers. comm.).

Threats. Loss of sparsely-vegetated communities from vegetation establishment and succession; invasive species contributing to accelerated succession; recreation disturbance from off-road vehicle use, dogs, and human foot traffic to plants, invertebrates, and birds (ground-nesting species, shorebirds during stopovers), reduced or disrupted sand supply from shoreline protection or disrupted transport (jetties, etc).

Rock Outcrop Ecosystems

One of the unique features of the Cordova Shore is the juxtaposition of different ecosystems within a small area. In the north-central part of the unit, a distinctive rock knoll called Banana Island or Belly-Rising-Up by the Tsawout people rises from the surrounding wetland complex (Figure 10). Several smaller rock knolls are found northeast of the sewage treatment plant but they are generally smaller and more heavily disturbed (Figure 10). Banana Island is accessible by trails from the north side and provides a prominent viewpoint from which to see the extent of the Tsawout Wetland.

a

b

Figure 10. Representative photos of rock outcrop ecosystems of Cordova Shore: (a) view of Banana Island (rock knoll) from wetland area; and (b) licorice fern on small rock outcrop north of the sewage treatment plan. Photos by N. Page.

Ecological Communities. The rock knoll supports two main ecosystem types: (1) open rock areas with grass, forb, and moss cover and isolated Douglas-fir and Garry oak trees; and (2) closed canopy mixed forest with Douglas-fir and big-leaf maple. Most of the species of conservation significance found in rock bluff ecosystems in the Georgia Basin are associated with uncommon micro-habitats like shaded cliffs or seepage areas; Howell's triteleia is found in open grassland areas of Banana Island.

Terrestrial Ecosystem Mapping undertaken for this portion of the Cordova Shore (Stacey and Filatow, 2009) mapped two ecological communities in the rock knoll. The forested portion was considered Douglas-fir–Alaska oniongrass Forest, a red-listed ecological community. The non-

forested portion was mapped as Fescue–Common camas Herbaceous Vegetation. The dominant species in the forested unit are Garry oak, Indian-plum, Nootka rose, common snowberry, blue wildrye, great camas, grey rock-moss, red fescue, and chocolate lily.

The dominant species in the non-forested unit (based on sampling at similar ecosystems) are Cladina species, Wallace's selaginella, common camas, meadow death camas, fescue species, common velvet grass, orchardgrass, Pacific sanicle, Alaska oniongrass, *Brodiaea* species, and *Lomatium* species.

Stacey and Filatow (2009) note that: "These units are underlain by bedrock and small shallow pockets of rubbly-sandy colluvium and/or glacial till. Soils are shallow and enriched with organic materials (Ah horizon)".

Species at Risk. Only one species considered provincially or nationally rare is found specifically within the rock knoll ecosystem – Howell's triteleia.

Howell's triteleia *(Triteleia howellii)*: a very small population (1 plant in 1 sq. meter (Parks Canada, 2005) is found in the Garry oak ecosystem associated with the rock knoll (Belly-Rising-Up). The exact location is not known but was observed by Fairbarns (2007). The COSEWIC status report (Douglas and Penny, 2003) states: "this is a geographically highly restricted species with a small population occurring at a few scattered sites within remnant Garry oak habitats. It is located within a highly urbanized region with ongoing risks to the species from such factors as habitat loss, competition with invasive species, habitat fragmentation and competition with invasive species"; conservation status: G3G4, S1, Red, Endangered (2003).

Recreation Values. Two trails provide access to the southern rock knoll, and recreation use has increased because of development of the Oceanside RV park. The knoll provides a prominent viewpoint in the central portion of Cordova Shore.

Cultural Values. The largest rock knoll (Banana Island) has patchy but abundant camas lily and chocolate lily in the spring, as well as harvest brodiaea and white triteleia – all food plants of Coast Salish groups (B. Kendrick, pers. comm.).

Threats. Damage from excessive recreation (crushing, abrasion of plants from humans and dogs); invasive plants (particularly invasive grasses).

Sand Bluff Ecosystems

The southwest portion of Cordova Shore is a defined by a bluff (Figure 12) that rises steeply from the lowlands to the plateau above. The north half of the bluffs are located behind the Tsawout Wetland which provides protection from coastal erosion. In this area, the bluff is forested with mixed deciduous-coniferous forest that thrives on the moist sandy soils. Minor slope failures occur where seepage, windthrow, or other local conditions expose the underlying

sediments. Some minor clearing has also occurred for residential or agricultural development.

The southern half of the bluff complex surrounds Cowichan Head, a glacially-derived sand and till deposit that is similar, but older, to the Quadra sand deposits of James and Sidney islands (Clague, 1977) (Figures 11 and 12). This section is actively eroded by waves, and is the primary source of sand to the beaches of Cordova Shore. ȾIXEN is the product of long-term sand movement from the Cowichan Head bluffs. Short sections of shoreline protection designed to reduce bluff erosion and protect property at the bluff crest are found near Cowichan Head, however, most appears to be failing and unsuccessful. Patchy vegetation establishment occurs throughout the actively eroding areas (Figure 11).

a

b

Figure 11. Representative photos of sand bluff ecosystems of Cordova Shore: (a and b) Actively eroding bluffs of Cowichan Head. Photo a by Parks Canada and b by N. Page.

Ecological Communities. No ecological communities have been described from the bluff ecosystems of Cordova Shore. Most of the forest ecosystems are too young to be considered at risk, while the non-forested ecosystems are actively eroding and support few distinct species (often weedy or early successional species such as red alder colonize sand bluffs).

Species at Risk. No rare species have been described from the bluff ecosystems.

Recreation Values. The Cowichan Head bluffs provide a dramatic backdrop to the Cordova Shore, but their steepness and the private property constraints limit recreation access. There are two undeveloped access points near Cowichan Head (Martindale Road and Campion Street); both have limited recreation potential (DCS, 2001).

Cultural Values. The bluffs are considered prominent landscape features in central Saanich and define the coastal landscape in many areas. Views from the bluff crest are expansive. The bluffs have geological and biological values and have been used to study glaciation (i.e., Clague, 1977). Important fossil remains of mammoths and other late-Pleistocene animals have been found at the Cowichan Head bluffs which form the southern boundary of Cordova Shore

(Steffen and Harington, 2010; Harington, 1996).

Threats. Disruption to sediment supply through shoreline armouring, vegetation stabilization; invasive plants may accelerate stabilization (yellow tree lupine observed on Cowichan Head bluffs).

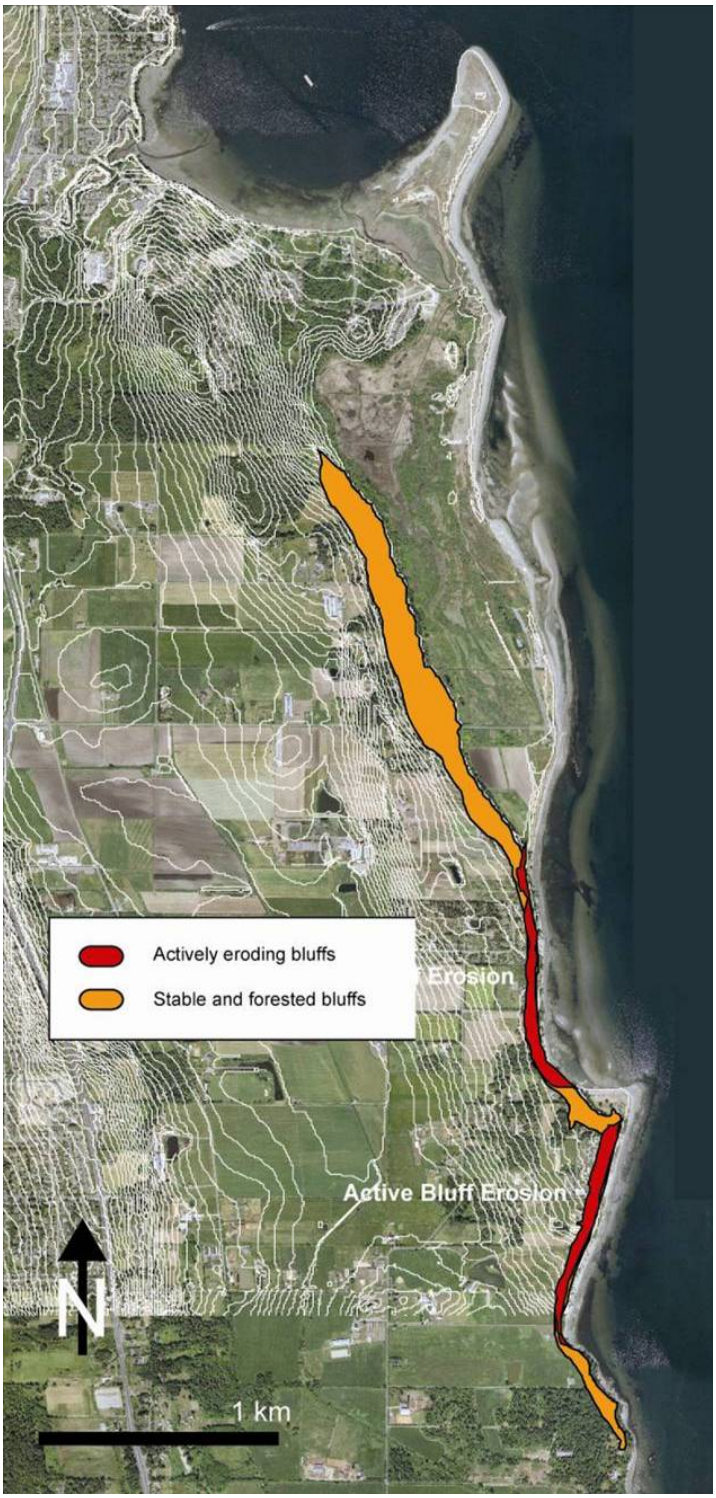


Figure 12. Location of bluff ecosystems in Cordova Shore. The red polygons show the location of actively eroding bluffs at Cowichan Head. Note that the bluff transitions to more gentle upland near the northwest corner of the Tsawout Wetland.

PART 4. CONSERVATION ISSUES

There are five primary conservation issues in the Cordova Shore that are encompassed by this strategy. They are similar to the four threats to natural ecosystems in the study area (introduced species, altered disturbance regime, development, and recreation) identified by the TEM mapping project (Stacey and Filatow, 2009).

Based on a qualitative assessment of their overall effect on ecosystem condition, they are ranked in order of priority:

1. Disruption to hydrologic processes in the Tsawout Wetland complex;
2. Impacts from recreation;
3. Invasive species establishment and spread;
4. Disruption to coastal sediment transport processes; and
5. Loss of ecosystems from development activities.

Each issue is discussed in more detail in the following section.

Disruption to Hydrologic Processes

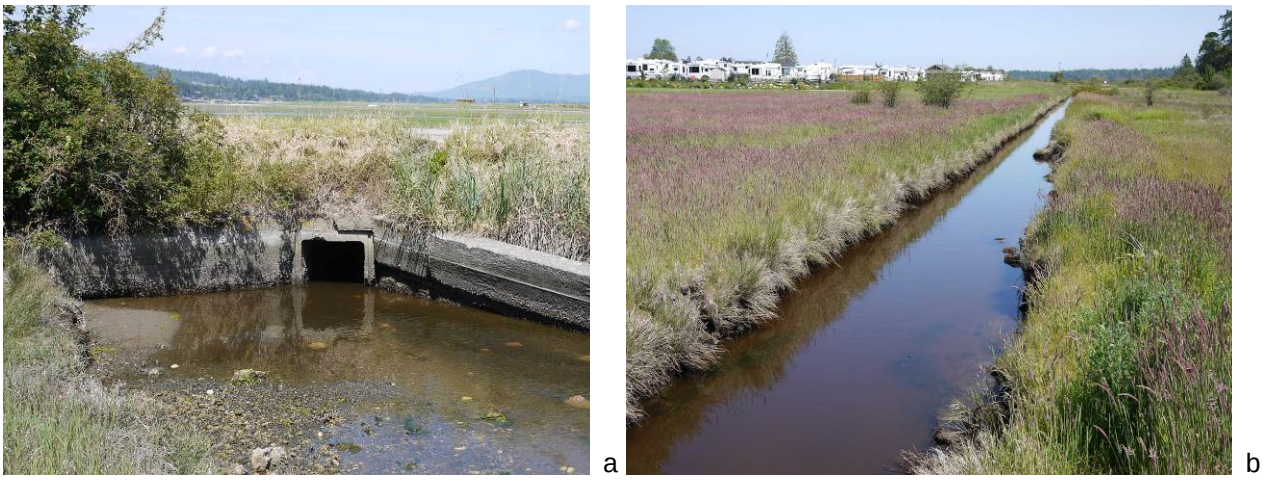
The Tsawout Wetland, composed of salt, brackish, and freshwater wetlands communities, has changed rapidly over the past 100 years because of drainage, diking, agriculture, and urban development. Historically, the Tsawout Wetland was inundated by tidal waters twice per day as a continuation of the Saanichton Lagoon. Early settlers constructed a network of drainage ditches throughout the wetland to reduce growing season water levels and promote pasture, hay production, and other agricultural uses (Figure 13). Additional ditches were installed in the 1940s. Culverts and fill were installed to reduce tidal inflows into the wetland (Figure 13).

More recently (1950s), a second drainage system was installed in the southern part of Cordova Shore to increase drainage and promote agricultural use (potatoes and other crops) (see “South Drainage” in Figure 14) (G. Gollmer, pers. comm.). This included the creation of additional drainage ditches and a new outfall consisting of an armoured pipe and outlet control. The outlet allows water to drain from the wetland during low tides, while at high tides seawater is prevented from flowing back into the wetland. A dike (see Figure 14) was also constructed to prevent saltwater inundation and debris deposition of adjacent agricultural land during large storms, as well as maintain the shoreline location in Island View Beach Regional Park. The drainage system and dike are maintained by CRD Regional Parks and the District of Central Saanich.

Table 3 on the following page summarizes the causes and effects of hydrologic disruption on the Tsawout Wetland.

Table 3. Causes and effects of hydrologic disruption and other impacts on the Tsawout Wetland.

Causes	Effects
• Installation of culverts and fill placement at wetland outlet • Installation of drainage ditches • Installation of second drainage outlet in Island View Beach Regional Park • Filling for agricultural use • Vegetation management for agricultural use (historic)	• Reduced salt water inundation (volume and salinity) • Lower summer water level (terrestrialization) • Vegetation change; loss of salt and brackish marsh species • Vegetation change: colonization of terrestrial grasses, shrubs, and trees • Changes to wetland foodweb (reduced marine nutrients) • Reduced waterfowl habitat • Reduced fish habitat and impeded fish access • Potential changes to mosquito community



a b

Figure 13. Examples of drainage disturbance of the Tsawout Wetland: (a) small box culvert that restricts tidal exchange into the salt marsh south of Saanichton Lagoon; (b) main drainage ditch in the north part of the Tsawout Wetland (Oceanside RV Park in background).

