Brigade Bay Bluffs Nature Reserve

Long Bay Wetland Nature Reserve

Management Plan
Gambier Island, BC
November 30, 2005

Prepared for:
The Islands Trust Fund
200 – 1627 Fort Street
Victoria, BC V8R 1H8

Prepared by:
Cascade Environmental Resource Group Ltd.
3-1005 Alpha Lake Road
Whistler, BC V0N 1B1

Approved by the Trust Fund Board
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EXECUTIVE SUMMARY

In January 2005, the Islands Trust Fund acquired two parcels of land west of Brigade Bay on Gambier Island. The Brigade Bay Bluffs (5.14 ha) and Long Bay Wetland (38 ha) areas were donated by Coastland Wood Industries Ltd. and Mike Jenks as part of the Brigade Bay subdivision development.

Cascade Environmental Resource Group Ltd. was retained by the Islands Trust Fund (ITF) to prepare a management plan for the Brigade Bay Bluffs and Long Bay Wetland properties. As a policy, management plans are required for all lands owned by the Trust Fund Board. The intent of the management plan is to “provide long term direction and guidance for the protection of values and features of significance and for public use” and will include the following information (ITFa, 2002):

- Purpose and objectives for the properties
- Background information and environmental inventory
- A record of public and stakeholder consultation
- Identification of management issues and concerns
- Strategies and recommended actions for the management of the properties

BRIGADE BAY BLUFFS NATURE RESERVE

The Brigade Bay Bluffs Nature Reserve area is located to the northwest of Brigade Bay and covers an area of 5.14 hectares. The reserve consists of a steep forested area with rocky bluffs and outcroppings. The elevation ranges from 60 to 240 m. The area has been selectively harvested, resulting in large deciduous species and pole/sapling sized conifers. Some large veteran trees (bigleaf maple, Douglas-fir and hemlock species) are located in areas with steeper terrain.

The general management direction of the Brigade Bay Bluffs Nature Reserve is to allow natural succession to continue without intervention. With the possible exception of fire, natural disturbance factors due to wind (windthrow), pest infestation, disease and wildlife use should proceed without intervention. Only the removal of invasive plant species (noxious weeds) is permitted. Due to the steep terrain and lack of access to the area, there are limited recreational opportunities within the reserve and as such, rock climbing should not be permitted. Limited educational opportunities will be permitted with the reserve. The following action items were identified within this management plan:

⇒ **Action Item 1**: Develop a signage plan to clearly delineate Islands Trust Fund Property and to provide education information regarding preservation and environmental protection efforts.

⇒ **Action Item 2**: Develop a landowner contact program for owners of the lots in the Brigade Bay Subdivision.

⇒ **Action Item 3**: Investigate the potential of expanding the Brigade Bay Bluffs Nature Reserve onto the Crown land to the west.
Action Item 4: As development of adjacent properties occurs, evaluate potential access points from the new developments.

Action Item 5: Develop mapping for integration with signage program and place at key strategic locations. These include public facilities (i.e. docks) at New Brighton, Long Bay and Brigade Bay.

Action Item 6: Include Squamish Nation in correspondence relating to the Brigade Bay Bluffs Nature Reserve and continue to solicit input regarding the management of the site.

Action Item 7: Address issues regarding liability and safety and integrate this information with the signage/interpretative program as appropriate.

Action Item 8: To mitigate liability and risk to public safety adequate signage should be installed at key access points to deter the public from entering the reserve including the access from the Brigade Bay subdivision road.

Action Item 9: Develop a fire protection plan in consultation with the Gambier Fire Protection Group.

Action Item 10: Include permanent fire ban information within the signage program.

Action Item 11: Inspect the reserve area on a regular basis (every 2 to 5 years) for the presence of invasive plants and remove as necessary using mechanical or biological means.

Action Item 12: Include "No Hunting" information in the signage program around the perimeter of the Brigade Bay Bluffs Nature Reserve.

Action Item 13: Encourage students, academic institutions, and/or naturalist clubs to conduct rare or endangered species surveys within the reserve.

Action Item 14: Solicit expressions of interest by individuals and/or existing non-profit stewardship groups for the management of the Brigade Bay Bluffs Nature Reserve.

Action Item 15: Sign a volunteer management agreement with the approved group.

Action Item 16: Explore with the local stewardship group the need for placing a conservation covenant on title.

Action Item 17: In consultation with the stewardship group, develop a viable monitoring program to measure ecosystem health within the Brigade Bay Bluffs Nature Reserve. Key attributes should include photo point records, wildlife sightings, and vegetation surveys.

Action Item 18: Install signs at key points around the periphery of the property and at public staging areas. Refer to Action Items 1, 4, 7, 8, 10 and 12.
Action Item 19: Develop an interpretive program for education of youth and general public.

LONG BAY WETLAND NATURE RESERVE
The Long Bay Wetland Nature Reserve consists of upland areas surrounding a large wetland area and is located to the southwest of Brigade Bay. The nature reserve is a total of 38 hectares and the elevation ranges from 30 to 140 m. The wetland contains three tributaries that were significantly damaged by logging in 2000 and 2001. Restoration efforts were completed in 2002 and 2003. The wetland and tributaries are a component of the headwaters of the Long Bay watershed and Long Bay Creek, a fish bearing stream. The upland portions of the reserve area have also been selectively logged in the past and consist of mixed forest cover. The harvesting has resulted in a young forest stage with large deciduous species and pole/sapling sized conifers. The adjacent Brigade Bay Subdivision utilized a portion of the reserve area as a borrow pit for sand and gravel.

The general management direction of the Long Bay Wetland Nature Reserve is to allow natural successional processes to continue with low impact recreational use permitted. With the exception of fire, natural disturbance factors due to wind (windthrow), pest infestation, disease and wildlife use should proceed without intervention. Only the removal of invasive plant species and hazard trees around the trail system are permitted. Further development of the trail system including the creation of a loop around the wetland could be permitted. The reserve provides opportunity for low-intensity recreation uses on a network of trails. Trails with interpretive signage should be constructed on existing trails, and along access roads. Action items identified in this management plan include:

Action Item 1: Develop a signage plan to clearly delineate Islands Trust Fund Property and to provide education information regarding preservation and environmental protection efforts.

Action Item 2: Develop a landowner contact program for new lot owners of the Brigade Bay Subdivision.

Action Item 3: Restore denuded area (borrow pit) adjacent to the road using native plant and seed stock.

Action Item 4: Investigate the potential of expanding the Long Bay Wetland Nature Reserve onto the Crown land to the south. With the Halkett Provincial Park in close proximity, it may be possible to acquire the intervening lands as nature reserve, thus creating a larger, more contiguous, ecological unit.

Action Item 5: Develop mapping for integration with signage program and place at key strategic locations. These include public facilities (i.e. docks) at New Brighton, Long Bay and Brigade Bay.

