Management Plan for the

Inner Island Nature Reserve

&

Adjacent Crown lands, Denman Island

prepared for

Islands Trust Fund Board
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by

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Islands Trust Fund Board Management Plan for the Denman Island Inner Island Nature Reserve and Adjacent Crown Lands

A. INTRODUCTION

A.1 Trust Fund Vision

The object of the Islands Trust is

> *"To preserve and protect the trust area and its unique amenities and environment for the benefit of the trust area of the Province generally, in cooperation with municipalities, regional districts, improvement districts, other persons and organizations and the government of the British Columbia."*

The *Islands Trust Act (Act)* establishes an Islands Trust Fund (ITF), "for the purposes of carrying out the object of the Trust." The Act also establishes a Trust Fund Board, "to administer the trust fund and to manage the real and personal property assets of the trust fund." The Board is authorized to acquire and hold money, land, and interests in land within the Trust area for purposes of carrying out the object of the Islands Trust. The Trust Fund Plan, prepared by the Board and approved by the Minister of Municipal Affairs, Recreation and Housing in accordance with the requirements of Section 37 of the *Islands Trust Act*, outlines the vision, priorities, goals, and policies of the Board and actions which will be taken to support the object of the Islands Trust.

The vision of the Trust Fund Board is to create a legacy of special places, protecting both natural and cultural features in perpetuity, in order to help sustain the unique character and environment of the Islands Trust Area

The mission of the Islands Trust Fund, as an active regional land trust, is to protect special places by encouraging, undertaking, and assisting in voluntary conservation initiatives within the Islands Trust Area. These voluntary conservation initiatives include:

- conservation education,
- land donations and acquisitions to create protected areas, and
- private land stewardship through conservation covenants and similar tools.

Lands with characteristics of interest to the Trust Fund Board have areas or features representative of the Islands Trust Area natural or cultural heritage. Lands of interest to the Trust Fund Board must contain one or more of the following features of significance:

- rare, threatened, vulnerable, exceptional or representative plants and plant communities,
- Garry oak, Arbutus, Douglas-fir and Western hemlock woodlands or forests,
- wildlife habitat or corridors,
- streams, lakes, wetlands, marshes or land associated with a body of fresh water,
- watershed or groundwater recharge values,
- shorelines, including beaches, rock outcrops and islets,
- coastal and inland cliffs,
- buffer areas adjacent or in close proximity to protected lands,
- unusual features or anomalies within the Islands Trust Area,
- archaeological sites,
- historic or cultural landscapes of significance,
- mixed rural landscapes such as farms or other rural areas that contain a mix of woodlands, creeks, wetlands, heritage orchards and cleared lands,
- opportunity for nature study or nature education programs,
- opportunity for low intensity, low-impact nature-related recreation, or

- scenic amenities or outstanding views.

Management plans will be prepared for properties owned by the Trust Fund Board (ITFB 2002). These plans will vary according to the specific characteristics, needs, and proposed use(s) of the property.
Generally, management plans will address the following matters:

- purpose and objectives for the site,
- background information including the site history and local and regional context,
- environmental inventory,
- management issues such as the extent and nature of protection required, appropriate uses and level of use, research guidelines, risk management, special needs at the site, and
- strategies and actions to achieve the purpose and objectives for the site and to address management issues and needs.

It is Trust Fund Board policy to prepare and approve a management plan for properties it acquires (ITFB 2003). This document presents a management plan for the Inner Island Nature Reserve on Denman Island (Lot A), and the wetlands and associated uplands of Lot 1, and the SW ¼ of Section 22.

A.2 Background Summary

Project History
Kennedy (1993a) documents the events that led to the creation of the Inner Island Nature Reserve and the Trust Fund Board resolutions to acquire adjacent Crown land. Slightly less than half of the SE 1/4 of Section 21 on Denman Island was donated to the Vancouver Foundation in the 1970's. In 1977, at the request of the Islands Trust and the Denman Island Ratepayers and Residents Association, the Vancouver Foundation transferred 25.6 ha (56.4 acres) (Lot 1) to the Crown, apparently to be held in perpetuity as a nature reserve. This transfer took place with the agreement that the title to the property would eventually be passed to the Trust when it was given the power to hold lands.

The remainder of the quarter section, and other lands, were sold to Raven Forest Products. A map reserve was registered on Lot 1 on behalf of the Ministry of Environment due to the wildlife habitat importance of the wetlands on the property.

In December 1989, B.C. Lands advised the Islands Trust that if the Ministry of Environment did not assume the responsibility of the Lot 1 within two years, the lands ministry would examine alternate methods of protection, and would entertain an application for the land by the Islands Trust Fund.

In September 1990, the Executive Committee of the Islands Trust Council passed a "Denman Crown Land Resolution" in which it was resolved, in part, that the Trust Council was prepared to recommend that the SW 1/4 of Section 22 should also be held by the Islands Trust Fund for a nature reserve and watershed protection.

The Trust Fund Board, in a meeting of October 19, 1990, passed a resolution to instruct staff to prepare a management plan, and subsequently apply for the acquisition of Lot 1 and the SW 1/4 of Section 22.

Creation of the map reserve isolated two small separate portions of the SE 1/4 of Section 21, totalling 9.4 ha (21 acres). In December 1992, this property was purchased by the Denman Conservancy Association and donated to the Islands Trust Fund, the first property acquired by the Fund. The two portions of the property were consolidated as 'Lot A' and designated the Inner Island Nature Reserve. Subdivision approval had to be granted by the Agricultural Land Commission, which stipulated that Lot A had to be eventually consolidated with Lot 1, the map reserve. On March 11, 1992, the Trust Fund Board passed two resolutions to pursue this consolidation. Map 1 illustrates the current status of these lands.