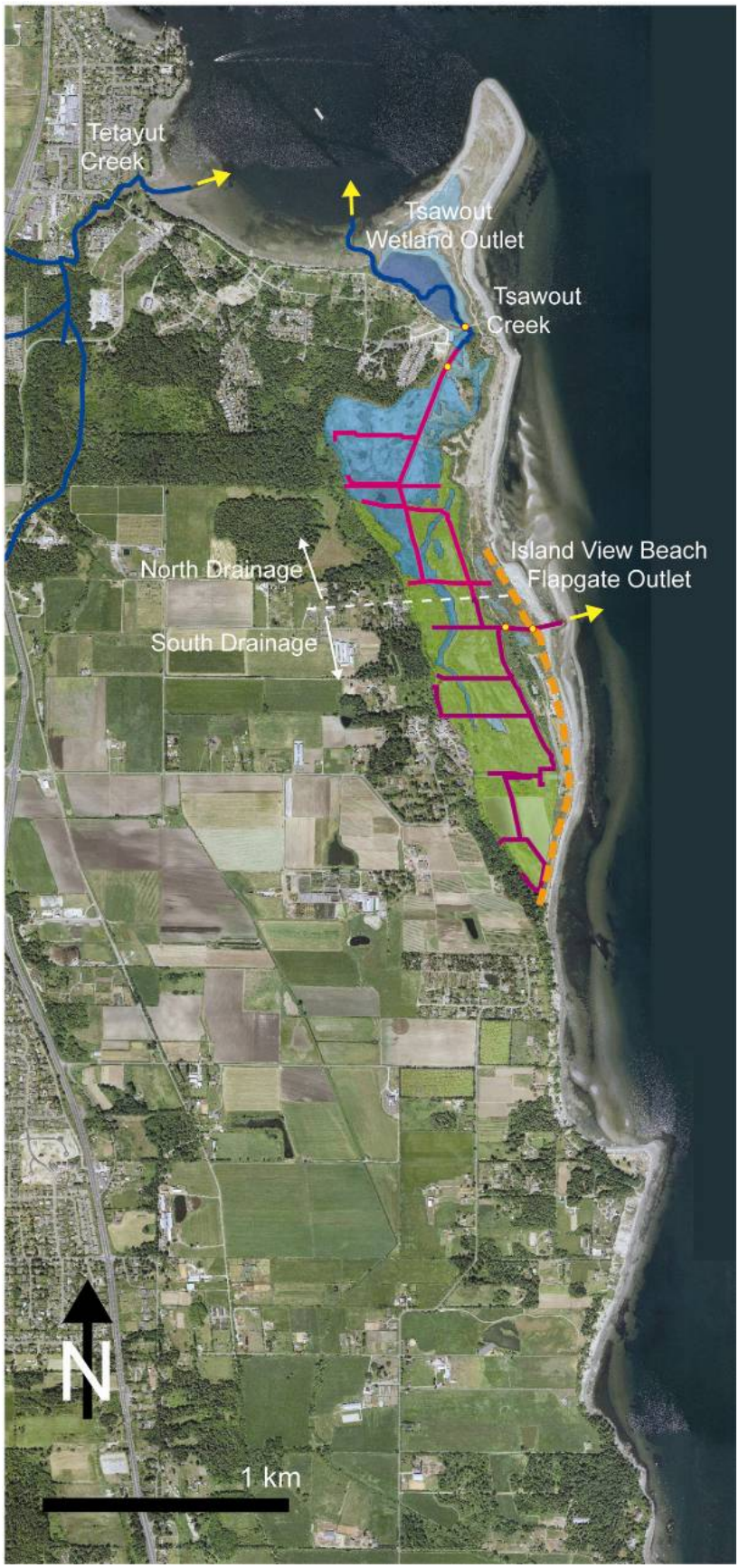


Figure 14. Drainage system of the Cordova Shore. It includes natural channels (dark blue), and two manmade drainage systems: the North Drainage (pink) which includes the salt and brackish marshes and drains to Saanichton Lagoon through Tsawout Creek; and the South Drainage (purple) which drains Island View Beach and the farmlands to the south and discharges through a flapgate. The drainage systems are connected. The shoreline protection dike is shown with a dashed orange line.

Recreation Impacts

Recreation is an important activity in Cordova Shore, especially in Island View Beach Regional Park and along the shoreline within the Tsawout Reserve (Figure 15). As described previously, it includes walking, horseback riding, dog-walking, picnicking, swimming, kayaking, boating, fishing, and bird watching. Off-road vehicle use was also a common activity in ȾIX̱EṈ until recently.

Dog-walking is considered an important recreational activity in Island View Beach Regional Park, as well as the shoreline of ȾIX̱EṈ. Dogs have the potential to affect ecological values such disruption or predation of ground-nesting birds, and erosion or disturbance to plants in high use areas. To address impacts to wildlife and other natural features, the Tsawout First Nation has requested that visitors to the shoreline portion of the reserve do not bring their dogs. As well, CRD Parks has a policy for Island View Beach Regional Park that states: "between June 1 and September 15, dogs on leash are allowed to pass through but are not allowed to stay in beach and picnic areas. The fields, hedgerows and shoreline provide important habitat for many varieties of resident and migrating birds." (CRD, 2010d).

Table 4 summarizes the causes and effect of recreation disturbance on wildlife and vegetation.

a

b

Figure 15. Examples of recreation disturbance: (a) tracks from off-road vehicle use on ȾIX̱EṈ (note, access management by Tsawout First Nation has reduced or eliminated this use); and b) trails through brackish wetland near Banana Island. Photo a by Parks Canada and b by N. Page.

Table 4. Causes and effects of recreation disturbance on wildlife and vegetation. Disturbances considered here include indirect effects from infrastructure development which are conducted partly in support of recreational activities.

Causes	Effects
• Development of formal and informal trails in sensitive habitats • Disturbance (noise, visual, chasing) to birds and small mammals from humans and dogs • Development of drainage structures, dikes, etc to protect recreation facilities • Beach fires	• Abrasion and compaction to plants and soil from trail development and use • Loss or failure of bird nesting habitat • Loss or reduction in bird stopover or feeding • Loss of culturally important plants • Damage or mortality to vegetation from fire

Invasive Species

Invasive plants contribute to habitat loss and accelerated vegetation succession in several ecosystems in Cordova Shore (Table 5; Figures 16 and 17). Most importantly, Scotch broom and non-native grasses have colonized of sparsely-vegetated sand ecosystems in Island View Beach Regional Park and to a lesser extent ƛIX̱EN̲, pasture grasses from early agriculture are prevalent in wet meadows and brackish marshes, and non-native grasses and forbs are abundant in rocky outcrops.

Scotch broom, gorse, European beachgrass, carpet burweed, and Dalmatian toadflax are considered the highest priority invasive plants in Cordova Shore; Scotch broom is widespread and abundant in Island View Beach Regional Park, while gorse, European beachgrass, carpet burweed, and Dalmatian toadflax have smaller populations at present but have the potential to spread rapidly. European beachgrass is found in 2–4 small patches on the northern margin of Island View Beach Regional Park and the southern part of the Tsawout Reserve. Carpet burweed occurs in the RV park in Island View Beach Regional Park and is often associated with camping areas (Ceska and Ceska, 2008). Dalmatian toadflax is found in the dunes in the south part of the Tsawout reserve. Some of the other non-native species which contribute to habitat loss or change in the Cordova Shore include Himalayan blackberry, cutleaf blackberry, common periwinkle, tree lupine (at Cowichan Head bluffs and tip of ƛIX̱EN̲ (see Figures 16 and 17), bentgrass species, and common velvetgrass.

Non-native animals, including feral cats and Eastern Cottontail rabbits, have less visible, but still important, effects on ecological values of the Cordova Shore. Feral cats are common in the Tsawout First Nation lands, and predate birds, small mammals, and reptiles. Eastern Cottontail Rabbits browse yellow sand-verbena in sparsely-vegetated sand dune communities. European Rabbits have recently been observed in Island View Beach Regional Park (M. Fuchs, pers. comm.).

a

b

Figure 16. Examples of invasive plants at Cordova Shore: (a) gorse on ȾIX̱EṈ (removed by Tsawout First Nation); and (b) tree lupine on open dune near tip of ȾIX̱EṈ. Photos by N. Page.

Table 5. Causes and effects of invasive species on ecological communities.

Causes	Effects
• Multiple causes; most external to management of Cordova Shore • Sources and dispersal of invasive plants (soil, roots, seeds) • Increased opportunities for establishment (soil disturbance, changes to ecosystem conditions) • Development of populations of feral cats • Introduced Rabbits	• Competition with other species for resources (competitive exclusion) • Functional ecosystem changes (nutrient additions, reduced sand movement) • Biotic homogenization (all communities become similar) • Loss of habitat for rare species associated with sparsely-vegetated communities • Predation of birds, small mammals, and reptiles • Browsing of native vegetation; excavation of burrows

Disruption to Coastal Sediment Transport

Coastal sand ecosystems depend on the movement of sand from source areas such as the Cowichan Head bluffs to beaches, dunes, and spits. Reduced supply or disruptions to sand movement can stabilize dunes and spits and accelerate vegetation succession, or erode the beach or dune margin.

In the case of Cordova Shore, the biggest concern is the reduced area of sparsely-vegetated sand habitats from vegetation colonization (Figure 16). It is unclear how much of this is driven by changes to sediment supply or transport, and how much is caused by natural succession in

combination with accelerated vegetation development from invasive plants. Many coastal sand ecosystems in the Strait of Georgia have lost sparsely-vegetated habitats in the past 50 years, although the specific causes are not well understood (Page et al., in prep.). The existing shoreline protection dike along Cordova Shore has not likely reduced the transport of sediment to Cordova Spit; actively moving lobes of sand are present in the foreshore of island View Beach Regional Park. However, it likely reduces the movement of sand from the beach to the backshore by reducing or preventing the movement of sand by wind (Figure 17). Shoreline protection along the foreshore south of Island View Beach Regional Park and the boat launch and stormdrain in the park may disrupt sediment transport. Table 6 summarizes the causes and effects of disrupted coastal sediment transport.

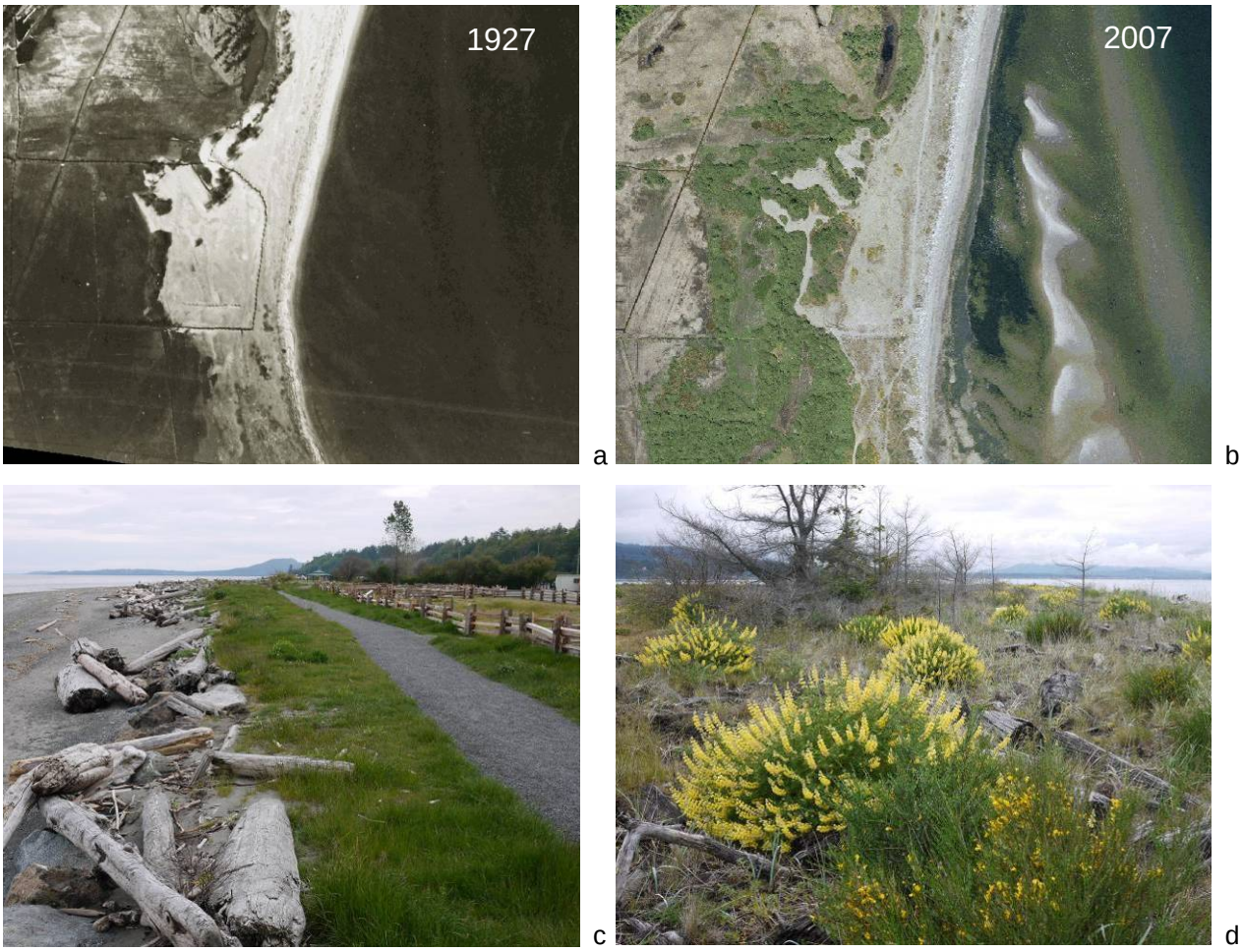


Figure 17. Changes to the extent of sand dunes on the southern portion of Tsawout Reserve and northern boundary of Island View Beach Regional Park (red line) between 1927(a) and 2007 (b) (80 years). Photo a by Government of Canada; b by CRD. Photo c shows the dike and foreshore trail in Island View Beach Regional Park that reduces sand movement into the backshore; Photo d shows yellow tree lupine and Scotch broom colonizing the backshore at the tip of Cordova Spit. Wood debris may contribute to stabilization at this site.

Table 6. Causes and effects of disruptions to coastal sediment transport.

Causes	Effects
• Reduced sand supply from feeder bluffs (natural stabilization or shoreline armouring) • Disrupted longshore transport from shoreline armouring, boat ramp, storm outfall • Reduced supply to dunes from trapping at beach (logs, grasses) • Reduced movement through and within dune from vegetation changes	• Loss of sparsely-vegetated communities • Accelerated vegetation succession on stable dunes • Loss of habitat for rare species associated with sparsely-vegetated communities • Loss of nutrient-rich(er) sands from the beach (older sand is acidic and nutrient-poor) • Reduced seed movement on stable dunes?

Urban and Agricultural Development

Almost 20% of Cordova Shore is private land, and the majority of lands in the Tsawout reserve are CP lands with de facto private control. Land use in private lands includes agricultural activities (cultivation of vegetable crops, pasture), rural or suburban residential use, and RV parks. Subdivision and development restrictions are provided for zoned agricultural lands under the Agricultural Land Reserve Act. Development of rural and suburban lands outside the Tsawout reserve are also regulated by the District of Central Saanich and the District of Saanich. Activities and land uses on reserve lands are managed by the Tsawout First Nation under the Land Code and the recently developed Community Plan (Tsawout First Nation, 2010).

Many of the effects of land development on conservation values in Cordova Shore are the result of historic development such as drainage and agricultural development. The most noteworthy recent development was the construction of the Oceanside RV park on a CP parcel within the southern part of the Tsawout reserve. Development of the RV park was associated with infilling of the margin of the Tsawout Wetland, loss of riparian vegetation, and an increase in recreation use, including dog walking, in adjacent areas. The Land Code and new Community Plan will provide better protection of environmentally sensitive lands (K. Cossey, pers. comm.).