Action Item 6: Clearly articulate existing trails in all mapping and signage programs.

Action Item 7: Develop an alternative trailhead for Mt. Artaban trail that avoids trespass on private property.
⇒ **Action Item 8:** In consultation with the Sea Ranch Strata Council, develop an interpretive trail system that takes advantage of existing trails and focuses on the educational and recreational opportunities of the Long Bay Wetland Nature Reserve.

⇒ **Action Item 9:** Include Squamish Nation in correspondence relating to the Long Bay Wetland Nature Reserve and continue to solicit input regarding the management of the site.

⇒ **Action Item 10:** Construct and maintain a loop trail that provides nature viewing and wetland interpretive opportunities for visitors to the Long Bay Wetland Nature Reserve.

⇒ **Action Item 11:** Address issues regarding liability and safety by integrating this information with the signage/interpretative program as appropriate.

⇒ **Action Item 12:** To mitigate liability and risk to public safety adequate signage should be installed at key access points to inform the public of safe practices (i.e. staying on designated trails) when entering the reserve.

⇒ **Action Item 13:** Develop a fire protection plan in consultation with the Gambier Fire Protection Group.

⇒ **Action Item 14:** Include permanent fire ban information within the signage program.

⇒ **Action Item 15:** Inspect the reserve area on a regular basis (every 2 to 5 years) for the presence of invasive plants and remove as necessary using mechanical or biological means.

⇒ **Action Item 16:** Include “No Hunting” information in the signage program around the perimeter of the Long Bay Wetland Nature Reserve.

⇒ **Action Item 17:** Encourage students, academic institutions, and/or naturalist clubs to conduct rare or endangered species surveys within the reserve.

⇒ **Action Item 18:** As detailed in Action Item 8, construct and maintain a loop trail that provides nature viewing and wetland interpretive opportunities for visitors to the Long Bay Wetland Nature Reserve while avoiding adverse environmental impacts. Utilize appropriate trail construction techniques in sensitive areas (i.e., boardwalks).

⇒ **Action Item 19:** Solicit expressions of interest by individuals and/or existing non-profit stewardship groups for the management of the Long Bay Wetland Nature Reserve.

⇒ **Action Item 20:** Develop a set of operating guidelines and principles for the stewardship group.

⇒ **Action Item 21:** Explore with the local management / stewardship group the need for placing a conservation covenant on title.
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⇒ Action Item 22: In consultation with the stewardship group, develop a viable monitoring program to measure ecosystem health within the Long Bay Wetland Nature Reserve. Key measurement tools should be quantitative in nature and should include photo point records, wildlife sightings, vegetation surveys, and water quality monitoring.

⇒ Action Item 23: Install signs at key points around the periphery of the property and at public staging areas. Refer to Action Items 1, 5, 6, 11, 12, 14 and 16 above for information to include within the signage program.

⇒ Action Item 24: Develop an interpretive program for education of youth and general public.

⇒ Action Item 25: Working with the youth camps and academic institutions exploit educational opportunities as afforded by the wetlands.

It should be noted that all action items described in this plan are restricted by annual budget amounts approved by Trust Council and the capacity of the management group.
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STATEMENT OF LIMITATIONS

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1.0 INTRODUCTION

1.1 BACKGROUND
Gambier Island, located in Howe Sound (Map 1), is one of a number of islands that is governed by The Islands Trust. The Islands Trust area, encompassing the islands of Howe Sound, is recognized as having one of the rarest and one of the most diverse ecosystems in Canada (Islands Trust Fund, 2002). As such, the Province created the Islands Trust to protect the diverse ecosystems, rural character and unique beauty for future generations. The mandate of The Islands Trust is to preserve and protect the Trust Area and its unique amenities and environment for the benefit of the residents of the Trust Area and the residents of British Columbia (Islands Trust Fund, 2002a).

The Islands Trust Fund (ITF) was established to carry out the “preserve and protect” mandate of the Islands Trust. The ITF works in partnership with conservation agencies and the community to protect special areas through voluntary land donations, conservation covenants, land acquisition and public education (ITF, 2002a). The vision of the ITF Board is “to create a legacy of special places, protecting both the natural and cultural features in perpetuity, in order to help sustain the unique character and environment of the Islands Trust Area” (ITF, 2002a).

Map 1: Location Map

In January 2005, the Islands Trust Fund acquired two parcels of land west of Brigade Bay, on Gambier Island. Map 2 provides and overview of the two nature reserves. The Brigade Bay Bluffs (5.14 ha) and Long Bay Wetland (38 ha) areas were donated to the ITF by Coastland Wood Industries Ltd. and Mike Jenks as part of the Brigade Bay subdivision. The ITF established the Brigade Bay Bluffs and Long Bay Wetland Nature Reserves to facilitate their mandate of protecting special areas.
Map 2: Overview of Brigade Bay Bluffs and Long Bay Wetland Nature Reserves
1.2 **SIGNIFICANCE IN THE PROTECTED AREAS SYSTEM**

The protection of significant areas is one of the goals detailed in the Islands Trust Fund Plan 2003 – 2007, herein referred to as “ITF Plan” (ITF, 2002a). Significant areas are described as having significant characteristics or values. Section 4.1.4 of the ITF plan identifies the features of significance or criteria used to assess potential projects. The Brigade Bay Bluffs and Long Bay Wetland reserve areas meet the designated criteria as they possess the following:

- The potential to contain rare, threatened, vulnerable, exceptional or representative plants or plant communities
- 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
- Coastal and inland cliffs

In addition as per Section 4.1.4 of the ITF Plan, the reserve areas have the potential to provide the following:

- Opportunities for nature study or nature education programs
- Opportunities of low intensity, low impact nature-related recreation

1.3 **ISLANDS TRUST FUND MANAGEMENT PLAN**

The preparation of a management plan for all lands owned by the Trust Fund Board is a policy detailed in the Islands Trust Fund Plan 2003 – 2007. Cascade Environmental Resource Group Ltd. (CERG) was retained by the Islands Trust Fund to prepare a management plan for the Brigade Bay Bluffs Nature Reserve and the Long Bay Wetland Nature Reserve.