As of February 2005, the status of Lot 1 and the adjacent Crown Land (SW ¼ of Sec 22) is unchanged from October 1990. Lot 1 and Lot A have not been consolidated.

General Visual Description
The Inner Island Nature Reserve and adjacent Crown lands are located on Denman Island, one of the northern Gulf Islands in the Strait of Georgia, approximately 20 km south of Courtenay-Comox on Vancouver Island (Map 2). The Islands Trust Fund property is approximately 9.4 hectares in size in two separate parcels and is located in the northern interior of the island, just south of Chickadee Lake. The parcels are separated by a relatively long and narrow wetland created by beaver activity. The majority of the northern Trust Fund parcel was logged in the mid 1980's. The southern Trust Fund parcel was selectively logged around 1900 and now supports a relatively open second growth Douglas-fir forest. Rough roadways **(now decommissioned**) enter each Trust Fund parcel. The two parcels of Lot A are separated by a large sedge meadow and beaver ponds following a stream course in Lot 1.

Value to the Community
The wildlife habitat and freshwater catchment values of the wetlands adjacent to the Inner Island Nature Reserve are well recognized. The older second growth Douglas-fir forest at the margins of the wetland, the southern portion of the Trust Fund property and the adjacent Crown land in Section 22 act as buffers for the wetland and have substantial conservation value as future old growth forest. Less than six percent of the Island is currently protected as park land or nature reserve (Kennedy 1993a). The property is also a potential linkage in a trail way linking four parcels of Crown land and Fillongley Provincial Park (Kennedy and Willis 1988).

B. PROJECT DESCRIPTION

B.1 Purpose
The wetlands and associated forested uplands represent an opportunity to maintain an integrated ecological unit with considerable conservation values. This wetland unit is largely encompassed by three lots:

1. Lot A, 9.4 ha, currently held by the Islands Trust Fund as the Inner Island Nature Reserve;

2. Lot 1, 25.6 ha of wetlands and a corridor of Douglas-fir forest owned by the Crown and held under map reserve to the Ministry of Environment; and

3. the SW ¼ of Section 22, an adjacent unoccupied forested Crown-owned property.

Lot 1 and the SW ¼ of Sec. 22 should be formally added to the nature reserve to protect the integrity of the wetlands and protect an old second-growth lowland Douglas-fir forest of considerable conservation value. **Recent logging north, west and southeast (circa 2001) of Lot 1 adds greater conservation significance to the SW ¼ of Sec. 22 and requires the guaranteed preservation of Lot 1.**

All three properties have characteristics considered of interest to the Trust Fund Board (ITFB 1992). These include:
- rare, threatened, vulnerable, exceptional or representative plants and plant communities,
- Garry oak, Arbutus, Douglas-fir and Western hemlock woodlands or forests,
- wildlife habitat or corridors,
- streams, lakes, wetlands, marshes or land associated with a body of fresh water,
- watershed or groundwater recharge values,
- buffer areas adjacent or in close proximity to protected lands,
- unusual features or anomalies within the Islands Trust Area,
- opportunity for nature study or nature education programs,

- opportunity for low intensity, low-impact nature-related recreation, or
- scenic amenities or outstanding views.

The wetlands in Lot 1 were identified as the "North Marsh" in the Island Trust Natural Areas Inventory (Benn 1975), considered a moderate priority area for protection.

B.2 Goals and Objectives

The goal of the Inner Island Nature Reserve and adjacent Crown lands, if the latter are acquired and consolidated into the Reserve, is to protect and maintain the wildlife habitat and conservation values of the marsh and surrounding areas of older second growth Douglas-fir forest.

Objectives to achieve this goal include:

- minimize interference with natural biological and hydrological processes
- minimize negative effects from surrounding land uses on the pond, marshes and adjacent forested areas
- minimize the effects of human activities within the Inner Island Nature Reserve

B.3 Strategy for Conservation

The Trust Fund Board will consider making application to B.C. Lands to acquire title to Lot 1 and the SW 1/4 of Section 22. If acquired, the lands would be held under one authority, the Islands Trust Fund, as the Inner Island Nature Reserve and application for rezoning the lands for Conservation will be made. This consolidation would create a manageable ecological unit of 108 ha in one of the island's most environmentally significant areas. These lands are to be held for the stated purposes in perpetuity, and conservation covenants restricting activities in variance with the property goals and objectives, are to be registered against them where possible. Additional lands that support the goal of the Reserve may be identified for addition to the Reserve and efforts to acquire them will be considered.

B.4 Limitations

This management plan was developed in 1994 with information and input limited to a review of existing information including a draft of an earlier document by a Denman Island Conservancy board member, and Islands Trust staff, and one site visit.

The management plan was revised in 2005 with additional information gathered by Denman Conservancy Association including a review of current land use regulations and numerous site visits.

C. PHYSICAL AND NATURAL FEATURES

C.1 Location

The Inner Island Nature Reserve lands are located approximately one kilometer north of Denman Island Village, off Pickles Road.

C.1.1 Legal Description

The Island Trust Fund property is approximately 9.4 ha in size and is described as:

Lot A, SE 1/4, Section 21, Plan VIP 55499, Denman Island, Nanaimo District. This lot consists of two parcels, situated on either side of the following.

A 25.5 ha adjacent Crown Land parcel is held under map reserve to the Ministry of Environment, Lands and Parks. This property is described as:

Lot 1, SE 1/4, Section 21, Plan 35639, Denman Island, Nanaimo District.

A second Crown land parcel is held under map reserve for land use planning purposes. This 72.7 ha property is described as:

The SW 1/4 of Section 22, Denman Island, Nanaimo District.

C.1.2 Map Location

Map sheets 92F 056 and 057 (1:20,000) and 92F/10 (1:50,000).