Expansion of recreation facilities such as trails, roads, parking areas, boat launches, and buildings in Island View Beach Regional Park also has the potential to affect conservation values in Cordova Shore. A new park management plan is being developed to guide park activities and facilities.

The causes and threats associated with urban and agricultural development on ecosystems in Cordova Shore are summarized in Table 7.

Table 7. Causes and effects of urban and agricultural development.

Causes	Effects
• Vegetation and soil removal or disturbance. • Disruption to surface and subsurface water flow • Construction of roads, buildings, and associated infrastructure • Habitat fragmentation and loss of connectivity • Introduction of invasive species • Increased human use of adjacent natural areas	• Loss of ecological communities including plants and animals • Incremental changes to ecosystem functions • Degraded wetland or stream conditions from hydrologic disturbance and introduction of contaminants • Reduced wildlife movement and loss of disturbance-sensitive species • Change in composition of ecological communities (biotic homogenization)

PART 5. CONSERVATION STRATEGIES

Goal

The overall goal of the Cordova Shore Conservation Strategy is to protect, restore, and celebrate the unique ecological and cultural values of Cordova Shore.

Conservation Strategies

Ten strategies are proposed:

Strategy 1. Manage collaboratively

Strategy 2. Recognize ecological boundaries

Strategy 3. Protect and restore ecological and physical processes

Strategy 4. Protect and restore cultural resources

Strategy 5. Control invasive plants and animals

Strategy 6. Manage recreation and access

Strategy 7. Address impacts from adjacent lands

Strategy 8. Contribute to species at risk recovery

Strategy 9. Promote education and research

Strategy 10. Celebrate ecological and cultural uniqueness

Conservation Actions

Conservation actions are described in text form on the following pages and summarized in Table 8. The table presents information on the recommended institutional participants, timelines (1-yr, 2-yr, 5-yr, 10-yr), and priority. Priority is ranked as High, Medium, or Low based on a qualitative assessment of the importance of the action in addressing the conservation issues described in Part 4 of this report, and the practicality of undertaking the action with available expertise and resources. High priority actions are shown in red.

Strategy 1. Manage Collaboratively

A1. Build on the informal and collaborative approach (Cordova Shore Conservation Partnership) to management of Cordova Shore that was initiated in 2006 by the Tsawout First Nation, CRD Regional Parks, and the District of Central Saanich, in collaboration with the Canadian Wildlife Service and other partners.

A2. Involve adjacent and CP landowners in the Cordova Shore conservation initiative through informal discussions and direct consultation such as public meetings.

A3. Investigate models for co-management of economic resources (fish, shellfish, etc) by Tsawout First Nation and other levels of government.

A4. Collect and distribute resource materials (cultural information, GIS data, ecosystem mapping, species at risk reports, etc) to assist in management planning by all involved.

A5. Share resources for habitat restoration, invasive species management, and other on-the-ground activities, including developing a native plant nursery for sand ecosystem restoration.

A6. Develop collaborative invasive plant control and recreation access plans that improve conservation throughout the Cordova Shore.

A7. Develop collaborative educational materials and programs for members of the Tsawout First Nation, visitors to Island View Beach Regional Park, and the greater community.

Strategy 2. Recognize Ecological Boundaries

A8. Use five major biophysical systems to inform conservation planning of TIXEN/Cordova Shore:

- Marine ecosystem structured by the movement of water, sediment, and species movement;
- Coastal wetland ecosystem structured by tidal inundation, long-term sediment deposition, freshwater inflows, and vegetation succession;
- Coastal sand ecosystem (spit and dunes) structured by sediment transport, soil conditions, and vegetation succession;
- Rock knoll ecosystem which supports Garry oak and associated species and is a unique part of the Cordova Shore landscape; and
- Coastal bluff ecosystem (forested and active) which provides sand to Cordova Shore.

A9. Recognize, through municipal plans and park management, the physical and ecological connections between these biophysical systems including the movement of sand from Cowichan Head which sustains dunes and the spit, as well as the movement of sediment and nutrients into Saanichton Bay, Saanichton Lagoon, and Tsawout Wetland through tidal circulation.

A10. Improve the coordination of landscape-scale conservation planning within the Sidney Island–James Island–Cordova Shore conservation unit involving Tsawout First Nation, CRD Regional Parks, CRD Stormwater, Harbours and Watersheds Program, District of Central Saanich, Parks Canada, B.C. Ministry of Environment, The Nature Conservancy of Canada, Garry Oak Ecosystems Recovery Team, Coastal Sand Ecosystems Recovery Team, and private landowners (including CP landowners on the Tsawout Reserve). Organize a workshop to collaborate on conservation planning.

Strategy 3. Protect and Restore Ecological and Physical Processes

A11. Encourage the use of municipal tools including development permit areas to protect active bluffs and coastal sediment transport. The overall goal is to sustain sediment supply to Cordova Shore's coastal sand ecosystem (T̸IX̱EṈ), which depends on maintaining natural rates of bluff erosion at Cowichan Head and uninterrupted coastal sediment transport. Use the District of Central Saanich's OCP as a model.

A12. Develop a feasibility plan for restoring the hydrologic patterns and processes of the Tsawout Wetland. The plan should be developed by a team of engineers and biologists, with direction from Tsawout First Nation and CRD Regional Parks. The purpose of the plan should be to provide strategic direction on the feasibility of restoration, and the key steps in the restoration process.

A13. As a first step in developing the feasibility plan, the effects of culverts, infill, and ditches on the hydrology (e.g., flood elevations), vegetation patterns, and wildlife use of the Tsawout Wetland should be investigated. This should include detailed hydrologic surveys of drainage patterns and water exchange (water balance). Two culverts near the outlet of the wetland (Beach Road culvert and the culvert near the Oceanside RV park) and historic fill should be assessed for flow conveyance into the wetland.

A14. To the extent possible, remove the shoreline protection dike in Island View Beach Regional Park to restore natural rates of wind-transported sand movements to the backshore, allow storm surges and coastal flooding, and facilitate natural recovery of upland ecosystems.

A15. If possible, dismantle or modify the South Drainage system in Island View Beach Regional Park and adjacent areas given changing agricultural uses of the area. Note, the South Drainage system is used to drain the farmland south of Island View Road and drainage improvements may be required to prevent or limit seasonal flooding. There may be opportunities to create ponds and shallow open water wetlands in Island View Beach Regional Park to increase habitat values and provide flood storage.

A16. Manage vegetation in the coastal sand ecosystem (development of Scotch broom, non-native grasses, and native moss in dune areas) and wetland complex succession (shrub and tree encroachment on margin of Tsawout Wetland) caused by invasive plants, reduced coastal sediment transport, and reduced seasonal flooding. Specifically:

- Identify potential changes to vegetation including shrub or tree dieback if tidal flooding is restored. This information is required to assess potential negative and positive changes to the Tsawout Wetland caused by increased tidal flooding;
- Remove (scalp) grass and moss mat to restore sparsely-vegetated communities in Island View Beach Regional Park as part of Scotch broom removal (discussed in Strategy 5); and
- Also see Strategy 5 (Control Invasive Plants and Animals) for additional actions.

A17. Investigate the effect of stormwater discharge from Tetayut Creek (Sandhill Creek) and Tsawout Creek on sediment quality, sediment character (sand vs. mud), and eelgrass populations in Saanichton Bay. This should expand on the work done under the CRD

Stormwater, Harbours and Watersheds Program and may include developing a sediment budget (kg/yr of different sediment sizes), measuring metals and hydrocarbons in fine sediment, measuring fecal coliform in runoff and Saanichton Bay, measuring shellfish quality, and mapping eelgrass (with assistance from SeaChange Conservation Society). This information would be used to better measure trends in the marine ecosystem, either positive or negative, caused by watershed management or other activities.

A18. If possible, limit the Central Saanich mosquito control program in the context of wetland conservation and the effects of larvicide on the wetland's food web. Conduct larval surveys to identify specific wetland habitats in the Tsawout Wetland which have the highest abundance of Summer Saltmarsh Mosquito.

A19. Invite Ducks Unlimited as well as CWS waterfowl and wetland experts to participate in the Cordova Shore Conservation Partnership. These agencies' expertise in wetland restoration and creation would be useful for exploring options for improving tidal flooding of the Tsawout Wetland, as well as wetland creation on the newly acquired regional park property.

Strategy 4. Protect and Restore Cultural Resources

A20. Recognize the right of the Tsawout First Nation to sustainably harvest plant and animal resources from Cordova Shore.

A21. Engage Fisheries and Oceans Canada and B.C. Ministry of Environment to review sustainable harvest levels for fish, marine invertebrates, and wildlife in Cordova Shore.

A22. Increase food, medicinal, and material plant resources through propagation (seeding, nursery production, etc). Possible species include yarrow, Pacific crabapple, and barestem desert-parsely. Incorporate culturally important plants into revegetation plans for disturbed or restored sites (closed roads, restored dune areas, etc).

A23. Restore or enhance eelgrass beds in Saanichton Bay by addressing causes of their decline such as sediment composition or quality changes, or by active replanting.

A24. Create an ethnobotanical garden for use in education of children and others from the Tsawout community and surrounding areas. Possible sites are adjacent to the Seafood Festival area, or the dune area immediately south of the Sewage Treatment Plant.

Strategy 5. Control Invasive Plants and Animals

A25. Survey the distribution of invasive plants in Cordova Shore and develop an invasive plant management plan to guide control and restoration activities.

A26. Control Scotch broom, gorse, European beachgrass, carpet burweed, and yellow toadflax, as the highest priority invasive plants in Cordova Shore.

A27. Control Himalayan blackberry, cutleaf blackberry, common periwinkle, common velvetgrass, and other non-native species throughout Cordova Shore. Target small populations of common periwinkle initially.

A28. Restore invasive plant management sites with native plants, including species of conservation concern and cultural value to the Tsawout First Nation. Sparsely-vegetated ecosystems should be revegetated with appropriate native species to avoid creating dense plant communities.

A29. Involve Tsawout community members and other local residents, volunteers from the greater community, stewardship groups, the Coastal Invasive Plant Committee (CIPC), and others in the invasive plant management program.

A30. Control feral cats and rabbits. Cats predate birds and small mammals and should be controlled through capture, neutering or spaying, and adoption. European rabbits should also be controlled using similar methods.

Strategy 6. Manage Recreation and Access

A31. Maintain, and if required, expand, the successful fencing and access barriers to prevent off-road vehicle use in sand and wetland ecosystems on Tsawout First Nation's land.

A32. Use orthophotos and ground-based GPS surveys to map primary and secondary trails, paths, and routes throughout Cordova Shore to assist in access and recreation planning.

A33. Review the trail network from the perspective of conservation objectives as part of the development of the Island View Beach Regional Park Management Plan. Close, reroute, or fence trails which conflict with conservation objectives. In particular, the large number of trails in the dune area at the north end of the regional park contributes to degradation. Fencing should be used to prevent vegetation trampling or wildlife disturbance adjacent to high use trails.

A34. Enhance the education of park visitors to emphasize the effects of off-leash dogs on wildlife, particularly shorebirds, waterfowl, and ground-nesting birds in Island View Beach Regional Park. This should be accomplished with improved signage as well as on-the-ground communication between parks and bylaw staff and dog walkers. Review the use of Island View Beach Regional Park by professional dog walkers.

A35. Strengthen dog management regulations and enforcement to protect native ecosystems and species from trampling, harassment, and fouling by dogs as part of the Island View Beach Regional Park Management Plan.

A36. Continue the stewardship and regulatory approaches for managing dog and pedestrian impacts on ƛIX̱EṈ by the Tsawout First Nation. Consider closing public access to the Tsawout portion of the shoreline during sensitive periods for waterfowl and shorebird use, and for ground-nesting birds.

A37. Investigate the potential for establishment of a provincial Wildlife Management Area, and the associated development of ecologically-appropriate regulations, in the marine portion of Cordova Shore.

A38. Investigate the potential for co-operative enforcement (CRD Regional Parks and Tsawout First Nation) of regulations related to ecological conservation such as off-leash dog activities.

Strategy 7. Address Impacts from Adjacent Lands

A39. Encourage the District of Central Saanich, District of Saanich, and coastal landowners to maintain natural rates of bluff erosion at Cowichan Head.

A40. Support stormwater management in the Tetayut Creek (Sandhill Creek) watershed to reduce sediment and water quality impacts on intertidal ecosystems in Saanichton Bay. Stormwater management may be more effective if specific downstream impacts (e.g., sedimentation, fecal coliforms, specific contaminants) to wetland and marine ecosystems are better known.

A41. Support ecologically-sensitive development planning to protect actively eroding bluffs at Cowichan Head and prevent infilling of the Tsawout Wetland.

A42. In consultation with landowners, including CP properties on Tsawout First Nation's lands, identify important conservation areas (wetlands, bluffs, forests, etc) that should be protected through acquisition, restrictive covenants, stewardship agreements, or other measures.

Strategy 8. Contribute to Species at Risk Recovery

A43. Support collaborative management of species at risk in the broader Sidney Island–James Island–Cordova Shore conservation unit involving Tsawout First Nation, CRD Regional Parks, Parks Canada, BC Ministry of Environment, the Nature Conservancy of Canada, the Garry Oak Ecosystems Recovery Team, the Coastal Sand Ecosystem Recovery Team, and private landowners.

A44. Implement recovery activities outlined in the recovery strategies for nationally-listed species at risk (note, recovery planning has not be initiated for Edward's Beach Moth):

- For Sand-verbena Moth: increase yellow sand-verbena populations (measured as foliar cover) within each locality used by the Sand-verbena Moth by 20% by 2017. This rate of increase will result in a doubling of host-plant resources by 2045 and partially address the estimated historic loss of yellow sand-verbena at known population sites. See BC Invertebrates Recovery Team (in prep) for more information;
- For contorted-pod evening primrose: (1) increase the area of occupancy and abundance of existing populations that are below minimum viable population size (once minimum viable population size is determined); (2) conduct trials for Contorted-pod Evening-primrose population establishment; and (3) develop and implement a translocation plan and establish new populations as per recovery objectives. See Vennesland and Fairbarns (in prep.) for more information.

- For Howell's triteleia (Parks Canada Agency, 2006): (1) maintain extant populations of Howell's triteleia at current levels of abundance or greater; (2) restore Howell's triteleia to its estimated approximate historical extent of occurrence and area of occupancy; and (3) attain a viable Canadian population of Howell's triteleia.
- For Streaked Horned Lark (from Environment Canada, 2008): (1) develop habitat suitability ratings and conduct site assessments; (2) assess habitat restoration requirements; (3) determine feasibility of habitat creation techniques, and, if feasible, create new sites; and (4) develop and implement regional and site-specific management plans at existing sites and, if determined to be feasible, create habitat at potential sites in the Fraser River delta and on southeastern Vancouver Island.