The management plans are intended to provide long term direction and guidance for the integration of the protection of the significant characteristics within the nature reserve, while allowing for public use and enjoyment. This management plan will:

- Provide background information and site history about the reserve areas
- Provide an overview of the current and adjacent land use
- Provide an environmental inventory of the reserve areas detailing the features of significance and attributes
- Establish the purpose and objectives for the reserve areas
- Identify the identified management issues provided at the public information meeting, from public comments and through research
- Discuss the management issues related to the protection of the values, significant natural features, ecology of the reserve areas, and visitor use
- Provide a discussion of the strategies and actions to achieve the reserve area purpose and objectives and to address the management issues and needs
- Provide mapping of the reserve areas including the local context of the site, terrestrial ecosystem mapping zones, sensitive areas, and a photographic log detailing key areas for monitoring
• Provide a baseline from which monitoring for success of the reserve areas can be measured

1.4 STUDY LIMITATIONS
In the preparation of this management plan, a number of limitations were encountered and are noted here:
• Site visits were limited to three separate occasions
• Certain portions of the sites were inaccessible due to rugged/steep terrain
• Efforts to contact First Nations to solicit input were unsuccessful
• At least 20 stakeholders were contacted directly or indirectly in the form of emails and at the open house
• No written responses were received from stakeholders during the consultation process

1.5 RESERVE AREA GOALS AND OBJECTIVES
As detailed in the ITF Plan 2003 – 2007, the primary objective of the Islands Trust Board, with respect to managing protected properties, is “to let nature take its course” (ITF, 2002a). The lands owned by the ITF are not created for public recreation, consumptive or commercial activities, but are nature reserves. A Trust Fund Board Nature Reserve is an area that has been set aside because it has regionally significant natural ecosystems (landscape units with little or no human development) and may contain nationally and provincially identified ecosystems and species that are considered endangered, threatened or of special concern.

The primary purpose of a Nature Reserve is the preservation and protection of the natural ecosystem. The size of a Nature Reserve should be sufficient to ensure that these ecosystems remain viable over the long term.

Activities permitted on a nature reserve will have minimal impact on the land and in general will only include hiking and only in areas that are considered not sensitive to this activity. The location and extent of hiking trails are noted in Appendix six.

The purpose of establishing the Brigade Bay Bluffs Nature Reserve and Long Bay Wetland Nature Reserve include:
• Protecting representative natural ecosystems and natural values of the sites
• Protecting rare and endangered plant and animal species
• Maintaining biological diversity and perpetuation of important genetic resources
• Allowing natural forest succession to occur
• Protecting the sites in accordance with the objectives of the Islands Trust Fund and the Islands Trust

The management objectives of the Islands Trust Fund for the Brigade Bay Bluffs and Long Bay Wetland Nature Reserves include:
Protecting the ecosystem and significant characteristics
Allowing low-level, low-impact pedestrian use of the property

Ensuring that the permitted uses do not compromise the significant values or natural conditions of the sites by setting up a monitoring program
2.0 OVERVIEW OF THE NATURE RESERVES

2.1 RESERVE AREA LOCATION
The Brigade Bay Bluffs Nature Reserve and the Long Bay Wetlands Nature Reserve areas are located on the east side of Gambier Island, on the lower slopes of Mt. Artaban (elevation 614 m) as per Maps 1 and 2. Gambier Island is only accessed by passenger ferry between the BC Ferry Langdale Terminal and the Government Dock at New Brighton, on the west side of Gambier Island. Access to Brigade Bay, on the east side of Gambier Island, is via water taxi or private watercraft. Road access on Gambier Island is limited to the southwest portion of the island and there is no road access to the site from the Government Dock at New Brighton.

The Brigade Bay Bluffs Nature Reserve is accessed via a road to the Brigade Bay subdivision, as is the Long Bay Wetland. There is also a road easement bisecting the Long Bay Wetland Nature Reserve, tending towards Long Bay. The road surface limits potential traffic within this access to off-road vehicles, at least through the Long Bay Wetland Reserve. West of this point, road conditions limit access to hikers, mountain bikers, etc.

2.2 RESERVE AREA HISTORY
The Brigade Bay Bluffs and Long Bay Wetland reserve areas were donated to the Islands Trust Fund by Coastland Wood Industries Ltd. and Mike Jenks as part of a subdivision development on Gambier Island. An Initial Environmental Assessment was completed during the developments stages of the subdivision and provides much of the baseline information provided in this management plan (CERG, 2001) and can be found in Appendix 5. The subdivision has been in the planning stages since 2000, with the residential lots put on the market in 2004. An additional residential subdivision is also planned to the south of the existing subdivision.

Traditional use of the nature reserve sites by First Nations is inferred by the presence of two archaeological sites on Brigade Bay, which are protected under the Heritage Conservation Act. Further, the reserve areas will provide additional protection of riparian areas for First Nation traditional use as adjacent properties currently have covenants protecting the right of access for First Nations. The riparian covenants associated with the adjacent development stipulate that “the right of passage by members of the Squamish Nation for the purposes related to continuation of current use of lands or resources for traditional purposes” shall not be restricted (DFO, February 25, 2004). Consultation between Squamish Nation and Fisheries and Oceans Canada during the Brigade Bay subdivision development determined that the Brigade Bay Site – Ho-mahmk, and surrounding environs are well known for deer hunting, plant products, and as a camp site and safe haven for members of the Squamish Nation traveling in Howe Sound (DFO, December 2, 2003). Initial contact has been made with representatives of the Squamish Nation, and it is hoped that further dialogue will elucidate the extent of traditional and current use within the nature reserves.
The presence of large western redcedar and Douglas-fir stumps, and the lack of old growth trees in the both nature reserves is indicative of historic logging that took place near the turn of the previous century, and possibly a second harvest near the middle of the 20th century. A recent selective harvest throughout the majority of the nature reserves occurred in 2000 – 2001, resulting in a complex forest structural stage, dominated by pole-sapling conifers, with (particularly in the wetland) occasional young to mature deciduous trees.

Impacts to the Long Bay Wetland were identified in the environmental assessment completed by Cascade Environmental Resource Group Ltd. in 2001 for the recent residential development of Brigade Bay (CERG, 2001) (see Appendix 5). The proponent of the Brigade Bay Development Project voluntarily conducted a rehabilitation project of the unnamed drainage through the wetland, consisting of removal of excessive slash, and channel blockages, de-compacting affected soils, and the revegetation of disturbed riparian areas. Removal of excessive woody debris and de-compaction of affected soils was completed in October 2002, with disturbed areas broadcast seeded with a reclamation seed mix in the spring of 2003. In the fall of 2004, 2100 live cuttings (700 willow, 700 red-osier dogwood and 700 black cottonwood) were planted in the Long Bay Wet, as were 400 Douglas-fir and 400 western redcedar plugs. The planting efforts were limited to the Long Bay Wetland Nature Reserve and did not include the Brigade Bay Bluffs Nature Reserve. There has been no formal audit of the success of the Long Bay Wetland planting efforts. An article by Lois Kennedy in the Sunshine Coast Conservation Association Letter, June 2005 issue further describes the recent history of the nature reserve areas and can be found in Appendix 1.