Lat/Long: 49°33' N 124°48' W	UTM Zone 10: 369798E 54889337N (NAD27)
Aerial Photo Line BCB 91023	Photo Numbers 42 & 43. Scale 1:15,000

C.1.2 Directions to Site

From where the Vancouver Island ferry lands on Denman, follow Denman Road to the village area at the top of the hill. Continue east and bear left at the junction with Lacon Road. Continue along Denman Road and up a steep hill. At the top of the hill turn left (north) onto Pickles Road. Approximately one kilometer along Pickles Road is a bridge across the beaver pond marsh. Parking for a few cars is available in a pull out on the north end of the bridge on the right (east) side of the road. A pull out on the right side of the road just south of the bridge can also provide parking for one or two more cars.

A very rough trail parallels the beaver pond marsh south east from the main pull out into the SW 1/4 of Section 22. Rough roadways **(now decommissioned)** proceed a short distance into the northern parcel of Lot A from both sides of Pickles Road. Another roadway enters the southern most portion of Lot A from Pickles Road.

C.2 Site Description

C.2.1 Climate

Climate in the upper Gulf Islands has been described by Chilton (1975) and reviewed by Preston (1976). While there is some minor local variation, climatic averages are relatively consistent throughout the area. Climate in the Strait of Georgia exhibits a characteristic pattern of warm dry summers and mild wet winters. The maritime influence tends to moderate the effects of elevation, latitude, and aspect on local temperature and precipitation. Temperature on Denman Island is generally moderate. The mean temperature of the warmest month is about 17.5°C and in the coldest month is about 2°C.

Annual precipitation is approximately 1340 mm. Precipitation generally increases from sea level to hilltops, and about 80 percent falls between October and March. Around eight percent of winter precipitation falls as snow, which rarely lasts more than a few days on the ground. July is the warmest and driest month.

Warm temperatures and low precipitation in the summer months can lead to a soil moisture deficit. Moisture deficits are influenced by aspect, slope, vegetation cover, and the ability of the soil to retain moisture. The moisture deficit usually begins in May and ends with the autumn rains in early-to-mid October.

C.2.2 Physiography

The southeast portion of the beaver pond marsh is located in a narrow valley between two gently rolling forested knolls (Topographic Map). The marshy valley broadens out considerably as it curves around to the north. Elevation ranges from 50 to 80 meters above sea level.

C.2.3 Geology and Soils

The Inner Island Nature Reserve and adjacent Crown lands are underlain by sandstone rock which dates from the Upper Cretaceous age, 80 million years before present (Cathyl-Bickford 1992). The wetland occurs in a NW/SE trending fault which dips steeply towards the southwest (Ludvigsen 1993). Three soil types are found on Lot A and Lot 1 (Soil Map). A fourth soil type is found in the southern portion of the SW 1/4 of Section 22. The

location and characteristics of these soils have been described by Jungen (1978, 1985).

The northern portion of Lot A is underlain by Bowser soils although the area to the southeast of Pickles Road appears to be dominated by Hiller soil. Bowser soils have developed in shallow, sandy deposits of marine or stream origin, and usually overlay marine silts or clays. This soil type is imperfectly drained and is mostly free of coarse fragments. The upper layers of soil are rich and support lush plant growth. Trails through imperfectly drained soils can become quite muddy when saturated or the upper layers of soil are removed.

Hiller soils are well drained and have developed in sandy gravelly moraine deposits less than one meter thick over sandstone bedrock. Soil texture is gravelly loamy sand and the coarse fragment content is usually between 30% and 50%. Thick layers of forest duff contribute to the acid nature of this soil type. This soil type is moist throughout the rainy season, but becomes exceedingly dry during summer. When the soil is saturated, subsurface water flow will occur. Generally, well-drained sandy loams with a coarse fragment content below 50% present little impediment to either concentrated or dispersed recreational use (Block and Hignett 1982). Hiller soils are also present in the southern portion of Lot A, to the west of the beaver pond marshes on Lot 1, and in the southwest 1/4 of Section 22.

The beaver pond marsh is underlain by Arrowsmith soil. Arrowsmith soils have developed in strongly acid organic deposits derived from mosses, sedges, and other wetland vegetation at an intermediate stage of decomposition. The depth of this organic material usually ranges from 40 cm to 160 cm. The soils are generally saturated and free water is common at or near the soil surface for most of the year. These soils have low bearing strengths, poor drainage, and high water table. There is some flood hazard. Arrowsmith soils are considered favourable for agriculture and have been extensively drained in other parts of the region. Although Arrowsmith soils generally underlie Lot 1, they extend well into the central portion of Lot A north.

Royston soils may also occur with Hiller soils in the southeast 1/4 of Section 22. Royston soils are derived from fine textured glacial moraine, with a coarse fragment content of between 20% and 40%. This soil type is imperfectly drained and occurs on slopes less than 35%. Water seepage usually maintains the subsoil in a moist condition throughout the main growing season. This soil type can be saturated to within 50 cm of the surface in the winter.

C.2.4 Hydrology

The Inner Island Nature Reserve and adjacent Crown lands are located in one of Denman Island's principle fresh water catchment areas (OCP Bylaw 60, 1991, Schedule D map). The Island Trust Fund holdings are divided by a long narrow marshy wetland area formed by beaver dams and fed by seepage and seasonal creeks. A large pond (approximately one hectare open water) is located at the southeastern end of the wetland and is fed by water flow through the wetland and a creek which enters from the southwest. Two small creeks drain from the wetland to the northeast, through the northern portion of Lot A and the SW 1/4 of Section 22. eventually feeding Beadnell Creek, a salmon spawning stream which flows through Fillongley Provincial Park and empties into Lambert Channel. Groundwater recharge likely occurs through faults and contact zones between rock types in underlying bedrock. Water levels in the beaver pond marsh have increased over the last ten years, but now appear to be relatively stable (Kennedy 1993b).