A45. Implement additional recovery actions for species at risk including:

- For contorted-pod evening-primrose: (1) fence existing populations at Island View Beach Regional Park to discourage walkers and dogs; (2) provide on-site signs; (3) remove Scotch Broom and other invasive shrubs from the existing populations and a buffer of at least 10 m; (3) implement a long-term restoration project involving an annual schedule of shrub removal to prevent re-invasion; (4) ensure that appropriate park staff are aware of occurrences and that any proposed future maintenance or replacement of park structures including the northern fence at Island View Beach should trigger an impact assessment and careful consultation with the Environment Protection Specialist.
- For Howell's triteleia, follow the recommendations provided by Fairbarns (2007): (1) inspect populations annually during each growing season to determine population size and assess threats and damage; (2) establish new subpopulations or expand the existing one by developing a restoration plan that addresses horticulture, experimental design, ecology, genetics and rehabilitation components; (3) marking priority sites for reintroduction; (4) removing invasive species from reintroduction sites; (5) establish experimental re-introduction plots and monitor re-introduced populations.
- For fleshy jaumea: no actions proposed; abundant population in saltmarsh needs no specific protection beyond maintaining access controls on vehicle use to FIXEN;
- For silky beach pea (from Fairbarns (2007): (1) barricades proposed to protect contorted-pod evening-primrose (see above) would also prevent further damage to sites supporting silky beach pea; (2) inspect populations annually during each growing season to determine population size and assess threats and damage; and (3) periodically assess the need for population augmentation based on monitoring results;.and
- For other coastal sand dune plants at risk (yellow sand-verbena, black knotweed, etc): focus on maintaining sparsely-vegetated sandy habitats by removing Scotch broom and other invasive plants, sustaining sand movement, and reducing intensive recreation.

A46. Support or undertake surveys to identify additional species at risk such as Edward's Beach Moth, ground-based arthropods, and bryophytes. Moth trapping for Edward's Beach Moth should be undertaken in the transition between the Saanichton Lagoon and sandy habitats, as well as in the dune areas near the Tsawout Wetland. Pitfall traps should be used to sample ground-based arthropods. Field surveys should be used to confirm the occurrence of Vancouver Island Ringlet (butterfly) in late May.

A47. Encourage the Canadian Wildlife Service to use Cordova Shore for breeding bird surveys, or as part of other bird monitoring programs, to improve knowledge about bird species at risk (e.g., Vesper Sparrow, Streaked Horned Lark, and seabirds).

A48. Encourage or require researchers and consultants who conduct species at risk surveys to involve one or more Tsawout youths in the sampling. A written report documenting methods and results should also be provided to the Tsawout First Nation and CRD Regional Parks.

Strategy 9. Promote Education and Research

A49. Develop education resources for school-aged children in the Saanich Tribal School program, as well as well the broader public school system.

A50. Enhance communications and interpretive services at Island View Beach Regional Park to educate park visitors about the ecological and cultural resources.

A51. Identify and support research activities that contribute to the conservation of Cordova Shore.

A52. Foster projects from UVIC's Restoration of Natural Systems program and Royal Road's University's Master of Science program.

A53. Encourage UVIC's Restoration Institute to use Cordova Shore as a model site for the coastal restoration program in 2010.

Strategy 10. Celebrate Ecological and Cultural Uniqueness

A54. Use a variety of methods to tell the *story* of the cultural and ecological uniqueness of the Cordova Shore. Review opportunities to use photography contests, artist workshops, and similar activities to celebrate cultural and ecological uniqueness.

A55. Use the Tsawout Seafood Festival, canoe races, Earth Day, and other events to celebrate the ecological and cultural uniqueness of Cordova Shore.

A56. "Brand" conservation activities throughout the Cordova Shore with a unique identifier to promote a landscape-scale view of conservation planning and stewardship, and the Cordova Shore Conservation Partnership.

A57. Celebrate ancestors, under the direction of the Tsawout First Nation.

A58. Encourage artists to help celebrate the Cordova Shore through painting, photography, sculpture, video, and other mediums. Provide an opportunity of artists to show their work in signs, publications, displays, and local shows (libraries, schools, etc). Commission local artists to produce work that can be used to celebrate Cordova Shore.

A59. Provide opportunities for family gatherings on Cordova Shore by allowing supervised vehicle access to the Seafood Festival site during weekend afternoons (noon to 7 pm).

Table 8. Cordova Shore Conservation Strategy: Summary of strategies and actions. .

Strategy and Action	Participants*	Timeline	Priority
Strategy 1. Manage Collaboratively			
A1. Build on the Cordova Shore Conservation Partnership	All	ongoing	High
A2. Involve adjacent landowners	CRD, TFN, DCS	2 years (by 2012)	High
A3. Investigate models for co-management by Tsawout First Nation	TFN, CWS, DFO, MOE, CRD	2 years (by 2012)	Medium
A4. Collect and distribute resource materials	CRD, TFN, DCS	2 years (by 2012)	Low
A5. Share resources for habitat restoration	CRD, TFN, others	2 years (by 2012)	Low
A6. Develop collaborative management plans	CRD, TFN, DCS?	5 years (by 2015)	Medium
A7. Develop collaborative educational materials and programs	CRD, TFN	2 years (by 2012)	Medium
Strategy 2. Recognize Ecological Boundaries			
A8. Use biophysical systems to inform conservation planning	All	ongoing	Low
A9. Recognize physical and ecological connections	All	ongoing	Low
A10. Improve landscape-scale conservation planning	CRD, TFN, CWS, PC, NCC	ongoing	High
A11. Protect and restore ecosystems using municipal planning tools	CRD, TFN, DCS, DS	5 years (by 2015)	Medium
Strategy 3. Protect and Restore Ecological and Physical Processes			
A12. Develop a feasibility plan for wetland restoration	CRD, DCS, DS, TFN	2 years (by 2012)	High
A13. Investigate the effects of culverts and infill on wetland hydrology	CRD, TFN, CWS, DCS, DU	2 years (by 2012)	High
A14. To the extent possible, remove the shoreline protection dike	CRD	2 years (by 2012)	High
A15. If possible, dismantle or modify the South Drainage system	CRD, DCS	2 years (by 2012)	High
A16. Manage vegetation succession	CRD, TFN	10 years (by 2019)	Medium
A17. Investigate the effects of stormwater discharge	CRD, DCS, DFO, TFN	2 years (by 2012)	Medium
A18. If possible, limit the mosquito control program	DCS, CRD, TFN	2 years (by 2012)	Medium
A19. Invite Ducks Unlimited to participate in wetland restoration	TFN, CRD, CWS	year (by 2011)	High

Strategy 4. Protect and Restore Cultural Resources			
A20. Recognize the right of the Tsawout First Nation to harvest resources	All?	5 years (by 2015)	High
A21. Review sustainable harvest levels	All?	2 years (by 2012)	Medium
A22. Increase culturally important through propagation	TFN	2 years (by 2012)	Medium
A23. Restore eelgrass beds in Saanichton Bay	TFN, CRD, DFO	5 years (by 2015)	Medium
A24. Create an ethnobotanical garden	TFN	5 years (by 2015)	Low
Strategy 5. Control Invasive Plants and Animals			
A25. Survey invasive plants and develop a management strategy	CRD, TFN, DCS	2 years (by 2012)	High
A26. Control Scotch broom, gorse, European beachgrass, carpet burweed, yellow toadflax	CRD, TFN	2 years (by 2012)	High
A27. Control other invasive and non-native plant species	CRD, TFN	5 years (by 2015)	Medium
A28. Restore invasive plant management sites	CRD, TFN	5 years (by 2015)	Medium
A29. Involve community members, stewards, and other local residents	CRD, TFN	2 years (by 2012)	Medium
A30. Control feral cats and rabbits	TFN	5 years (by 2015)	Low
Strategy 6. Manage Recreation and Access			
A31. Maintain access barriers to prevent off-road vehicle use	TFN	1 year (by 2011)	High
A32. Map primary and secondary trails, paths, and routes	CRD, TFN, DCS	2 years (by 2012)	Medium
A33. Review conflicts between trails and conservation areas	CRD, TFN, DCS	2 years (by 2012)	High
A34. Use education to reduce off-leash dog impacts	CRD, TFN	2 years (by 2012)	Medium
A35. Strengthen dog management regulations	CRD	2 years (by 2012)	Medium
A36. Use stewardship to manage dog and pedestrian impacts on the spit	TFN	2 years (by 2012)	Medium
A37. Investigate the establishment of a Wildlife Management Area	CWS, MOE, TFN, CRD	5 years (by 2015)	Medium
A38. Investigate the potential for co-operative enforcement of bylaws	CRD, DCS, TFN	2 years (by 2012)	High
Strategy 7. Address Impacts from Adjacent Lands			
A39. Maintain natural rates of bluff erosion at Cowichan Head	DCS, DS	5 years (by 2015)	Medium
A40. Support stormwater management in the Tetayut Creek	DCS, TFN	5 years (by 2015)	Medium
A41. Support development planning to protect sensitive ecosystems	DCS, TFN	2 years (by 2012)	High

A42. Identify important conservation areas for protection	DCS, TFN, CRD	2 years (by 2012)	High
Strategy 8. Contribute to Species at Risk Recovery			
A43. Support species at risk recovery in the broader landscape unit	CRD, TFN, PC, DCS, NCC, CWS	5 years (by 2015)	High
A44. Implement recovery activities outlined for SARA species	CRD, TFN, PC, MOE	2 years (by 2012)	High
A45. Implement recovery actions for rare plants	CRD, TFN, PC, MOE	2 years (by 2012)	High
A46. Support or undertake surveys for species at risk	CRD, TFN, DCS, MOE, VNH, PC	2 years (by 2012)	High
A47. Undertake breeding bird surveys or other monitoring programs	CWS	5 years (by 2015)	Low
A48. Encourage species at risk surveys	CRD, TFN, MOE, DCS	2 years (by 2012)	Medium
Strategy 9. Promote Education and Research			
A49. Develop education resources	CRD, TFN	2 years (by 2012)	Medium
A50. Enhance interpretive services at Island View Beach Regional Park	CRD	2 years (by 2012)	Medium
A51. Identify and support research activities	All	2 years (by 2012)	Low
A52. Foster research projects	All	2 years (by 2012)	Low
A53. Encourage UVIC's Restoration Institute to use Cordova Shore	All	year (by 2011)	High
Strategy 10. Celebrate Ecological and Cultural Uniqueness			
A54. Tell the story of the cultural and ecological uniqueness	All	2 years (by 2012)	High
A55. Use events to celebrate the ecological and cultural uniqueness	All	year (by 2011)	High
A56. "Brand" conservation activities	All	2 years (by 2012)	Medium
A57. Celebrate ancestors	TFN	5 years (by 2015)	Medium
A58. Encourage artists to celebrate the Cordova Shore	All	2 years (by 2012)	Low
A59. Provide opportunities for family gatherings	TFN	year (by 2011)	High

* Participants: CRD = Capital Regional District, TFN = Tsawout First Nation, CWS = Canadian Wildlife Service, DCS = District of Central Saanich, DS = District of Saanich, PC = Parks Canada, NCC = Nature Conservancy of Canada, VNH = Victoria Natural History Society DFO = Fisheries and Oceans Canada, MOE = Ministry of Environment

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Appendices

Appendix 1a. Common and scientific names of plant species in the report

Plants	
Alaska oniongrass	*Melica subulata*
American glasswort	*Salicornia virginica*
American glehnia	*Glehnia littoralis ssp leiocarpa*
American searocket	*Cakile maritima*
barestem desert-parsely	*Lomatium nudicaule*
beach bindweed (beach morning glory)	*Convolvulus soldanella*
beach pea	*Lathyrus japonicus*
Black knotweed	*Polygonum paronychia*
blue wildrye	*Elymus glaucus ssp. glaucus*
chocolate lily	*Fritillaria affinis var. affinis*
Cladina species	*Cladina species*
common camas	*Camassia quamash*
common periwinkle	*Vinca minor*
common snowberry	*Symphoricarpus albus*
common velvet grass	*Holcus lanatus*
contorted-pod evening primrose	*Camissonia contorta*
cutleaf evergreen blackberry	*Rubus laciniatus*
dune wildrye grass	*Leymus mollis*
European searocket	*Cakile edentula*
fleshy jaumea	*Jaumea carnosa*
graceful arrow-grass	*Triglochin concinna*
great camas	*Camassia leichtlinii ssp. suksdorfii*
grey rock-moss	*Racomitrium canescens ssp. canescens*
harvest brodiaea	*Brodiaea coronaria ssp. coronaria*
Himalayan blackberry	*Rubus armeniacus*
Hooker's onion	*Allium acuminatum*
Howell's triteleia	*Triteleia howellii*
Indian-plum	*Oemleria cerasiformis*
Japanese eelgrass	*Zostera japonica*
large-headed sedge	*Carex macrocephala*
meadow death camas	*Zygadenus venonus*
Nootka rose	*Rosa nutkana*
Orchardgrass	*Dactylus glomerata*
Pacific crabapple	*Malus fusca*
Pacific sanicle	*Sanicula crassicaulis var. crassicaulis*
Coast (Pacific) silverweed	*Potentilla egedii*
Pacific willow	*Salix lucida ssp. lasiandra*
Northern (Pacific) wormwood	*Artemisia campestris ssp. pacifica*
Puget gumweed	*Grindelia stricta*
red fescue	*Festuca rubra*
sea-milkwort	*Glaux maritima ssp. maritima*
Silky beach pea (grey beach peavine)	*Lathyrus littoralis*
Silver burweed	*Ambrosia chamissonis*
Sitka willow	*Salix sitchensis*
skunk cabbage	*Lyschiton americanum*
springbank clover	*Trifolium wormskioldii*
sweet vernal grass	*Anthoxanthum odoratum*
tree lupine	*Lupinus arboreus*
Wallace's selaginella	*Selaginella wallacei*
white triteleia	*Triteleia hyacinthina*
yellow sand-verbena	*Abronia latifolia*
Dalmatian toadflax	*Linaria genistifolia ssp. dalmatica*

Appendix 1b. Common and scientific names of animal species in the report

Animals	
American Bittern	*Botaurus lentiginosus*
American Wigeon	*Anas americana*
Ancient Murrelet	*Synthliboramphus antiquus*
Band-tailed Pigeon	*Patagioenas fasciata*
Barn Swallow	*Hirundo rustica*
basket cockle	*Clinocardium nuttallii*
bent-nose macoma	*Macoma nasuta*
Blue Dasher	*Pachydiplax longipennis*
Brandt's Cormorant	*Phalacrocorax penicillatus*
Brant	*Branta bernicla*
butter clam	*Saxidomus giganteus*
California Gull	*Larus californicus*
Canada Goose	*Branta canadensis*
Caspian Tern	*Hyroprogne caspia*
Domestic Cat	*Felis catus*
Coho Salmon	*Oncorhynchus kisutch*
Common Murre	*Uria aalge*
Common Nighthawk	*Chordeiles minor*
Cutthroat Trout clarkii ssp	*Oncorhynchus clarkii clarkii*
Double-crested Cormorant	*Phalacrocorax auritus*
Dun Skipper	*Euphys vestris*
Eastern Cottontail	*Sylvilagus floridanus*
Edward's Beach Moth	*Anarta edwardsii*
European Rabbit	*Oryctolagus cuniculus*
Garry oak	*Quercus garryana*
Georgia Basin Bog Spider	*Gnaphosa snohomish*
Great Blue Heron fannini ssp	*Ardea herodias fannini*
Green Heron	*Butorides virescens*
Horned Grebe	*Podiceps auritus*
horse clam	*Tresus capax*
Hudsonian Godwit	*Limosa haemastica*
Keen's Myotis	*Myotis keenii*
Lewis's Woodpecker	*Melanerpes lewis*
Long-billed Curlew	*Numenius americanus*
Mallard	*Anas platyrhynchos*
Marbled Murrelet	*Brachyramphus marmoratus*
Moss' Elfin mossii ssp	*Callophrys mossii mossii*
Northern Goshawk laingi ssp	*Accipiter gentilis laingi*
Pacific gaper clam	*Tresus nuttallii*
Pacific littleneck clam	*Protothaca staminea*
Pacific sand lance	*Ammodytes hexapterus*
Pacific Sideband	*Monadenia fidelis*
Peregrine Falcon anatum ssp	*Falco peregrinus anatum*
Red-legged Frog	*Rana aurora*
River Otter	*Lontra canadensis*
Sand-verbena Moth	*Copablepharon fuscum*
Scotch broom	*Cytisus scoparius*
seashore saltgrass	*Distichlis spicata*
Sharp-tailed Snake	*Contia tenuis*
Short-billed Dowitcher	*Limnodromus griseus*
Short-eared Owl	*Asio flammeus*

Streaked Horned Lark strigata ssp	*Eremophila alpestris strigata*
Summer Saltmarsh Mosquito	*Aedes dorsalis*
Surf Scoter	*Melanitta perspicillata*
threespine stickleback	*Gasterosteus aculeatus*
Upland Sandpiper	*Bartramia longicauda*
Vancouver Island Ringlet	*Coenonympha californica insulana*
varnish clam	*Nuttallia obscurata*
Vesper Sparrow affinis spp	*Pooecetes gramineus affinis*
Western Branded Skipper oregonia ssp	*Hesperia colorado oregonia*
Western Grebe	*Aechmophorus occidentalis*
Western Toad	*Anaxyrus boreas*
white sand macoma	*Macoma secta*

Appendix 2. Potential species of conservation significance in Cordova Shore.