A small homestead area was located immediately west-north-west of Brigade Bay (outside the nature reserves), which remained standing as recently as the 1980’s. Some metal artefacts from the site were found amidst the non-native plant species in this locale (i.e. fruit trees, perennial flowers). The plant species were likely planted by the homesteaders occupying the area beginning in the 1920’s. Within the Agricultural Land Reserve, there have been no observations (during the ecological surveys in 2001, 2002, 2003 and 2004) of historical farming within the wetland portion of the Long Bay Wetland Nature Reserve.

2.3 **Public Information Session and Stakeholder Input**

A public open house was held in West Vancouver, B.C. on August 23, 2005 to solicit comments from stakeholders and members of the public regarding the management of the Brigade Bay Bluffs Nature Reserve. Advertisements were placed in the local Sunshine Coast and North Vancouver newspapers (in the absence of a formal Gambier Island newspaper). A total of eleven people attended the open house, including facilitators. Written comments were accepted until September 16, 2005, however no responses were received. Further solicitation of comments from stakeholders transpired via email. At least eleven stakeholders were contacted in the form of emails, with acceptance of comments until November 28, 2005, however no comments were received. Stakeholders contacted during the management planning process included representatives from:

- The Islands Trust Fund
- The Gambier Island Conservancy
- The Sunshine Coast Conservancy
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- Camp Artaban
- The Sea Ranch Strata Council
- Owners of property at Brigade Bay and at New Brighton
- The Squamish Nation
- The former property owner (donor)

A full listing of the stakeholders can be seen in Appendix Five.

The majority of verbal comments received from stakeholders included leaving the nature reserve areas “as is”; the retention of existing trails within the reserves (i.e. Mt. Artaban trail within the Long Bay Wetland Nature Reserve); ensuring that the general public is permitted access to the reserves; and that there is adequate directional/informational signage at public information area at New Brighton, Long Bay and Brigade Bay.
3.0 BRIGADE BAY BLUFFS NATURE RESERVE

3.1 SITE DESCRIPTION
The Brigade Bay Bluffs Nature Reserve area is located to the northwest of Brigade Bay, as per Map 3, (123°20'21" W, 49°29'39" N) and covers an area of 5.14 hectares (13 acres). The reserve consists of a steep forested area with rocky bluffs and outcroppings. The elevation ranges from 60 to 240 m. The area has been selectively harvested, resulting in large deciduous species and pole/sapling sized conifers. Some large veteran trees (bigleaf maple, Douglas-fir and hemlock species) are located in areas with steeper terrain. The reserve has the potential to provide suitable habitat for many threatened or endangered plant and animal species. Based on their habitat requirements, approximately 5 threatened or endangered plant species and 12 threatened or endangered animal species have the potential to inhabit the Brigade Bay Bluffs Nature Reserve.

3.1.1 Legal Description
The Brigade Bay Bluffs Nature Reserve is legally described as PID: 015-940-870, District Lot 1257, Group 1, New Westminster District, Except, Firstly Part in Reference Plan 2829, Secondly Part Subdivided by Plan BCP15304.

3.1.2 Zoning
According to the Islands Trust Gambier Island Land Use Bylaw No. 86, 2004 the zoning of the Brigade Bay Bluffs Nature Reserve is G2 (Nature Reserve) (Islands Trust, 2004). The purpose of this zone is to provide regulations to maintain and enhance the ecological values, ecosystems and unique areas of nature reserves and sanctuaries. Permitted uses within the zone include ecosystem preservation use, water recharge use, trail use, fish and wildlife habitat protection use, and accessory used including but not limited to fire protection. No buildings except for outhouses, protective shelters and fire protection and fire fighting facilities are permitted. Structures are limited to pedestrian trail bridges, stairs, boardwalks, rails and culverts; signs and sign shelters; railings and fences; benches; and fire protection and firefighting facilities.

3.1.3 Adjacent Land Use
The Brigade Bay Bluffs Nature Reserve is bounded by Crown tenure land to the west, undeveloped private land to the north, a municipal park to the east and the Brigade Bay subdivision to the south. The Bert’s Bluff Trail is located on the Sea Ranch Strata public property lands and crown lands to the west of the nature reserve (see Appendix 6 for a listing of all trails). The trail does not enter the nature reserve.
Map 3: Brigade Bay Bluffs Nature Reserve
3.1.4 Connectivity
Considered by itself, the Brigade Bay Bluffs Nature Reserve is too small to provide significant habitat values. However, as the reserve area is located between the Crown tenure land to the west and the municipal park land to the east the reserve area provides important connectivity on the island. The Crown land is an extensive area, totalling approximately 3300 ha (8143 acres). The municipal park to the east of the reserve totals approximately 38 ha (93 acres). Together, the area of undeveloped land including the Crown land, municipal park and nature reserve (3343 ha, 8236 acres) is important to the integrity of the ecosystems on Gambier Island.

3.2 Reserve Area Attributes
An environmental assessment was completed for the original 113.3 ha (280 acre) Brigade Bay Subdivision and included the Brigade Bay Bluffs area. The assessment was completed by Cascade Environmental Resource Group Ltd. in 2001 (CERG, 2001) and can be found in Appendix 5. The following is a description of the attributes of the Brigade Bay Bluffs Nature Reserve area.

3.2.1 Cultural Environment
Other than past logging activities as noted in Section 2.2, the steep physical terrain on the site precludes all but the most persistent human visitor. First Nation traditional use within the Brigade Bay Bluffs Nature reserve is currently not known. However, it was determined through consultation with Fisheries and Oceans Canada and the Squamish Nation for the Brigade Bay subdivision development, that the area surrounding Brigade Bay is known for deer hunting, plant products and camping by the Squamish Nation (DFO, December 2, 2003).

3.2.2 Physical Environment
3.2.2.1 Geology/Geomorphology/Soils
The study area is underlain by Gambier Group rocks of the Mesozoic era. These stratified rock formations are composed of andesitic to dacitic tuff, breccia agglomerate, andesite, argillite, conglomerate, lesser marble, greenstone, and phyllite (BC Ministry of Energy and Mines, 2005). Intrusive rock of the Coast Plutonic complex, such as quartz diorite and diorite, occur in the vicinity. Regional fault systems are predominantly northwest striking.

The surficial character of the Brigade Bay Bluffs area is dominated by rocky outcrops, bluffs, benches, and ravines that are roughly southwest-to-northeast trending. Bedrock is overlain by a veneer of colluvium and glacial till, except where glacial processes removed these materials and only a thin organic layer has since accumulated. The general topography is characterized by slopes which range from gentle to very steep.

Soils mapping for the area indicates that Humo-Ferric Podzols are the most widely distributed soils of the area. The glacial till overlying bedrock result in well drained soils. Primary mineral deposits are colluvial and glacial derived. Soil processes that are characteristic of this submaritime forest include Mor humus formation (associated with the
accumulation of acid organic matter), leaching, eluviation, and illuviation (Meidinger and Pojar, 1991).