C.2.5 Vegetation and Landscape Classification

The properties occur within the Coastal Douglas-fir moist maritime (CDFmm) biogeoclimatic zone (Klinka et al. 1979, Meidinger and Pojar 1991). This zone is characterized by forests dominated by coast Douglas-fir (*Pseudotsuga menziesii var menziesii*) with a shrub understory of salal (*Gaultheria shallon*) and dull oregon grape (*Mahonia nervosa*). Vegetation communities are most strongly differentiated by available soil moisture, depth and nutrient status. Western red cedar (*Thuja plicata*), grand fir (*Abies grandis*) and red alder (*Alnus rubra*) occur on moister sites. Garry oak (*Quercus garryana*) and arbutus (*Arbutus menziesii*) are most often restricted to dry

rocky sites on hilltops and along the coast.

C.2.6 Flora

The vegetation description provided in this section is based on information in Kennedy (1993a), a forest cover map produced by Raven Forest Products, a 1991 species list by Dr. E.C. Pielou, and a site visit in November 1993.

In June, 2003, The Nature Conservancy of Canada (NCC) commissioned Ryan Durand to produce a baseline study of the Nature Reserve. Aided by Jenny Balke, RBio., he produced the "Baseline Inventory of the Inner Island Nature Reserve, Denman Island". This document is a good photographic record of conditions existing on the property. It does not contain an inventory of flora and fauna.

If required, a more formal vegetation inventory should be undertaken during June when the maximum number of herbaceous species are visible.

The logging and fires associated with human settlement and activity on Denman Island have resulted in extensive cleared areas and a mosaic of different forest age classes and structures. In general, all forested areas on the Island are second-growth; only a few small sites, such as portions of the forested corridor adjacent to the wetlands in Lot 1, possess remnants of the original forest.

Early logging typically removed only the most valuable and accessible trees, although a number of later 'passes' may have resulted in the removal of the majority of mature Douglas-fir and large western red cedar. This selective or patch logging 'released' the small western red cedars, grand fir, and western hemlocks growing beneath the Douglas-fir canopy and provided gaps in the forest canopy to facilitate Douglas-fir regeneration. Standing dead trees (snags) and large trees with broken tops or curved trunks were often not cut. Where felled trees exhibited rot or imperfections they were left on the ground. Subsequent fires may have further modified the forest composition and structure of these logged areas.

Forest Vegetation

There is a considerable range of forest ages, composition, and structure within the Inner Island Nature Reserve and adjacent Crown lands. The forests in the Islands Trust Fund property are very different. Lot A north was logged around the turn of the century **(1900)** and again in 1984. A strip of trees, both Douglas-fir and western red cedar, was left along Pickles Road to retain its heritage character. Scattered and clumped smaller trees of both these species were also left standing in other parts of the property. Regeneration appears to be occurring in two stages. A large number of two to four meter tall western hemlocks occur on all parts of the property except the marsh. However, there are also large numbers of grand fir and Douglas-fir seedlings less than 50 cm tall. The understory of the forested areas is dominated by bracken fern (*Pteridium aquilinum*), oregon grape, twin flower (*Linnea borealis*), red huckleberry (*Vaccinium parvifolium*), and sword fern (*Polystichum munitum*). Roadways have been invaded by exotic grasses, thistles (*Cirsium spp.*), Queen Anne's lace (*Daucus carota*) and pearly everlasting (*Anaphalis margaritacea*).

Lot A south was also selectively logged around the turn of the century **(1900)**. Logging was prevented in the mid 1980's, although a roadway was started which has now started to regenerate nicely. The property is forested by well-spaced second-growth Douglas-fir. Relatively large western red cedar, grand fir, and western hemlock are present. There is a lush understory of oregon grape, salal, sword fern and a variety of moss species. Vanilla leaf (*Achlys triphylla*), red huckleberry, and woodland rose (*Rosa gymnocarpa*) occur in suitable sites. There is a large amount of woody debris, including large moss covered logs, on the forest floor. This forest extends past the eastern boundary of the property into Lot 1. Very similar strips of forest make up the boundaries of Lot 1 north of Pickles Road, between the wetland and adjacent logged properties. Several very large old-growth Douglas-fir occur on the strip along the western border of Lot 1 and just to the south of Lot A north. A similar type of forest

also occurs in the western and southern portion of the SW 1/4 of Section 22. Sword fern, lady fern (*Athyrium filix-femina*) and skunk cabbage (*Lysichitum americanum*) occur along streams. To the northeast in Section 22, the vegetation shifts to stands dominated by red alder with an understory of sword fern and stinging nettle (*Urtica dioica*). Plant growth in these alder stands is extremely lush.

Beaver Pond Marsh

The vegetation of the marsh in Lot 1 varies with water depth. Around the open water of the beaver pond and south of Pickles Road is a dense shrub growth of hardhack (*Spirea douglasii*) and willows (*Salix spp.*). Pacific crabapples (*Malus fusca*) also occurred on the margins of the water but have been flooded out in recent years (Kennedy 1993b). Yellow pond lilies (*Nuphar polysepalum*) float on the water surface and a number of submergent plants such as pondweed (*Potomageton spp.*) are visible in the water. Other marsh plants such as marsh cinquefoil (*Potentilla palustris*) water crowfoot (*Ranunculus aquatilis*), and water parsley (*Oenanthe sarmentosa*) are on the list compiled by Dr. Pielou. A large number of western red cedars, killed by the flooding, are still standing throughout the marsh. Extensive flat shallow areas in the portion of the marsh north of Pickles Road are dominated by extensive patches of sedges (*Carex spp.*). This sedge marsh extends well into the centre of Lot A north. A survey of aquatic and marsh vegetation during the summer months is necessary to determine the full range of species present.