Common Name	Scientific Name	Global Rank[1]	Subnational (Provincial) Rank[2]	SARA Status[3]	BC Status[4]
Plants					
yellow sand-verbena	*Abronia latifolia*	G5	S3		Blue
contorted-pod evening-primrose	*Camissonia contorta*	G5	S1	E (Apr 2006)	Red
beach morning glory	*Convolvulus soldanella*	G5	S3		Blue
American glehnia	*Glehnia littoralis ssp. leiocarpa*	G5T5	S3		Blue
grey beach peavine	*Lathyrus littoralis*	G5	S2	Under Assess	Red
black knotweed	*Polygonum paronychia*	G5	S3		Blue
large-headed sedge	*Carex macrocephala*	G5	S3S4		Yellow
beach bluegrass	*Poa confinis*	G5	S3S4		Yellow
hybrid wildrye	*Leymus x vancouverensis*	GNA	S3S4		Yellow
fleshy jaumea	*Jaumea carnosa*	G4G5	S2S3		Blue
Howell's triteleia	*Triteleia howellii*	G3G3	S1	E (2003)	Red
Invertebrates					
Pacific Sideband	*Monadenia fidelis*	G4G5	S3S4		Blue
Moss' Elfin, *mossii* subspecies	*Callophrys mossii mossii*	G4T4	S2S3		Blue
Common Ringlet, *insulana* ssp	*Coenonympha tullia insulana*	G5T3T4	S1		Red
Western Branded Skipper, *oregonia* ssp	*Hesperia colorado oregonia*	G5T3T4	S2S3	T (Nov 2000)	Blue
Dun Skipper	*Euphyes vestris*	G5	S3		Blue
Blue Dasher	*Pachydiplax longipennis*	G5	S3S4		Blue
Georgia Basin Bog Spider	*Gnaphosa snohomish*	not ranked	not ranked	Under Assess	nr
Sand-verbena Moth	*Copablepharon fuscum*	G1G2	S1	E (Nov 2003)	Red
Edward's Beach Moth	*Anarta edwardsii*	G3?	S1	E (May 2009)	Red
Vertebrates					
Northern Goshawk, *laingi* ssp	*Accipiter gentilis laingi*	G5T2	S2B	T (Nov 2000)	Red
Great Blue Heron, *fannini* ssp	*Ardea herodias fannini*	G5T4	S2S3B,S4N	SC (Mar 2008)	Blue
Short-eared Owl	*Asio flammeus*	G5	S3B,S2N	SC (Mar 2008)	Blue
American Bittern	*Botaurus lentiginosus*	G4	S3B		Blue
Green Heron	*Butorides virescens*	G5	S3S4B		Blue
Common Nighthawk	*Chordeiles minor*	G5	S4B	T (Apr 2007)	Yellow
Peregrine Falcon, *anatum* ssp	*Falco peregrinus anatum*	G4T4	S2B	SC (Apr 2007)	Red
Bald Eagle	*Haliaeetus leucocephalus*	G5	S5B,S5N	NAR (May 1984)	Yellow
Barn Swallow	*Hirundo rustica*	G5	S3S4B		Blue
Caspian Tern	*Hydroprogne caspia*	G5	S3B	NAR (May 1999)	Blue
Band-tailed Pigeon	*Patagioenas fasciata*	G4	S3S4B	SC (Nov 2008)	Blue
Double-crested Cormorant	*Phalacrocorax auritus*	G5	S3B	NAR (May 1978)	Blue
Brandt's Cormorant	*Phalacrocorax penicillatus*	G5	S1B,S4N		Red
Marbled Murrelet	*Brachyramphus marmoratus*	G3G4	S2B, S4N	T (2000)	Red
Common Murre	*Uria aalge*	G5	S2B,S4N		Red
Western Toad	*Bufo boreas*	G4	S4	SC (Nov 2002)	Yellow
Sharp-tailed Snake	*Contia tenuis*	G5	S1	E (May 1999)	Red
Northern Alligator Lizard	*Elgaria coerulea*	G5	S4S5	NAR (May 2002)	Yellow
Keen's Myotis	*Myotis keenii*	G2G3	S1S3	DD (Nov 2003)	Red
Cutthroat Trout, *clarkii* ssp	*Oncorhynchus clarkii clarkii*	G4T4	S3S4		Blue
Coho Salmon	*Oncorhynchus kisutch*	G4	S4	E (May 2002)	Yellow
Red-legged Frog	*Rana aurora*	G4	S3S4	SC (Nov 2004)	Blue

NOTES:

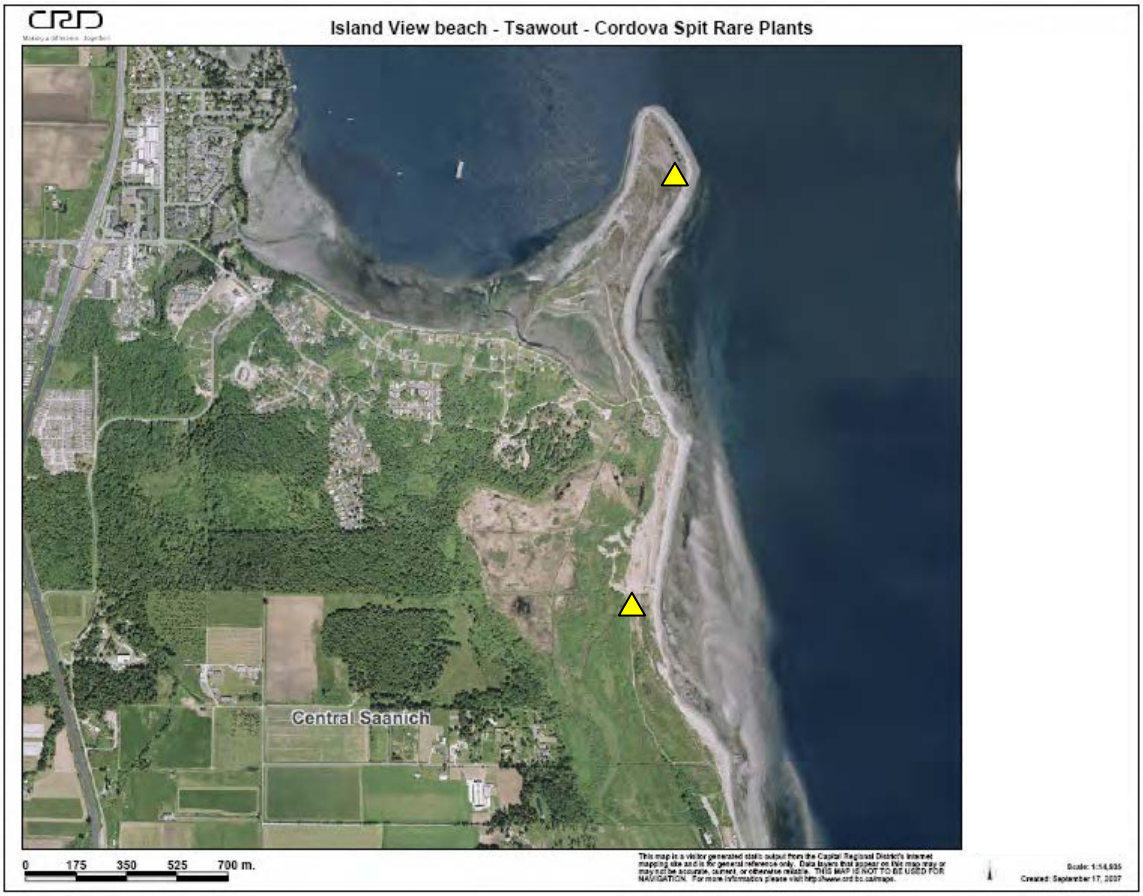
[1] Global rank defines the conservation status across the entire range of the species: G1 (Critically Imperiled); G2 (Imperiled); G3 (Vulnerable).

[2] Subnational (provincial) rank defines the conservation status in BC: S1 (Critically Imperiled); S2 (Imperiled); S3 (Vulnerable).

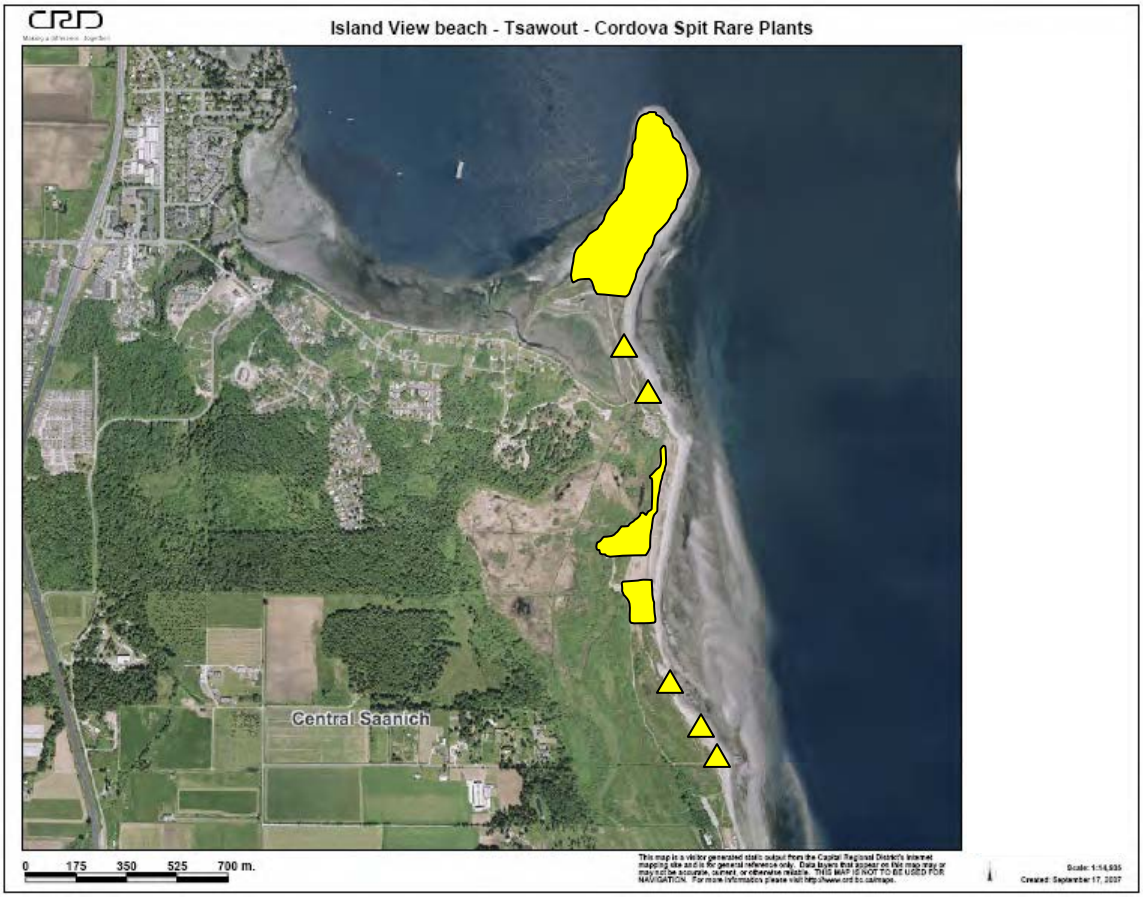
[3] SARA (Species at Risk Act) designations and date of listing: Endangered (E): a wildlife species that is facing imminent extirpation or extinction;
Threatened (T): a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction;
Special Concern (SC): a wildlife species that may become a threatened or an endangered species because of biological characteristics and identified threats.
"DD" indicates not designated because of deficient data and "NAR" is not at risk.

[4] BC Red and Blue List: Red-listed species are Extirpated, Endangered, or Threatened in British Columbia. Blue-listed species are of Special Concern.

Appendix 3. Maps of rare plant locations from Fairbarns (2007).



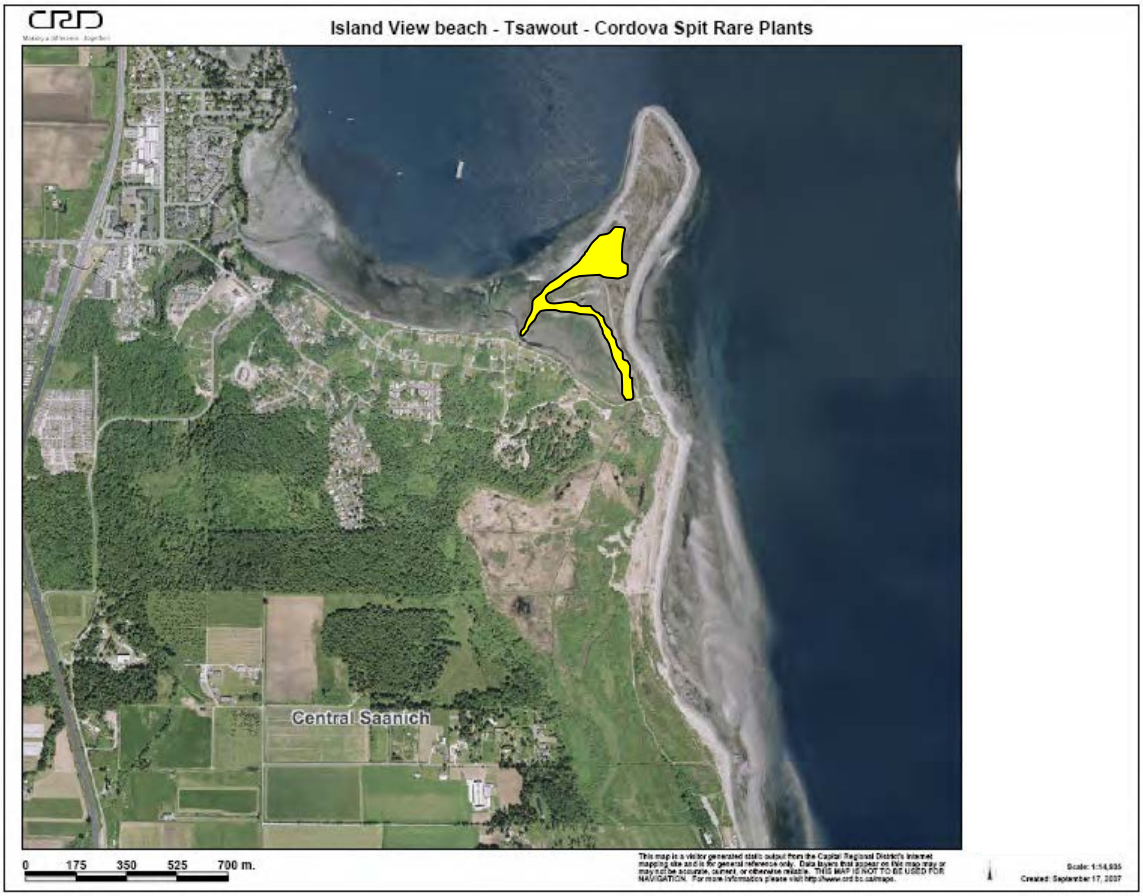
Locations of Contorted-pod Evening-primrose