3.2.3 Terrestrial Environment

3.2.3.1 Vegetation

Biogeoclimatic Zone Classification

The Brigade Bay Bluffs Nature Reserve area is classified within the very dry maritime subzone (xm) of the Coastal Western Hemlock Zone (CWH) (Green & Klinka, 1994). The CWHxm has warm, dry summers and moist, mild winters with relatively little snowfall. Climatic factors, in conjunction with existing soil conditions, result in a productive coastal forest with a long growing season although water deficits may occur on zonal sites.

The entirety of the Brigade Bay Bluffs Nature Reserve falls within a single vegetation (TEM–terrestrial ecosystem mapping) unit. The TEM code for this unit, RScx5, refers to the biogeoclimatic site series of CWHxm-5, on coarse textured soils that are drier than average, and a young forest structural stage (trees 50 – 80 years old). The polygon was recently selectively harvested for merchantable timber in 2000, thus the resulting forest cover is dominated by large deciduous species and sapling/pole size conifers in a complex structural stage. The residual forest cover is the predominant structure and is characteristic of a young forest. However, the ground cover disturbed during harvest operations and the subsequent increase in light penetration, has resulted in a ground structure synonymous with early stand initiating stages.

The forest cover of this ecosystem unit is mixed, consisting of both deciduous and coniferous species. The predominant tree species include red alder (Alnus rubra), bigleaf maple (Acer marcoyphyllum), western redcedar (Thuja plicata), and western hemlock (Tsuga heterophylla). Paper birch (Betula papyrifera) and Sitka spruce (Picea sitchensis) are also present at low densities. Forest structure is young with an age class of 50-60 years. Coniferous species were variable in size and ranged from sapling to 50 years in age. Crown closure ranges from 5-20% depending on the extent of harvest.

The ground cover of the Brigade Bay Bluffs polygon is a mix of residual forest ground cover and graminoid-dominated stand initiating species. Negligible amounts of shrub species were identified within the polygon. Characteristic herbaceous species include western fescue (Festuca occidentalis), bracken fern (Pteridium aquilinum), foxglove (Digitalis purpurea) and twinflower (Linnaea borealis). A list of vegetation species observed during the 2001 (CERG) inventory can be found in Appendix 2 and 5.

Rare and Endangered Plant Species

Species of concern in British Columbia have a provincial status designation, which is summarized on the Ministry of Water, Land and Air Protection (MWLAP) Conservation Data Centre (CDC) red or blue list. The red list includes indigenous species or subspecies considered to be endangered or threatened. Endangered species are facing imminent extirpation/extinction, whereas threatened groups or species are likely to become
endangered if limiting factors are not reversed. The blue list includes taxa considered to be vulnerable because of characteristics that make them particularly sensitive to human activities or natural events (BC Ministry of Water, Land and Air Protection and Sustainable Resource Management, 2005). Although blue listed species are at risk, they are not considered endangered or threatened. Tracking data for the Sunshine Coast Forest District (BC Ministry of Water, Land and Air Protection and Sustainable Resource Management, 2005) include species that have the potential to occur based on their habitat requirements as outlined by the biogeoclimatic classification system.

Five rare, endangered or threatened plant species have the potential to occur within the rocky slope habitats of the Brigade Bay Bluffs Nature Reserve. These include:

- Allow Dune bentgrass (Agrostis pallens)
- Field fodder (Cuscuta pentagona)
- Macoun’s groundsel (Senecio macounii)
- Poison oak (Toxicodendron diversilobum)
- Redstem springbeauty (Claytonia rubra spp. Depressa)

A discussion of these plants habitat requirements can be found in Appendix 2.

Natural Succession
The reserve area is classified within the very dry maritime subzone (xm) of the Coastal Western Hemlock Zone (CWH) (Green & Klinka, 1994). If undisturbed over the next 10 to 25 years, the forest would mature, with the conifers resuming their pre-harvesting dominance. The quality of the habitat will be restored when late-successional forest conditions develop throughout the Brigade Bay Bluff Nature Reserve.

3.2.3.3 Wildlife and Wildlife Habitats
Observation of wildlife and wildlife signs were recorded as part of the cursory site survey conducted by CERG in July 2001. The wildlife investigation was approached from a habitat perspective.

Birds
Harvested areas, rock bluffs and forests, all contain unique habitat structure and associated species. The harvested areas within the reserve provide clearings and edge ecotones preferred by white crowned sparrows (Zonotrichia leucophrys), spotted towhee (Pipila maculates), dark eyed junco (Junco hyemalis), olive-sided flycatcher (Contopus borealis) and American robin (Turdus migratorius). The coniferous forests within the site provide ideal foraging and nesting opportunities for a wide range of forest birds. Bird species observed during site visits include varied thrush (Ixoreus naevius), golden-crowned kinglet (Regulus satrapa), chestnut-backed chickadee (Parus rufescens), pine siskin (Carduelis pinus), red-breasted nuthatch (Sitta Canadensis) and Steller’s jay (Cyanocitta stelleri). Other non-passerine species observed during the site visit include the turkey vulture (Cathartes aura), bald eagle (Aquila chrysaetos), red tailed hawk (Buteo
jamaicensis), blue grouse (Dendragapus obscurus), red-breasted sap sucker (Sphyrapicus ruber), and northern flicker (Colaptes auratus). Additional species expected to occur within the nature reserve are listed in Appendix 5.

**Mammals**

The size of Gambier Island and its inherent barriers to distribution limit the presence and abundance of many wide ranging mammal species. Although large carnivores and omnivores such as wolf (Canis lupus), coyote (Canis latrans), cougar (Puma concolor) and black bear (Ursus americanus) are not expected, the proximity of the island to mainland does not exclude these mammals from the island. Historical records have only occasionally placed bears on the island. Black tailed deer (Odocoileus hemionus) occur at high density on the island in absence of a natural predator. Other mammals observed during the site visit include the Douglas squirrel (Tamiasciurus douglassi) and raccoon (Procyon lotor). Smaller, more local species likely to occur include the vagrant shrew (Sorex vagrans), snowshoe hare (Lepus americanus), deer mouse (Peromyscus maniculatus), and several bat species (Chiroptera).

**Amphibians and Reptiles**

Reptile species expected to occur include northern alligator lizard (Gerrhonotus coeruleus), particularly on rocky outcroppings, common garter snake (Thamnophis sirtalis), northwestern garter snake (T. ordinoides), and western terrestrial garter snake (T. elegans) (Gregory and Campbell, 1984). The Brigade Bay Bluffs does not provide suitable habitat for most amphibians as there are no riparian or wet areas.