C.2.7 Fauna

A wide variety of animal species have been recorded for the Inner Island Nature Reserve, although no formal inventory has been done (Kennedy and Willis 1988, Kennedy 1993a). The variety of habitat types and large numbers of standing dead trees, make the area an important feeding, breeding, and over wintering site for wildlife. Cutthroat and rainbow trout have been recorded in the beaver pond and deep water wetlands. It is thought some of the small feeder streams may have small areas of spawning habitat for these species. Coho salmon fry have been introduced to the beaver pond. The beaver pond and associated wetlands are important breeding habitat for amphibians such as tree frogs, red-legged frogs, rough skinned newts and northwestern salamanders and foraging habitat for garter snakes. Woody debris on the forest floor, including fairly large logs, and the presence of moist hollows indicate good salamander habitat.

The wetlands also attract a number of waterfowl species, fish eating birds, and songbirds which feed on the rich insect life or require dense shrubbery for nest sites. Trumpeter swans and Canada geese have been known to overwinter at the beaver pond wetlands. Wood ducks, ring-necked ducks, common golden eye, buffleheads, hooded mergansers, and several species of dabbling ducks have been sighted in the wetland, although there are no records of these species breeding at the site. Belted kingfishers and great blue herons are regular foragers. American bittern have also been sighted. A variety of forest and wetland songbirds are present in the Reserve and adjacent properties. The large numbers of snags in the wetland and the forest provide ample feeding sites for the full range of woodpecker species, which in turn benefit other cavity nesting species. Snags also provide perches for osprey and bald eagles. Other raptors such as the great horned owl, sharp-shinned hawk and Cooper's hawk have been recorded in the area.

The wetlands and forests also provide habitat for a variety of mammal species. Beaver, otter, and mink are commonly sited in the wetlands. Shrews, deer mice, a number of bat species, Townsend's vole, and short tail weasels are also likely present. Columbia black tail deer sign is everywhere. A pine marten has been sighted in the area.

C.2.8 Ecological History and Processes

Fluctuating climate since the last glacial advance has shaped the recolonization rates and species composition of plant and animals in the Gulf Islands. Each climatic period in the last 10,000 to 15,000 years has favoured specific species mixes over others. Present vegetation associations have located along a general gradient of moisture and nutrients, but natural disturbances, such as fire and windthrow also play a major role. Most animal

species have specific habitat requirements and are often associated with more than one habitat type over their life cycle. Human alterations to natural disturbance regimes, extensive landscape alterations to adjacent areas, and the introduction of exotic species may have major influences on the composition and character of remnant natural and semi-natural areas.

Forests

Forest development is centred around disturbance regimes, which provide sites for tree establishment as a result of overstory mortality. Prior to European settlement, fire was perhaps the prominent disturbance in the CDFmm biogeoclimatic zone, although windthrow and mortality from insects and disease also affect forest stands. Most Douglas-fir forests exhibit a moderate fire regime characterized by infrequent (25-100 year) fires which partially replaced the forest stand (Agee 1990). The effect of these fires varies with wind patterns, forest structure, topography, and moisture. Some trees are killed immediately, others die slowly. Small trees are particularly vulnerable to fire.

After fire, or disturbances such as logging, tree establishment occurs in the newly available growing space, often for decades after the event. Smaller established trees not killed by the disturbance may be 'released' from the shading of the canopy and become the new site dominants. Once regenerating trees are large enough for the forest canopy to close, competition for light and nutrients becomes intense. Overtopped trees become stressed and may be killed by shading, insects, or disease. Standing dead and fallen trees from all sources play an important role in the ecology of the forest as sources of nutrients, soil stabilization, sites for plant establishment, and wildlife habitat.

Eventually, tree density decreases to the point where tree deaths create gaps which are too large to be filled by growth in the lateral branches of surrounding trees. Once gaps occur, understory species richness and cover values increase. Established stands often contain two or more age classes and species combinations in a 'patchy' pattern. Patchiness of age classes contributes to the diversity of habitat types.

Pond and Wetlands

The ecology of aquatic and wetland environments has been reviewed by Reid and Wood (1976) and Mitch and Gosselink (1986). These systems are dynamic and highly productive. The composition and structure of vegetation is generally determined by water depth and plant colonization history. Water depth is shaped by topography, drainage area, sedimentation, and biological activity (such as beavers), and varies with seasonal and yearly precipitation patterns. A mosaic of wetland community types such as open water, flooded treed and shrubby areas (swamps), and shallow areas dominated by herbaceous vegetation (fens and marshes) are usually interspersed. Wetlands often function as water storage areas during winter rain events, moderating stream flow and reducing downstream flooding potential.

Current wetlands have established since the retreat of ice at the end of the last glacial period. Glacial meltwaters created extensive drainage systems. Sediments carried by these waters settled out in basins and in other areas where stream flow slowed. Seeds and spores of plants, micro-organisms, snail eggs and other aquatic organisms were carried in by water flows or on the feathers and feet of waterfowl. Over time, aquatic and marsh plant species became established, died, and sank to the bottom where they decomposed slowly, trapping additional sediments and building up organic material.

The decomposition of this net accumulation of material, and the inflow of nutrients from precipitation and water flows from surrounding lands, lead to a highly productive growth of phytoplankton, submerged and floating aquatics, and herbaceous and woody plant species. In effect, wetlands filter nutrients and sediments from the water. Plant species composition, distribution, and productivity is affected by seasonal and year to year changes in temperature, light, oxygen, nutrient levels, and water flows. Some researchers suggest periodic natural physical

disturbance such as storms and flooding may be essential for maintaining high productivity levels in wetland ecosystems.