Locations of Yellow Sand Verbena

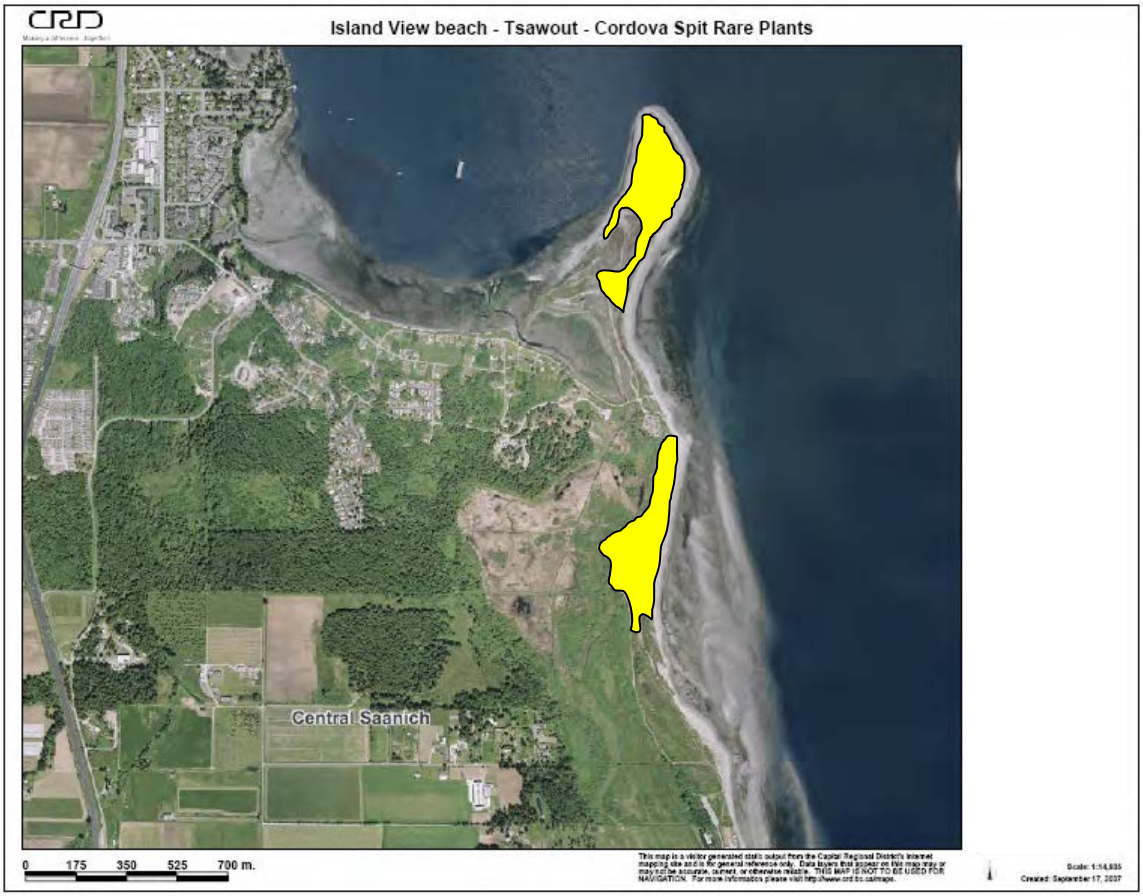
Locations of Beach Bindweed

Locations of American Glehnia (Beach Carrot)



Locations of Fleshy Jaumea

Locations of Grey Beach Peavine



Locations of Black Knotweed

Location of Howell's Triteleia

Appendix 4. Bird records for Sidney Channel IBA (IBA, 2010).

Species	Season	Number		Unit	Date	Reference
Black Brant (Western)	WI	300		I	1997	
Black Brant (Western)	SM	3,000	C	I	1995*	
Black Oystercatcher	BR	20	N	P	1995*	
Brandt's Cormorant	FM	900	G	I	1995*	
Glaucous-winged Gull	BR	400		I	1995*	
Great Blue Heron (BC coast)	BR	100	C	P	1988	
Great Blue Heron (BC coast)	BR			P	1994	
Great Blue Heron (BC coast)	RE	50	N	I	1995*	Butler 1997
Harlequin Duck (Western)	FM	50		I	1995*	
Marbled Murrelet	SU	50		I	1995*	
Mew Gull	SM	500	G	I	1995*	
Pigeon Guillemot	WI	300	N	I	1995*	
Rhinoceros Auklet	BR	650		I	1995*	

Note: species shown in bold indicate that their population level (as estimated by the maximum number) exceeds at least one of the IBA threshold (national, continental or global). The site may still not qualify for that level of IBA if the maximum number reflects an exceptional or historical occurence. *date is only an approximation.

Key

Season: Wintering (WI), Spring Migration (SM), Breeding (BR), Fall Migration (FM), and Summer Migration (SM)

Number Code: National (N), Continental C, and Global

Unit: Individuals (I); Pairs (P)

Butler, R.W. 1997. The great blue heron. UBC Press, Vancouver.

Appendix 5. Birds of Cordova Shore (from Bartley, 2008)

Birds Recorded by Glenn Bartley (2007 surveys)		Season						
Group	**Common name**	**Sp**	**Su**	**Fa**	**Wi**	**Relative Abundance**	**General Habitat**	**Observer**
Ducks and Geese	American Wigeon	x			x	Common winter resident	Lagoon	GB 2007
Ducks and Geese	Blue-winged Teal	x				Spring migrant	Lagoon	GB 2007
Ducks and Geese	Brant	x			x	Common	On spit near Lagoon	GB 2007
Ducks and Geese	Bufflehead	x			x	Common winter resident	Open ocean and lagoon	GB 2007
Ducks and Geese	Canada Goose	x		x	x	Common	On spit near lagoon	GB 2007
Ducks and Geese	Common Goldeneye				x	Common winter resident		GB 2007
Ducks and Geese	Common Merganser	x		x	x	Common	Open ocean	GB 2007
Ducks and Geese	Green-winged Teal				x	Spring migrant	Lagoon	GB 2007
Ducks and Geese	Harlequin Duck				x			GB 2007
Ducks and Geese	Hooded Merganser	x		x	x	Common winter resident	Open ocean and lagoon	GB 2007
Ducks and Geese	Lesser Scaup	x			x	Winter resident	Open ocean	GB 2007
Ducks and Geese	Long-tailed Duck				x	Spring and summer resident		GB 2007
Ducks and Geese	Mallard	x	x	x	x	Common	Lagoon, wetland	GB 2007
Ducks and Geese	Northern Pintail	x			x	Common	Lagoon	GB 2007
Ducks and Geese	Northern Shoveller				x			GB 2007
Ducks and Geese	Red-necked Grebe				x	Rare winter resident		GB 2007
Ducks and Geese	Surf Scoter	x		x		Winter resident	Open ocean	GB 2007
Goatsuckers	Common Nighthawk			x		Rare fall migrant – possibly nesting at the spit	Perched in dune vegetation or on logs	GB 2007
Gulls	California Gull			x	x	Common fall visitor	Shoreline and open ocean	GB 2007
Gulls	Caspian Tern	x	x	x				GB 2007
Gulls	Glaucus-winged Gull	x	x	x		Year round resident	Shoreline	GB 2007
Gulls	Heerman's Gull			x		Common in fall	Shoreline and open ocean	GB 2007
Gulls	Mew Gull	x	x		x	Common in Winter and Spring	Shoreline	GB 2007
Gulls	Ring-billed Gull				x			GB 2007
Herons	Great Blue Heron	x	x	x		Year round resident	Lagoon or shoreline	GB 2007
Hummingbirds	Anna's Hummingbird	x		x		Year round resident	In shrubs	GB 2007
Hummingbirds	Rufous Hummingbird	x				Summer resident	In shrubs	GB 2007
Kingfishers	Belted Kingfisher	x	x	x	x	Summer resident	Perched near lagoon or stream	GB 2007
Marine Birds	Common Loon	x		x		Spring migrant	Open ocean	GB 2007
Marine Birds	Common Murre			x	x	Common offshore in fall through winter	Open ocean	GB 2007
Marine Birds	Double-crested Cormorant	x	x		x	Year round resident??	Open ocean	GB 2007
Marine Birds	Pacific Loon	x		x	x	Spring migrant	Open ocean	GB 2007
Marine Birds	Pelagic Cormorant	x	x	x	x	Year round resident??	Open ocean	GB 2007
Marine Birds	Pigeon Guillemot	x		x	x	Winter	Open ocean	GB 2007
Marine Birds	Rhinoceros Auklet	x		x	x	Year round resident	Open ocean	GB 2007
Marine Birds	Western Grebe			x		Infrequent offshore	Open ocean	GB 2007
Passerines	American Goldfinch	x	x	x		Summer resident	In shrubs	GB 2007
Passerines	American Pipit			x		Fall migrant	On ground in dune vegetation	GB 2007
Passerines	American Robin	x	x	x	x	Summer resident	Perched in shrubs or on ground	GB 2007
Passerines	Barn Swallow	x	x	x		Summer resident	Flying over area searching for food	GB 2007
Passerines	Bewick's Wren	x	x	x		Year round resident	In shrubs	GB 2007
Passerines	Brown-headed Cowbird	x	x	x		Summer resident	In shrubs or trees	GB 2007
Passerines	Bushtit	x	x	x	x		Perched in shrubs	GB 2007
Passerines	Cassin's Vireo		x	x		Summer resident and Fall migrant	In shrubs or trees	GB 2007
Passerines	Cedar Waxwing	x	x	x		Summer resident	In shrubs or trees	GB 2007
Passerines	Chestnut-backed Chickadee	x	x	x		Year round resident	Perched in shrubs	GB 2007
Passerines	Common Yellowthroat	x	x			Summer resident	In shrubs	GB 2007
Passerines	European Starling	x	x	x		Summer resident	All areas	GB 2007
Passerines	Fox Sparrow				x	Winter		GB 2007
Passerines	Golden-crowned Kinglet				x	Winter		GB 2007
Passerines	Golden-crowned Sparrow	x		x	x	??	Perched in shrubs	GB 2007
Passerines	Horned Lark					Fall migrant	On ground in dune vegetation	GB 2007
Passerines	House Finch	x	x	x	x	Summer resident	In shrubs or trees	GB 2007
Passerines	House Sparrow		x	x		Year round resident	Perched in shrubs	GB 2007
Passerines	Lapland Longspur			x		Fall migrant	On ground in dune vegetation	GB 2007
Passerines	Marsh Wren				x	Winter		GB 2007
Passerines	Mountain Bluebird	x				Rare spring migrant	Perched in shrubs	GB 2007
Passerines	Mourning Dove			x		Common in summer (increasing?)	In shrubs, trees or on ground	GB 2007
Passerines	Northern Rough-winged Swallow	x	x			Summer resident	Flying over area searching for food	GB 2007
Passerines	Northern Shrike				x	Winter		GB 2007
Passerines	Northwestern Crow	x	x	x	x	Year round resident	All areas	GB 2007
Passerines	Orange-crowned Warbler	x	x			Spring migrant	In shrubs	GB 2007
Passerines	Purple Finch	x				Summer resident	In shrubs or trees	GB 2007
Passerines	Raven	x		x		Year round resident	All areas	GB 2007
Passerines	Red-winged Blackbird	x	x		x	Summer resident	Perched in shrubs or in wetland area	GB 2007
Passerines	Rock Dove				x			GB 2007
Passerines	Savannah Sparrow	x	x	x	x	Year round resident	In shrubs or dune grasses	GB 2007
Passerines	Song Sparrow	x	x	x		Summer resident	In shrubs	GB 2007

Passerines	Spotted Towee	x	x	x	x	Summer resident	In shrubs	GB 2007
Passerines	Swainson's Thrush	x				Summer resident	In woods	GB 2007
Passerines	Violet-green Swallow	x	x			Summer resident	Flying over area searching for food	GB 2007
Passerines	Warbling Vireo		x			Summer resident	Perched in shrubs	GB 2007
Passerines	Western Meadowlark			x	x	Fall migrant	In shrubs or trees	GB 2007
Passerines	White-crowned Sparrow	x				Common in spring and summer	Perched in shrubs	GB 2007
Passerines	Willow Flycatcher		x			Summer resident	Perched in shrubs	GB 2007
Raptors	American Kestrel	x				Rare	Flying over area searching for food or perched	GB 2007
Raptors	Bald Eagle	x	x	x	x	Year round resident	Flying over area searching for food or perched	GB 2007
Raptors	Cooper's Hawk			x	x	Common	Flying over area or perched searching for food	GB 2007
Raptors	Merlin			x		Rare fall visitor	Flying over area or perched searching for food	GB 2007
Raptors	Northern Harrier	x		x		Rare in winter	Flying over area searching for food	GB 2007
Raptors	Osprey	x	x	x	x	Summer resident	Flying over area searching for food or at nest	GB 2007
Raptors	Peregrine Falcon			x		Rare fall visitor	Flying over area or perched searching for food	GB 2007
Raptors	Sharp-shinned Hawk	x				Year round resident	Flying over area searching for food or in shrubs	GB 2007
Raptors	Turkey Vulture	x	x			Common in Summer	Flying over area searching for food	GB 2007
Shorebirds	Baird's Sandpiper			x		Fall migrant	Shoreline	GB 2007
Shorebirds	Black Oystercatcher	x			x	Year round resident	Shoreline	GB 2007
Shorebirds	Black Turnstone			x	x	Common	Shoreline	GB 2007
Shorebirds	Black-bellied Plover	x		x		Winter resident and spring migrant	Lagoon	GB 2007
Shorebirds	Dunlin	x				Spring migrant	Lagoon at low tide, shoreline	GB 2007
Shorebirds	Greater Yellowlegs	x		x	x	Common	Lagoon or along shoreline	GB 2007
Shorebirds	Killdeer	x	x	x	x	Spring and summer resident	Sparsely vegetated areas of spit and dunes	GB 2007
Shorebirds	Least Sandpiper			x	x	Fall migrant	Lagoon at low tide, shoreline	GB 2007
Shorebirds	Long-billed Curlew	x				Very rare spring migrant	Lagoon	GB 2007
Shorebirds	Long-billed Dowitcher	x				Spring migrant	Lagoon	GB 2007
Shorebirds	Sanderling			x		Fall migrant	Shoreline	GB 2007
Shorebirds	Semipalmated Plover					Fall migrant	Shoreline	GB 2007
Shorebirds	Short-billed Dowitcher	x				Spring migrant	Lagoon	GB 2007
Shorebirds	Western Sandpiper	x	x			Spring migrant	Lagoon at low tide, shoreline	GB 2007
Shorebirds	Whimbrel	x		x		Spring migrant	Shoreline	GB 2007
Shorebirds	Wilson's Snipe	x				Uncommon	Wetland area	GB 2007
Upland Game Birds	California Quail	x	x	x		Year round resident	In shrubs	GB 2007
Woodpeckers	Northern Flicker	x	x	x	x	Year round resident	In trees	GB 2007