**Rare and Endangered Wildlife Species**

Wildlife species of concern in British Columbia have a similar provincial status designation as described previously for the rare and endangered plant species. The Brigade Bay Bluffs Nature Reserve provides suitable habitat for up to 7 blue listed species, and 3 red listed species. Red listed species (endangered or threatened) that could potentially be found in the Brigade Bay Nature Reserve include:

- Keen’s long-eared myotis (Myotis keenii)
- Peregrine falcon anatum subspecies (Falco peregrinus anatum)
- Purple martin (Progne subis)

Blue listed species (vulnerable) that could potentially be found in the Brigade Bay Nature Reserve include:

- Band-tailed pigeon (Patagioenas fasciata)
- Blue dasher (Pachydiplax longipennis)
- Pacific sideband (Monadenia fidelis)
- Peregrine falcon pealei subspecies (Falco peregrinus pealei)
- Townsend’s big-eared bat (Corynorhinus townsendii)
- Western screech-owl, kennicottii superspecies (Megascops kennicottii kennicottii)
- Western sulphur (Colias occidentalis)

A discussion of habitat requirements for these species can be found in Appendix 2.
3.2.3.4 Valued Ecosystem Components

**Wildlife Trees**
Wildlife trees on site include standing snags, some veteran trees, and trees with broken tops. These trees are important as perching areas for raptors such as red-tailed hawk (*Buteo jamaicensis*) and bald eagle (*Aquila chrysaetos*), and foraging and nesting sites for woodpeckers, small owls and other cavity nesters. Several veteran bigleaf maple (*Acer marcophyllum*), Douglas-fir (*Pseudotsuga menziesii spp. menziesii*) and western hemlock (*Tsuga heterophylla*) trees are located within the Brigade Bay Bluffs Nature Reserve. Occasional large snags with good cavity-nesting potential are scattered throughout, and feeding sign of red-breasted sapsucker (*Sphyrapicus ruber*), and pileated woodpecker were observed in these areas.

**Rocky Coastal Bluffs**
The dry and exposed rocky outcrops near the coastline provide habitat for unique plant and animal species. The thin soils of this harsh environment provide the growing medium for such unique plants as coastal reindeer lichen (*Cladina pertentosa*), dune bentgrass (*Agrostis pallens*), and white hawkweed (*Hieracium albiflorum*). Open ledges and horizontal fissures on cliffs and bluffs are known to provide the best nesting sites for red and yellow-listed birds such as the turkey vulture. Because of inaccessibility to logging operators, some large veteran Douglas-firs are still present, providing potential raptor perch sites. The northern alligator lizard prefers rocky habitats (McPhee et al., 2000).

**Wildlife Movement Corridors**
Rocky ridges are natural movement corridors for wildlife. These areas connect habitats within the subject property to adjacent forested areas of the Crown land to the west and the municipal park to the east.

3.3 MANAGEMENT ISSUES AND RECOMMENDED ACTIONS
As a result of the public consultation process, stakeholder input, and research, a number of issues were identified and described herein. For each of the identified issues, a management action response is recommended.

3.3.1 Site Issues

**Development of Adjacent Properties**
The property is located adjacent to the new Brigade Bay subdivision to the south and undeveloped private land to the north. The further construction of homes and cottages within the subdivision may bring increased foot and pet traffic into the nature reserve. As the boundaries of the reserve are currently not delineated nor have any signage, the general public may enter the nature reserve without knowledge. There is also a concern that rock climbers may utilize the area. The Crown land located to the west of the nature reserve may provide opportunities to expand the boundary of the reserve.
Due to the current low levels of utilization on the island, public trespass onto the Trust Lands, either intentional or inadvertent, is not a concern from an ecological perspective.

- **Action Item 1:** Develop a signage plan to clearly delineate Islands Trust Fund Property and to provide education information regarding preservation and environmental protection efforts.

- **Action Item 2:** Develop a landowner contact program for new lot owners of the Brigade Bay Subdivision.

- **Action Item 3:** Investigate the potential of expanding the Brigade Bay Bluffs Nature Reserve onto the Crown land to the west.

- **Action Item 4:** As development of adjacent properties occurs, evaluate potential access points from the new developments.

### Access to the Brigade Bay Bluffs from Adjacent Properties

Access to the site is provided only via the Brigade Bay subdivision road at the southern tip of the nature reserve. Participants at the Open House also voiced their concern about maintaining access to the reserve from Brigade Bay and Long Bay. Currently there is no signage to advise the general public about the location and access to the reserve from Brigade Bay and Long Bay.

- **Action Item 5:** Develop mapping for integration with signage program and place at key strategic locations. These include public facilities (i.e. docks) at New Brighton, Long Bay and Brigade Bay.

### Adjacent Recreational Facilities

The Bert’s Bluff trail is located to the west of the nature reserve (See Map 3). The trail links the common property at the Sea Ranch to a scenic lookout area. The trail does not currently enter the reserve. The proximity of the trail to the reserve is not a concern at this time.

### 3.3.2 Cultural Environment Issues

The reserve lies within the traditional territory identified by the Squamish Nation. The current levels of use of by the first nation group are currently not known. Initial contact has been made with representatives of the Squamish Nation, and it is hoped that further dialogue will determine the extent of traditional use within the nature reserve.

- **Action Item 6:** Include Squamish Nation in correspondence relating to the Brigade Bay Bluffs Nature Reserve and continue to solicit input regarding the management of the site.
3.3.3 Physical Environment Issues

Safety Issues
The physical steepness of the nature reserve area may pose safety issues in regards to the general public. A number of cliffs and steep terrain pose a risk of accidental falls and injury. There may be liability associated with injury during trespass. Emergency egress from the site is a concern due to the rugged nature of the site. As the forest cover develops, emergency access and egress may become difficult due to lack of openings in the forest.

⇒ **Action Item 7:** Address issues regarding liability and safety and integrate this information with the signage/interpretative program as appropriate.

⇒ **Action Item 8:** To mitigate liability and risk to public safety adequate signage should be installed at key access points to deter the public from entering the reserve including the access from the Brigade Bay subdivision road.

Fire Management
Gambier Island does not have a formal fire department (volunteer or otherwise). Gambier does have a “Gambier Fire Protection Group” that was established for the purpose of acquiring and training in the use of fire suppression equipment. Members of the group contribute time or money for fire suppression equipment (Watson, May 2005). While it is recognized that wildfires are an integral part of the forest ecology, there may be risk to adjacent properties. No camp fires should be permitted within the nature reserve.

⇒ **Action Item 9:** Develop a fire protection plan in consultation with the Gambier Fire Protection Group.

⇒ **Action Item 10:** Include permanent fire ban information within the signage program.

3.3.4 Terrestrial Environment Issues

Forest Development
As indicated earlier, a cornerstone objective of the Islands Trust Board is “to let nature take its course” (ITF, 2002a). With this in mind, and recognizing that the site was selectively harvested, the stand is healthy and regenerating. Forest development will continue to proceed along its current successional path. Non-native grasses planted post harvesting for erosion control will yield to forest cover over time. Any need for thinning or stand management efforts are not anticipated. In the interests of achieving natural conditions, as opposed to a working forest, no interceding management efforts are recommended at this time.