High vegetation productivity supports complex interconnected food webs of grazers, predators, and decomposers. The marsh fauna includes a wide range of taxa including bacteria, protozoa, worms, crustaceans, snails, insects, fish, amphibians, birds and mammals. Many species also rely on marshes for breeding habitat. Although most animal species are resident, marsh ecosystems provide valuable resting and feeding habitat for migratory waterfowl and shorebirds.

C.2.9 High Visibility and Sensitive Resources

The beaver pond and wetlands are highly visible and sensitive. Nutrient enrichment or siltation from surrounding lands can negatively affect water quality. Wildlife can be disturbed by human presence at the lake shore. The mucky soils and dense vegetation of shoreline margins and stream courses are susceptible to damage from trampling. Similar trampling damage can also occur in seepage areas and imperfectly drained soils in forests. Stream side areas, wetlands, dead and downed woody debris, and snags have all be been designated habitats of major concern by B.C. Environment (1991). Habitats under this designation are either rare in the province or susceptible to major impacts from human activities.

C.2.10 Key Environmental Factors

- Water levels in wetlands plays a major role in plant distributions and habitat values.
- For the wetland located on the crown land, beaver activity is the primary factor determining water levels.
- Wetlands are dynamic systems; biotic boundaries are not static.
- Water quality plays an important role in ecosystem productivity and habitat values.
- Fire is an integral component of Douglas-fir forest ecology.
- Thin strips of forest are subject to wind throw and damage.

C.2.11 Studies/Inventories

Although partial vegetation and bird species lists have been developed for the property, no detailed studies or inventories have been undertaken which are specific to the area.

C.3 Special Features

C.3.1 Rare/Endangered/Threatened Species

There are no documented occurrences of rare, threatened, or endangered species on the properties (BC Conservation Data Centre 1993).

C.3.2 Biodiversity

The site exhibits a relatively high diversity of plant and animal species and habitat types. The wetlands include open water, deep water wetlands, and sedge meadow. The large number of snags in the wetland add to the habitat values. There is variation in forest age, and structure. A number of forest community types are present. Remnant large trees, snags, and large downed logs contribute to wildlife habitat value.

C.3.3 Scenic/Aesthetic

There are excellent views of the beaver pond and wetlands from the Pickles Road bridge. The open character and well developed understory of the older Douglas-fir forest can be considered aesthetically pleasing.

C.3.4 Historical/Archaeological

A sawmill was located just east of Pickles Road and south of the wetland sometime around 1907. There is evidence of clearing and wooden pilings out into the wetland. Large high-cut Douglas-fir and western red cedar

stumps with springboard notches on the properties are evidence of logging at this time. A raised roadbed, now overgrown, runs through the southwest portion of the Crown land in Section 22.

C.3.5 Cultural

There are no known features of cultural significance on the Inner Island Nature Reserve.

D. LAND STATUS AND USE

D.1 Land Tenure and History

The land tenure and history has been reviewed by Willis and Kennedy (1983) and Kennedy (1993a). The SE 1/4 of Section 21 was originally part of a privately-owned tree farm, but was donated to the Vancouver Foundation in the 1970's. In 1977, at the request of the Islands Trust and the Denman Island Ratepayers and Residents Association, the Vancouver Foundation donated Lot 1 (25.5 ha) to the Crown, and placed under map reserve to the then Ministry of Environment. The remainder of the SE 1/4 of Section 21, along with other lands, was subsequently sold to Raven Forest Products of Campbell River who completed the transfer of Lot 1 to the Crown.

Creation of this nature reserve parcel isolated two small parcels (Lot A) of the remainder of the SE 1/4 of Section 21. In 1984, Raven Forest Products conducted patch logging in the northern parcel. The company began logging the southern parcel in 1990, but quickly stopped after the community expressed concern over potential negative effects on the stream bisecting the property and the adjacent nature reserve. After negotiations with the Denman Island Ratepayers and Residents Association, Raven Forest Products agreed to make these two parcels available for purchase.

In December 1992, the Denman Island Conservancy Association concluded subdivision and purchase of the 9.4 ha Lot A. This consolidation of two separate parcels was then donated to the Trust Fund Board for nature reserve purposes.

The SW 1/4 of Section 22 is a 72.7 ha block of vacant Crown land. According to Land Title Office records, the land was originally registered as private land in 1919 but was forfeited to the Crown in 1931 for tax default. A reserve from alienation for future recreational use was established on the parcel in 1971. The reserve was canceled in February 1988, but was reported as re-established in November of that year due to the area's importance for "land use planning purposes". A title search in June 1993, however, revealed no such charges or interests on the property.

D.2 Past and Present Land Use

High cut stumps with springboard notches indicate selective logging occurred in the area at the time of the sawmill operation around 1907. Patch logging occurred in the northern portion of Lot A in 1984. A small area of the southern portion of Lot A was logged in 1990. Since then, the only recorded uses of the properties have been wood cutting and limited recreation in the form of hiking and horse riding.

D.3 Community Plan Policies

The goal for land use and development in the Denman Island Official Community Plan (OCP) (Bylaw No. 60, 1991) is to "preserve and protect the ecology of Denman Island . . . including . . . the purity of its surface and ground water, the diversity of its bird, fish and animal life, and its variety of flora".

To meet this objective, the OCP outlines policies to "retain forested blocks of land and open space for wildlife habitat, recreation resource and watershed protection", "encourage the maintenance of riparian and linarian habitat", "discourage development encroachment on riparian habitat by maintaining large parcel sizes adjacent to

lakes and swamps" and encourage "the maintenance . . . of fishery producing streams and lakes"

The OCP (Schedule D Map) identifies the beaver pond and adjacent uplands as an "Environmentally Sensitive Area" containing "Important Riparian Habitat". This designation is given to lands of "natural or scenic interest, critical to wildlife and fisheries, or sensitive to development and contamination". The pond and its outflow have been designated a Water Course Development Permit Area (Schedule E Map) which are subject to the restrictions detailed in Section I. 2. As part of the OCP policy to protect water supply watersheds and catchment areas, "(t)he Trust will minimize public access trails or roads to year round wetlands and lakes".