Records by Others 2007

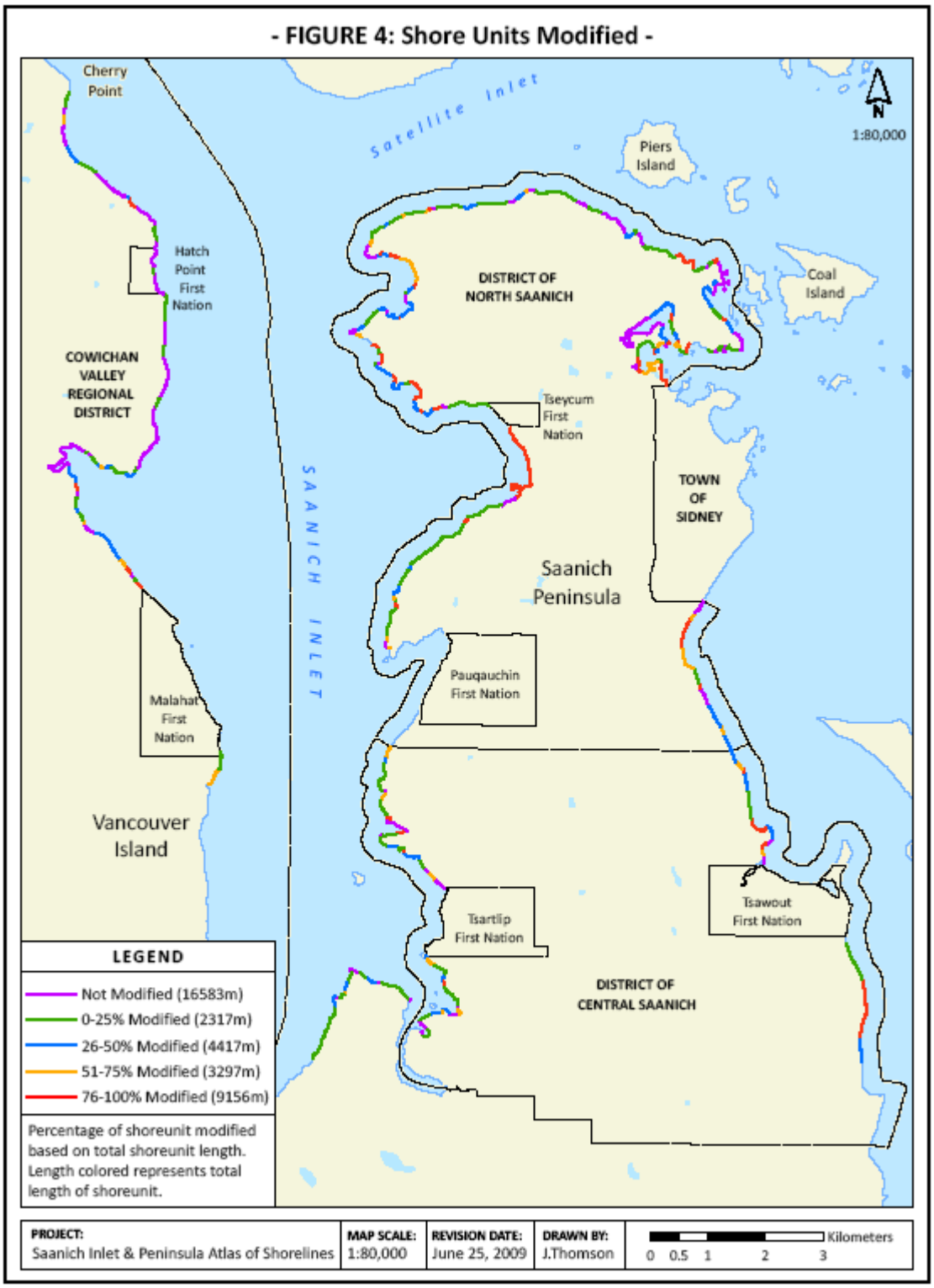
Shorebirds	Red-necked Phalarope		x				Cordova Spit	Others 2007
Shorebirds	Rock Sandpiper			x			Cordova Spit	Others 2007
Shorebirds	Pacific Golden Plover			x			Cordova Spit	Others 2007
Passerines	Snow Bunting			x			Cordova Spit	Others 2007
Ducks and Geese	Black Scoter				x		Cordova Spit	Others 2007
Passerines	Yellow-rumped Warbler	x					Island View Beach	Others 2007
Passerines	Cliff Swallow		x				Island View Beach	Others 2007
Passerines	Bank Swallow		x				Island View Beach	Others 2007
Raptors	Short-eared Owl			x			Island View Beach	Others 2007
Passerines	Townsend's Solitaire			x			Island View Beach	Others 2007
Passerines	American Tree Sparrow				x		Island View Beach	Others 2007

Historic Species (no date)

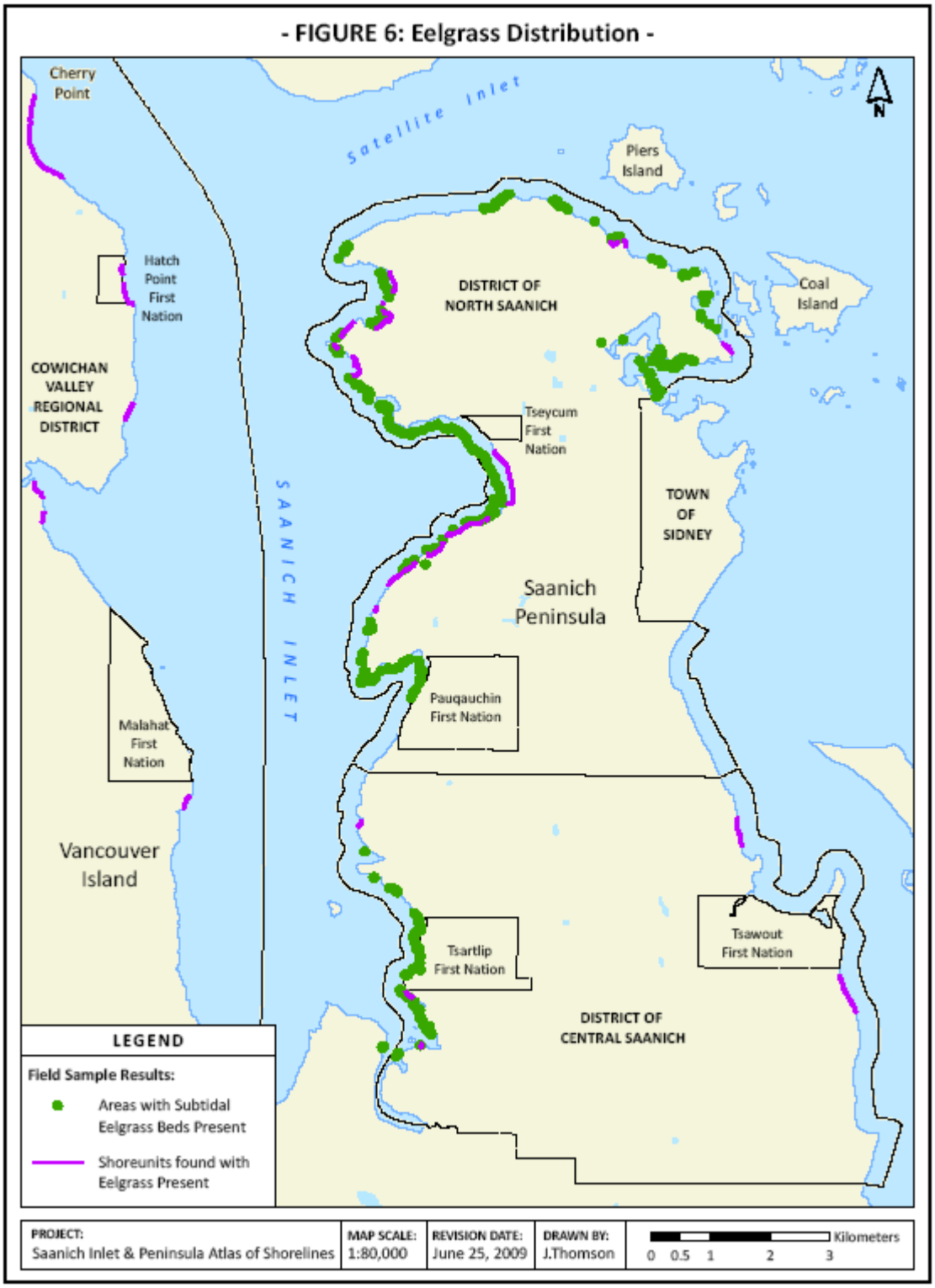
Shorebirds	Sharp-tailed Sandpiper	Cordova Shore Unit	Historic
Shorebirds	Pectoral Sandpiper	Cordova Shore Unit	Historic
Shorebirds	Upland Sandpiper	Cordova Shore Unit	Historic
Shorebirds	Hudsonian Godwit.	Cordova Shore Unit	Historic
Shorebirds	Bar-tailed Godwit	Cordova Shore Unit	Historic
Passerines	Swamp Sparrow	Cordova Shore Unit	Historic
Passerines	Lincoln's Sparrow	Cordova Shore Unit	Historic
Passerines	Brewers Blackbird	Cordova Shore Unit	Historic
Passerines	Hermit Thrush	Cordova Shore Unit	Historic
Passerines	Ruby-crowned Kinglet	Cordova Shore Unit	Historic
Passerines	Rock Wren	Cordova Shore Unit	Historic
Passerines	Say's Phoebe	Cordova Shore Unit	Historic
Passerines	Band-tailed Pigeon	Cordova Shore Unit	Historic
Passerines	Hutton's Vireo	Cordova Shore Unit	Historic
Woodpeckers	Lewis's Woodpecker	Cordova Shore Unit	Historic
Woodpeckers	Downy Woodpecker	Cordova Shore Unit	Historic
Woodpeckers	Hairy Woodpecker	Cordova Shore Unit	Historic
Ducks and Geese	Greater White-fronted Goose	Cordova Shore Unit	Historic
Ducks and Geese	Mute Swan	Cordova Shore Unit	Historic
Ducks and Geese	Trumpeter Swan	Cordova Shore Unit	Historic
Ducks and Geese	Gadwall	Cordova Shore Unit	Historic
Ducks and Geese	Eurasian Wigeon	Cordova Shore Unit	Historic
Ducks and Geese	Greater Scaup	Cordova Shore Unit	Historic

Ducks and Geese	Spectacled Eider	Cordova Shore Unit	Historic
Ducks and Geese	White-winged Scoter	Cordova Shore Unit	Historic
Ducks and Geese	Barrow's Goldeneye	Cordova Shore Unit	Historic
Gulls	Parasitic Jaeger	Cordova Shore Unit	Historic
Gulls	Bonaparte's Gull	Cordova Shore Unit	Historic
Gulls	Thayer's Gull	Cordova Shore Unit	Historic
Gulls	Western Gull	Cordova Shore Unit	Historic
Marine Birds	Common Tern	Cordova Shore Unit	Historic
Marine Birds	Red-throated Loon	Cordova Shore Unit	Historic
Marine Birds	Yellow-billed Loon	Cordova Shore Unit	Historic
Marine Birds	Horned Grebe	Cordova Shore Unit	Historic
Marine Birds	Eared Grebe	Cordova Shore Unit	Historic
Marine Birds	Brandt's Cormorant	Cordova Shore Unit	Historic
Shorebirds	Sora	Cordova Shore Unit	Historic
Shorebirds	Virginia Rail	Cordova Shore Unit	Historic
Marine Birds	Marbled Murrelet	Cordova Shore Unit	Historic
Marine Birds	Ancient Murrelet	Cordova Shore Unit	Historic

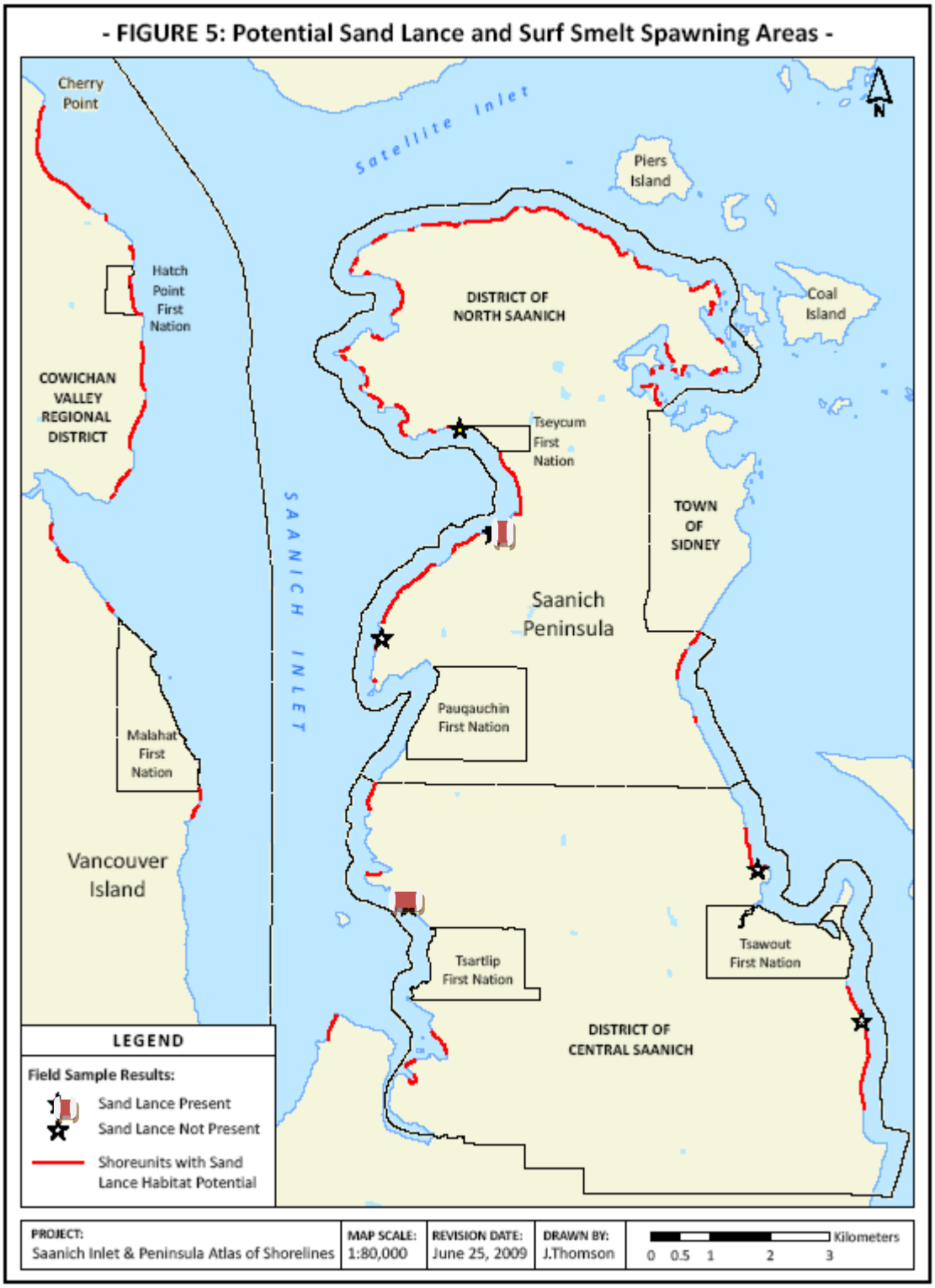
•Appendix 6. Shoreline mapping from SeaChange (2009).