Invasive Plant Species
As the majority of the reserve area was disturbed by logging activities, there is the possibility of invasion by (non-native) plant species. Two species identified as high risk in this area are Himalayan blackberry (*Rubus discolor*) and Scotch broom (*Cytisus*...
scoparius). These species are highly opportunistic and lack any natural competition. As a result, once established these species out-compete natural vegetation and can dominate and upset the natural ecology of the landscape (http://www.ucfv.bc.ca/biology/Biol210/1999/Exotic/Exotic_plant.htm#blackberry http://www.ucfv.bc.ca/biology/Biol210/1999/Exotic/Exotic_plant.htm#broom).

Limiting access into the reserve from the general public will discourage the transportation of invasive species into the area, but the transportation of seed material by birds and wildlife cannot be controlled. Removal of the invasive species by manual and biological methods is preferable to chemical methods.

⇒ **Action Item 11:** Inspect the reserve area on a regular basis (every 2 to 5 years) for the presence of invasive plants and remove as necessary using mechanical or biological means.

**Wildlife**

Generally, there are no wildlife issues identified with the site. However, it is understood that the reserve does and will continue to provide wildlife habitat as the forest regenerates to its successional status and integrates with the natural landscape. There is a significant deer population on Gambier Island and it is understood that hunting is allowed. As a nature reserve, hunting will not be permitted within its boundaries.

⇒ **Action Item 12:** Include “No Hunting” information in the signage program around the perimeter of the Brigade Bay Bluffs Nature Reserve.

**Rare and Endangered Species**

Although potentially occurring, no rare or endangered plants or animals were encountered over the course of conducting inventories. No action is required at this time.

⇒ **Action Item 13:** Encourage students, academic institutions, and/or naturalist clubs to conduct rare or endangered species surveys within the reserve.

### 3.3.5 Other Issues

**Management Group**

A stewardship group should be designated for the onsite management of the Brigade Bay Bluffs Nature Reserve. The responsibility of the stewardship group is to conduct regular site inspections and report any issues or problems to the ITF. The stewardship group should insure that adequate signage is positioned in key areas.

⇒ **Action Item 14:** Solicit expressions of interest by individuals and/or existing non-profit stewardship groups for the management of the Brigade Bay Bluffs Nature Reserve.

⇒ **Action Item 15:** Sign a volunteer management agreement with the approved group.
⇒ Action Item 16: Explore with the local stewardship group the need for placing a conservation covenant on title.

Monitoring Program

A number of monitoring sites were identified as part of this management planning exercise. The monitoring sites are delineated in Appendix 4, Map 5, with supporting photo documentation. The monitoring sites should be incorporated into a monitoring program to be conducted by the stewardship group. Further, additional monitoring locations may be determined over time as required.

⇒ Action Item 17: In consultation with the stewardship group, develop a viable monitoring program to measure ecosystem health within the Brigade Bay Bluffs Nature Reserve. Key attributes should include photo point records, wildlife sightings, and vegetation surveys.

Signage

As detailed above, directional, safety and interpretive signage is currently lacking for the Brigade Bay Bluffs Nature Reserve. Directional and information signage is needed at public access areas of Gambier Islands including the public wharfs/docks at New Brighton, Long Bay and Brigade Bay. Signage is required at key access points along the Brigade Bay subdivision access road to mark reserve area boundaries.

⇒ Action Item 18: Install signs at key points around the periphery of the property and at public staging areas. Refer to Action Items 1, 4, 7, 8, 10 and 12.

Education

Several youth camps operate on Gambier Island. These include Camp Artaban, Camp Fircom and Latona Beach Camp. The Brigade Bay Bluffs Nature Reserve provides opportunities for ecological learning. Working with the stewardship group, the youth groups could assist in the development of an interpretive program (in conjunction with the Long Bay Wetland Nature Reserve) and signage for educational use.

⇒ Action Item 19: Develop an interpretive program for education of youth and general public.

3.4 MANAGEMENT DIRECTIONS AND ACTION STRATEGIES

3.4.1 General Management Direction

The general management direction of the Brigade Bay Bluffs Nature Reserve is to allow natural succession to continue without intervention. With the possible exception of fire, natural disturbance factors due to wind (windthrow), pest infestation, disease and wildlife use should proceed without intervention. Only the removal of invasive plant species (noxious weeds) is permitted.

Due to the steep terrain and lack of access to the area, there are limited recreational opportunities within the Brigade Bay Bluffs Nature Reserve. Rock climbing should not be
permitted within the reserve area. Limited educational opportunities will be permitted with the reserve.

### 3.4.2 Immediate Strategies
The management actions items identified in Section 3.3 above and recommended for the immediate action are described below. Immediate action strategies should be completed within the first six months of approval of this plan.

**Management/Stewardship Group**

- **Action Item 14:** Solicit expressions of interest by individuals and/or existing non-profit stewardship groups for the management of the Brigade Bay Bluffs Nature Reserve.
- **Action Item 15:** Sign a volunteer management agreement with the approved group.

### 3.4.3 Short Term Strategies (1-2 years)
Short term action strategies include initiatives that should be implemented during the first two years of management of the Brigade Bay Bluffs Nature Reserve.

**Monitoring Program**

- **Action Item 17:** In consultation with the stewardship group, develop a viable monitoring program to measure ecosystem health within the Brigade Bay Bluffs Nature Reserve. Key measurement tools should be quantitative in nature and should include photo point records, wildlife sightings, and vegetation surveys.

**Signage**

- **Action Item 1:** Develop a signage plan to clearly delineate Islands Trust Fund Property and to provide education information regarding preservation and environmental protection efforts.
- **Action Item 4:** Develop mapping for integration with signage program and place at key strategic locations. These include public facilities (i.e. docks) at New Brighton, Long Bay and Brigade Bay.
- **Action Item 7:** Address issues regarding liability and safety and integrate this information with the signage/interpretative program as appropriate.
- **Action Item 8:** To mitigate liability and risk to public safety adequate signage should be installed at key access points to deter the public from entering the reserve including the access from the Brigade Bay subdivision road.
- **Action Item 10:** Include permanent fire ban information within the signage program.
- **Action Item 12:** Include “No Hunting” information in the signage program around the perimeter of the Brigade Bay Bluffs Nature Reserve.
⇒ Action Item 18: Install signs at key points around the periphery of the property and at public staging areas. Refer to Action Items 1, 4, 7, 8, 10 and 12 above.

Fire Protection Plan

⇒ Action Item 9: Develop a fire protection plan in consultation with the Gambier Fire Protection Group.

Consultation with Local Groups

⇒ Action Item 19: Develop an interpretive program for education of youth and general public.