The OCP identifies the pond and surrounding uplands as an "Environmentally Sensitive Area" containing important riparian habitat, and designates the pond and its outflow as an area subject to the restrictions of a "Watershed Water Supply Development Permit Area". This latter designation affects the eastern portion of the Section 22 Crown land.

The guiding objective for the natural environment in the Denman Island Official Community Plan (OCP) (Bylaw No. 60, as amended and adopted 28 August 2001) is "To identify, preserve and protect the integrity of the natural ecosystems on Denman Island and the adjacent islets including the foreshore and intertidal areas. This objective should be understood to be the highest priority in land use planning."

The objective for Lands and Forest is:
"To maintain, and where necessary restore, the diversity, structure and ecological functions of forests on the Island and protect surviving old growth forest; to avoid the fragmentation of forest blocks; to protect areas of sensitive or unique vegetation and areas which contain the habitat of rare or endangered species; and to retain sufficient natural habitat to ensure the preservation of native species."

The objective for fresh water is:
"To preserve, and where necessary restore, watersheds, lakes, wetlands, streams and riparian areas and to retain sufficient natural habitat to ensure the preservation of native species."

To meet these objectives, the OCP outlines policies in E.3 - Conservation/Recreation:

"Policy 2
In the Conservation/Recreation designation:

- **there should be no subdivision of land;**
- **the uses and densities should be restricted to conservation or outdoor recreation and educational programs;**
- **the only camping permitted should be in Fillongley Park;**
- **zoning regulations should establish setbacks from lot lines for any allowed buildings and structures;**
- **zoning regulations should establish sufficient setbacks to protect any watercourses and in the case of fish-bearing streams, setbacks should be adequate to protect the riparian habitat;**
- **zoning regulations should establish sufficient setbacks to protect the foreshore and coastal marine environment; and**
- **zoning amendments should be undertaken to ensure land is retained for conservation and recreation uses."**

And Advocacy Policy 2
"The Ministry of Water, Land and Air Protection, Ministry of Sustainable Resource Management and the British Columbia Assets and Land Corporation are encouraged:

- **to honour the wishes of this community to retain land in the Conservation/Recreation**

designation;"

The wetlands, pond and its outflows have been designated a Streams, Lakes and Wetlands Development Permit Area (Schedule E Map 2) according to Section 879 (1) (a) of the Municipal Act for the protection of the natural environment, its ecosystems and biological diversity. Development in these areas is restricted as set out in Schedule B of the OCP, Part F Development Permits, Section 4.)

D.4 Zoning, Registered and Unregistered Encumbrances

Lot A and Lot 1 are zoned 'Conservation', in the Denman Island Trust Committee Bylaw No. 65 (Schedule B Map, 2002). This zoning designation allows the land only to be used for passive recreation and allows buildings and structures for non-residential permitted uses, fences and signs.

A Section 215 covenant, under the Land Title Act, was registered on Lot A in 1992 in favour of the Ministry of Environment, Lands and Parks and the Regional District of Comox-Strathcona. The covenant has a number of conditions, the most notable of which are restrictions against building any permanent structure or structure which generates sewage, a requirement that the property be used only as bare land, and that no structure be located within 15 meters of a natural watercourse or 7.5 meters of a marsh or swamp area, whichever is greater.

The state of title certificate for Lot A shows that the Crown has a 1987 charge on the under surface rights on the property and that all minerals except coal, fireclay, gold and silver have been forfeited to the Crown.

The SW ¼ of Section 22 is zoned RE, Rural Resource. This zoning designation allows the land to be used for residence, agriculture, silviculture, parks, utilities, all designated home occupations, retail sales of forest products, wood working and wood processing. Accessory buildings and structures are permitted, as is intensive agriculture. One dwelling per 15 hectares is permitted.

These parcels are also in the Agricultural Land Reserve (Schedule B Map). Any subdivision of lands under this designation requires the approval of the Agricultural Land Commission.

A title search by the Islands Trust on July 21, 1993 revealed a charge held by the Crown on the under surface rights on Lot 1. There were no charges, liens, or interests on the SW 1/4 of Section 22.

D.5 Water Management/Licences

There are no water licences or human constructed control structures on the pond or streams on the Inner Island Nature Reserve property or the adjacent Crown land parcels.

A title search by the Islands Trust on July 21,1993 revealed a charge held by the Crown on the under surface rights on Lot 1. There were no charges, liens, or interests on the SW 1/4 of Section 22.

The state of title certificate for Lot A shows that the Crown has a 1987 charge on the under surface rights on the property and that all minerals except coal, fireclay, gold and silver have been forfeited to the Crown.

D.6 Surrounding Land Uses

Kennedy (1993a) provides an overview of surrounding land uses. Although the current land use bylaw (Bylaw No 65, 1992) has zoned most of the area Rural Resource, Kennedy (1993a) identified specific zoning uses on surrounding lands. Lands on the north and west of the Inner Island Nature Reserve and Crown lands are managed for forestry and designated silviculture use. Adjacent to the west boundary of Lot 1 a strip of the neighbouring parcel, approximately 50 meters wide, is zoned Conservation. Also to the north is farm property

designated agriculture. To the east of the Crown land on Section 22 are two privately owned lots, one designated agriculture and the other silviculture. On the south boundary of Section 21 are private lots zoned Rural Residential.

Private lands zoned agricultural lie south of Section 22; both pieces have been logged since 1998.

E. NATURAL RESOURCE MANAGEMENT ISSUES

Site history, biophysical factors, ecological processes, and surrounding land uses interact to affect remnant natural areas in complex and often unknown ways. Natural area management is also hampered by the small size of most remnant areas and the lack of congruence between ecological and legal boundaries. Increasing human population may put recreation pressure on these limited areas and greater development pressures on surrounding lands.