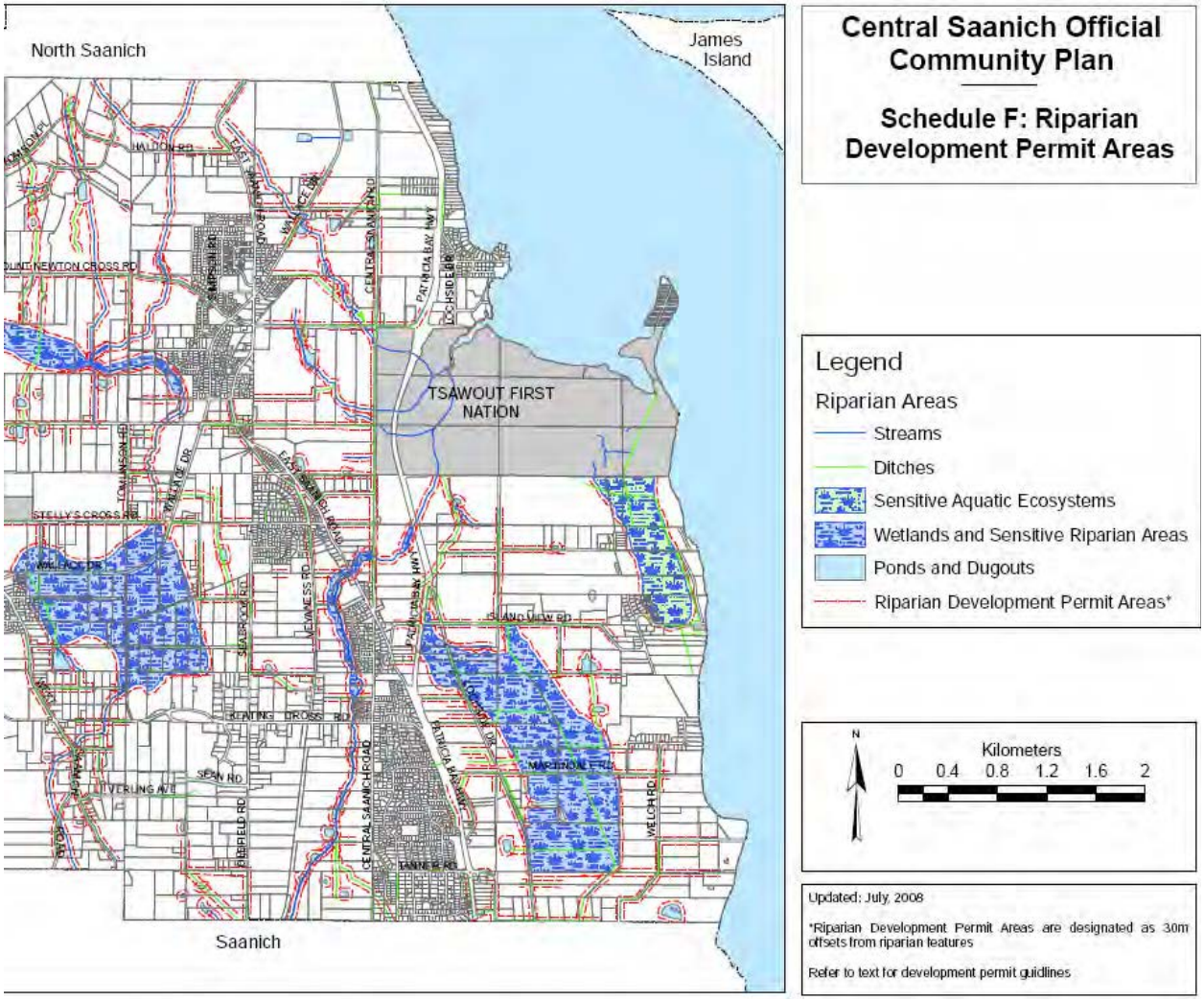


- FIGURE 6: Eelgrass Distribution -

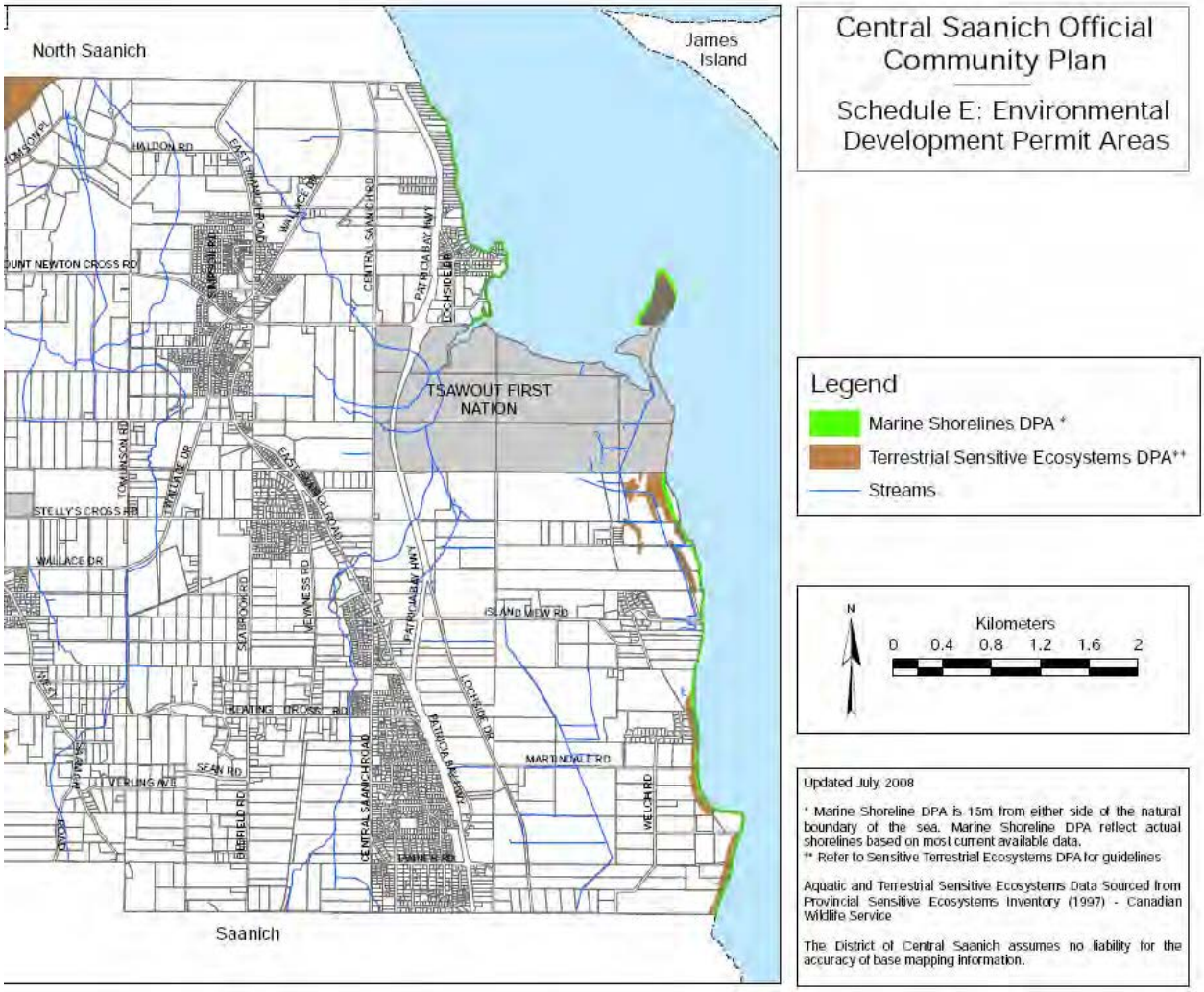


- FIGURE 5: Potential Sand Lance and Surf Smelt Spawning Areas -



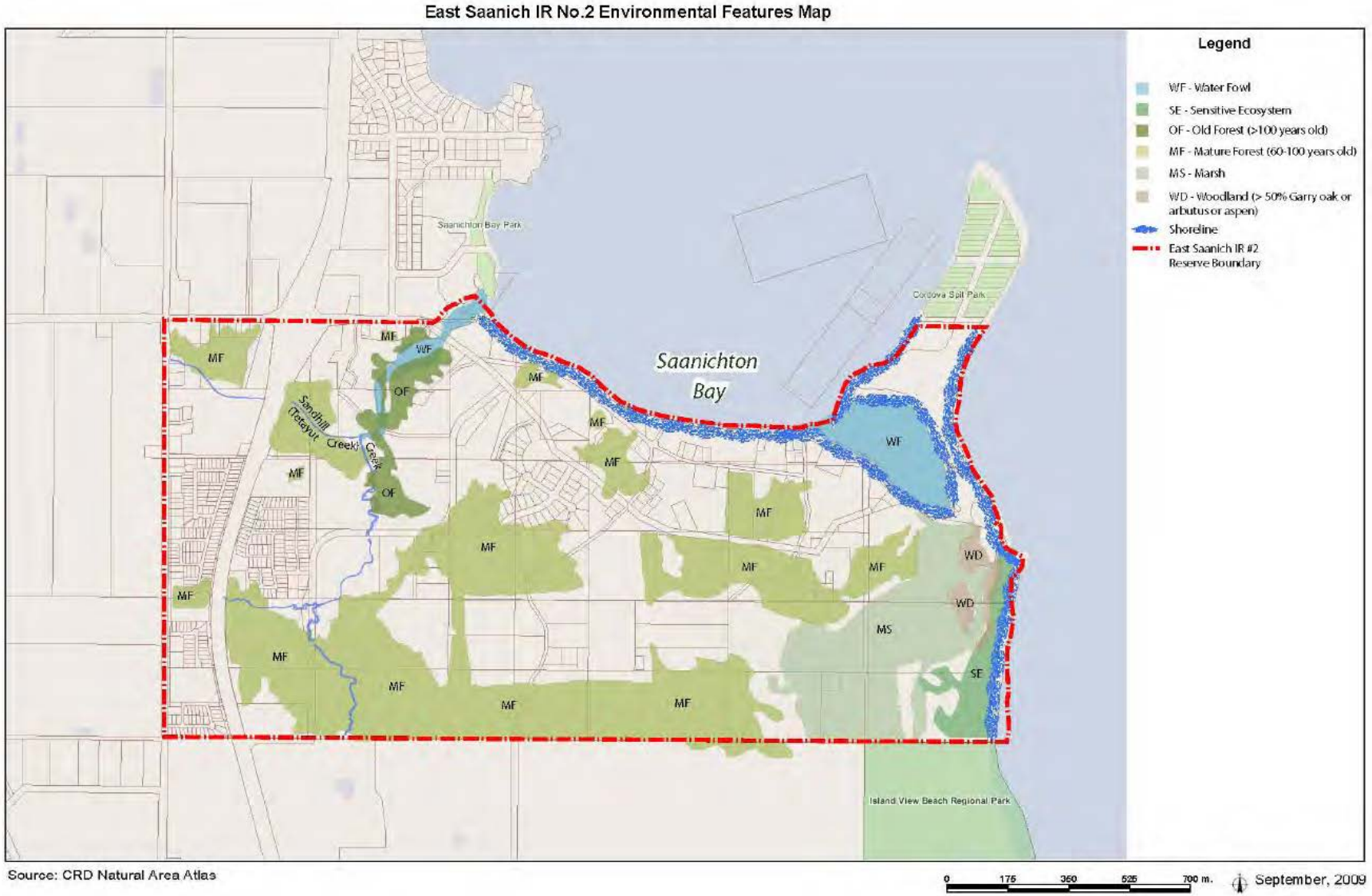


Appendix 7a. Riparian Development Permit Areas (DPA) in Cordova Shore area (District of Central Saanich OCP (DCS, 2008)).



Appendix 7b. Marine shorelien and terrestrial sensitive ecosystems Development Permit Areas (DPA) (District of Central Saanich OCP (DCS, 2008)).

Appendix 8. East Saanich IR No.2 Environmental Features Map (Figure 7.1 from Tsawout First Nation Comprehensive Community Plan (Tsawout First Nation, 2010).



TIXEN – Cordova Spit Working Group and Tsawout Lands Advisory

Appendix 9. Assessment of Values Threats and Goals

Value	Primary Threats	Desired Future	Goals
Resident and migratory birds • Migration • Spirituality • Hunting • Biodiversity	• Dogs (off leash) • Habitat disturbance from vehicles • Invasive species • Mosquito control? • Feral cats • Development	• Functional migratory stopover point • Preserve avian diversity of site	• Educate dog walkers • Signs • Bylaws *(Note potential to explore reciprocal/cooperative bylaw enforcement between Tsawout and CRD)* • Access control and management • Invasive species action plan
Sand dune, sand beach, & salt marsh ecosystems • Traditional uses (food, medicine) • Rarity • Unique ecosystem • Rare & endangered plants and animals	• Vehicle use • Invasive species • Pedestrians • Loss of traditional values • Alteration of natural processes (berm, shore stabilization) • Habitat destruction ie. trailer park • Overpopulation of Canada geese • Dogs, horses • Campfires • People removing wood	• Self sustaining populations of rare vegetation • Ability to harvest traditional plants and medicines • Natural processes restored to greatest extent possible	• Access control and management • Restoration of rare and culturally significant plant communities • Restoration of cultural practices • Protect sensitive areas against future damage • Invasive species action plan
Cultural Celebration • Honoring Ancestors • Family gathering	• Trespassing, loss of ownership • Inappropriate use (drinking, fires, sunbathing) • Dumping waste • Loss of traditional values	• A place for community gatherings and events (e.g. seafood festival, canoe races)	• Stop negative uses • Access control and management • Restoration of cultural practices • Community education and sharing of traditional knowledge
Healthy Recreational Use	• Inappropriate use (drinking, fires, sunbathing) • Dumping waste • Trespassing • Off-leash Dogs and large groups of dogs (ie commercial dog-walkers)	• Ecologically and culturally responsible recreation (passive recreation– with designated walkways through dunes (maybe a boardwalk), as well as hunting	• Work towards visible and positive conservation priorities to showcase and gain support for larger restoration goals. • Enforcement of bylaws • Stop negative uses • Access control and management

		and fishing – *but note differences in recreational uses and objectives between reserve and park lands*) • IVB – educated park users • Tsawout – a safe place that is for use by the community (not a public space)	
Partnerships, Education & Outreach	• Loss of traditional knowledge • Inappropriate planning and design • Lack of political support for protecting the land	• Revitalizing SENCOTEN • Project partners working together for conservation	• Educate the public and the community (including youth, occupants of trailer park, and broader communities) about the site and traditional uses. (*Note potential for joint interpretation between Tsawout and CRD – also to involve other community partners such as the Victoria Natural History Society)* • Community involvement in project. • Send message to all users of the area about what is acceptable. • Let community know what is being done and why

Additional issues: Cross-jurisdictional landscape issues, throughout traditional territory ie varied issues that affect health of Saanichton Bay (impacts on eelgrass, crab and clam fisheries, general water quality), such as stream water quality and quantity, overflows from sewage treatment plant, zinc in crab pots affecting health of waterfowl, and overfishing; also, disruption of food chains i.e. damage to waterfowl feeding grounds (such as herring concentrations) that might be some distance from TIXEN and IVB

This document was initially prepared by Glenn Bartley, UVIC Masters Student from Tsawout Community Interviews but further developed with the CRD, Central Saanich Municipality, Tsawout First Nation Lands Advisory, and Environment Canada representation. The document is still a work in progress.