A number of natural resource management issues have been identified for the Inner Island Nature Reserve and adjacent Crown lands. These include:

- wetland water levels;
- vehicle access to Lot A;
- firewood cutting;
- impacts from development on surrounding lands;
- the appropriate type and level of use;
- recreational impacts
- fire risk;
- exotic plant species;
- falling trees; and
- restoration of cleared areas.

Water Levels

Interference with water levels should be discouraged or very carefully considered. Existing water levels are maintained by beaver activity. Breaching of beaver dams will result in a concentrated pulse of water downstream, although the severity will vary with season. Marked changes in water levels will affect plant species distributions and fish habitat capability. Under the provincial Wildlife Act (1982), beaver dams can only be destroyed by a registered trapper, where necessary for the protection of property, or where authorized by regulation.

Vehicle Access

Since the decommissioning of the rough roadways that enter Lot A, there has been no evidence of vehicular activity within the Reserve.

Firewood Cutting

Downed wood has been removed from both parcels of Lot A. Active tree cutting was visible along the border with Lot 1 in the northern parcel in November 1993. Eliminating vehicle access may have solved the problem, but signs may need to be posted. **Some evidence of firewood cutting of downed trees has been observed in the last five years, particularly of those trees which may have partially blocked Pickles Road after severe wind storms.**

Effects of Surrounding Land Uses

Surrounding land uses may have effects on the wetlands and associated forested areas. Logging or land clearing which leaves a narrow (200 ft) strip of trees adjacent to the wetland exposed may cause wind throw or broken tops. Development on adjacent lands may also bring recreational pressures and the invasions of introduced plant species.

The maintenance of lake water quality is directly related to activities on adjacent lands. Although water quality is of greatest concern to those who use it for domestic purposes, aesthetic and wildlife habitat values can decline if nutrient enrichment (primarily phosphorous) causes excessive algal growth. Further residential development on surrounding lands could have such negative impacts on water quality.

Type and Level of Use
A trail through Lot 1 and the SW ¼ of Section 22 links Pickles Road with private property in the latter section. This trail appears to be **occasionally** used by horseback riders. **Trail usage appears to have decreased, perhaps because of the logging activity to the east and south**. If the Crown land properties are acquired, trail use should be monitored to determine if use levels are exceeding the bearing capacity of the soils and vegetation.

Recreation Impacts
The soils and vegetation of the forested areas are generally quite tolerant of dispersed recreational use such as hiking. Slopes are not excessive. The trail route may need to be adjusted to avoid seepage areas or sites where water collects. The lush vegetation growth, seepage areas, stream crossings, and water flows through the soil during winter suggest that the trail system may require maintenance.

Fire Risk
There is very little fire risk in the Inner Island Nature Reserve. The forest over most of the property is relatively open with a large vertical distance between the forest floor and the tree canopy. Fire risk is highest at the height of the summer moisture deficit. Warning signs could be posted when fire risk is high.

Exotic Plant Species
Introduced forbs and grasses have invaded cleared areas in Lot A. However, these species should disappear as forest growth proceeds. Thistles have the potential to spread widely during the interim. Holly (*Ilex aquifolium*) is present in the strip of forest that borders the wetland opposite the southern parcel of Lot A. This shade tolerant shrub/tree can readily invade the Douglas-fir forest throughout the Inner Island Nature Reserve. Holly spreads by bird dispersal of the seeds present in berries. The wetland should be carefully monitored for the appearance of purple loosestrife (Lythrum salicaria). Seeds of this exotic plant can arrive with waterfowl. Once established, purple loosestrife can displace much of the native marsh flora which is essential wildlife food and cover.

Falling Trees
There are a number of alder stands is the SW ¼ of Section 22. This species has a life span much shorter than conifers (approximately 60 years) and is quite susceptible to decay. Falling branches and tree fall are a natural hazard during high winds or wet snow falls.

Restoration of Cleared Areas

There is good natural forest regeneration in areas disturbed by logging or clearing. Management intervention to enhance the restoration of these areas appears unnecessary.

F. MANAGEMENT OBJECTIVES AND STRATEGIES

F.1 Objectives
The goal of the management of the Inner Island Nature Reserve is to protect and maintain the wildlife habitat and conservation values of the marsh and surrounding areas of coastal Douglas-fir forest. To achieve this goal, the following management objectives will be adhered to:

- minimize interference with natural biological and hydrological processes;
- minimize negative effects from surrounding land uses on the beaver pond wetland and adjacent forested areas; and
- minimize the effects of human activities within the Inner Island Nature Reserve .

F.2 Strategies

To achieve these objectives, the following strategies **may be** undertaken:

- minimize interference with the activities of beaver on the property except where beaver activity threatens the large trees along the edges of the wetland.
- ensure that roadways leading into Lot A off Pickles Road **remain inaccessible to vehicles**
- ask surrounding land owners to enter into verbal or written agreements to minimize their impacts on the beaver pond wetlands and adjacent forested areas
- monitor the property to identify any unauthorized use or encroachment or impacts from surrounding lands
- limit recreational use on the property
- consider the provision of a footpath
- monitor the wetland marshes for the appearance of purple loosestrife
- consider removing the holly from the Douglas-fir forest

G. INSURANCE

Reserve lands are included under Islands Trust public liability insurance coverage. The Management group is to obtain and maintain public liability insurance as specified in the Management Agreement and adhere to WCB Regulations when carrying out any works or activities on the Reserve lands.

H. MANAGEMENT AGREEMENT

The Trust Fund Board will contract with a management group approved by the Board, to enter and be on, and manage the Reserve for Reserve purposes. This plan will form a Schedule to the Agreement..

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