⇒ Action Item 2: Develop a landowner contact program for new lot owners of the Brigade Bay Subdivision.

3.4.4 Medium Term Strategies (3-5 years)
Medium term management strategies include initiatives that should be completed within three to five years.

Consultation with First Nations

⇒ Action Item 6: Include Squamish Nation in correspondence relating to the Brigade Bay Bluffs Nature Reserve and continue to solicit input regarding the management of the site.

Conservation Covenant

⇒ Action Item 16: Explore with the local stewardship group the need for placing a conservation covenant on title.

Monitoring of Invasive Plant Species

⇒ Action Item 11: Inspect the reserve area on a regular basis (every 2 to 5 years) for the presence of invasive plants and remove as necessary using mechanical or biological means.

Rare and Endangered Species Surveys

⇒ Action Item 13: Encourage students, academic institutions, and/or naturalist clubs to conduct rare or endangered species surveys within the reserve.

3.4.5 Long Term Strategies (6-10 years)
Long term strategies include initiatives that should be implemented between six to ten years.
Expansion of Brigade Bay Bluffs Nature Reserve

⇒ **Action Item 3:** Investigate the potential of expanding the Brigade Bay Bluffs Nature Reserve onto the Crown land to the west.

Monitoring of Adjacent Properties

⇒ **Action Item 4:** As development of adjacent properties occurs, evaluate potential access points from the new developments.
4.0 LONG BAY WETLAND NATURE RESERVE

4.1 SITE DESCRIPTION
The Long Bay Wetland Nature Reserve consists of upland areas surrounding a large wetland area. It is located to the southwest of Brigade Bay (123°20’16” W, 49°29’1” N) as per Map 4. The nature reserve is a total of 38 hectares (94 acres) and the elevation ranges from 30 to 140 m. The wetland contains three tributaries that were significantly damaged by logging in 2000 and 2001. Restoration efforts were completed in 2002 and 2003. The wetland and tributaries are a component of the headwaters of the Long Bay watershed and Long Bay Creek, a fish bearing stream. The upland portions of the reserve area have also been selectively logged in the past and consist of mixed forest cover. The harvesting has resulted in a young forest stage with large deciduous species and pole/sapling sized conifers. The adjacent Brigade Bay Subdivision utilized a portion of the reserve area as a borrow pit for sand and gravel. Based on their habitat requirements, approximately 16 threatened or endangered plant species and 13 threatened or endangered animal species have the potential to inhabit the area.

4.1.1 Legal Description
The Long Bay Wetland Nature Reserve is legally described as PID: 015-921-034, District Lot 1259, Group 1, New Westminster District, Except Part Subdivided by Plan BCP15304.

4.1.2 Zoning
According to the Islands Trust Gambier Island Land Use Bylaw No. 86, 2004 the zoning of the majority of the Long Bay Wetland Nature Reserve is G2 (Nature Reserve) (Islands Trust, 2004). The purpose of this zone is to provide regulations to maintain and enhance the ecological values, ecosystems and unique areas of nature reserves and sanctuaries. Permitted uses within the zone include ecosystem preservation use, water recharge use, trail use, fish and wildlife habitat protection use, and accessory used including but not limited to fire protection. No buildings except for outhouses, protective shelters and fire protection and firefighting facilities are permitted. Structures are limited to pedestrian trail bridges, stairs, boardwalks, rails and culverts; signs and sign shelters; railings and fences; benches; and fire protection and firefighting facilities.

A portion of the Long Bay Wetland Nature Reserve is found within the Agricultural Land Reserve (ALR). As such this area is zoned Agriculture (A). The purpose of the zone is to provide regulations to support the retention of small scale farming on Gambier Island in areas with agricultural potential and on land in the Provincial Agricultural Land Reserve. According to the Islands Trust Gambier Island Land Use Bylaw No. 86, 2004 the permitted used within the Agriculture Zone include agriculture use; single family residential use; associated secondary dwelling use; and accessory uses including but not limited to home occupations.
Map 4: Long Bay Wetland Nature Reserve
4.1.3 Adjacent Land Use
The Long Bay Wetland Nature Reserve is bounded by Sea Ranch strata common property to the west, the Brigade Bay subdivision to the north and east, and vacant Crown Land to the south.

4.1.4 Connectivity
The undeveloped vacant Crown Land to the south of the Long Bay Wetland Nature Reserve totals 344 ha (850 acres). In addition to the Long Bay Wetland the undeveloped area totals over 382 ha (944 acres) providing a large, un-fragmented area which is significant to the overall biodiversity of Gambier Island.

4.2 Reserve Area Attributes
An environmental assessment was completed for the original 113.3 ha (280 acre) Brigade Bay Subdivision and included the Brigade Bay Bluffs area. The assessment was completed by Cascade Environmental Resource Group Ltd. (CERG, 2001) and is included in Appendix 5. The following is a description of the attributes of the Long Bay Wetland Nature Reserve area.

4.2.1 Cultural Environment
The Long Bay Wetland Nature Reserve has experienced light recreational use in the past few years. A trail bisects the reserve from the south end of Brigade Bay, in a southwest direction towards Long Bay. An additional trail follows the road easement on the northern portion of the reserve, from Brigade Bay and onto the Sea Ranch common property. First Nation traditional use within the Long Bay Wetland Nature Reserve is not known. However, it was determined through consultation with Fisheries and Oceans Canada and the Squamish Nation for the Brigade Bay subdivision development, that the area surrounding Brigade Bay is known for deer hunting, plant products and camping by the Squamish Nation (DFO, December 2, 2003).

4.2.2 Physical Environment
4.2.2.1 Geology/Geomorphology/Soils
The study area is underlain by Gambier Group rocks of the Mesozoic era. These stratified rock formations are composed of andesitic to dacitic tuff, breccia agglomerate, andesite, argillite, conglomerate, lesser marble, greenstone, and phyllite (BC Ministry of Energy and Mines, 2005). Intrusive rock of the Coast Plutonic complex, such as quartz diorite and diorite, occur in the vicinity. Regional fault systems are predominantly northwest striking.

The surficial character of the study area is dominated by rocky outcrops and bluffs to the north and south east separated by a large gently sloping wetland. Where dominant, bedrock is overlain by a veneer of colluvium and glacial till, except where glacial processes removed these materials and only a thin organic layer has since accumulated. The general topography is characterized by uplands areas with slopes which range from gentle to very steep and low lying areas that are dominated by wetlands.
Soils mapping for the area indicates that Humo-Ferric Podzols are the most widely distributed soils of the study site in the upland areas. The glacial till overlying bedrock result in well drained soils. Average rooting depth ranges form 20-75 cm. Primary mineral deposits are colluvial and glacial derived. Soil processes that are characteristic of this submaritime forest include Mor humus formation (associated with the accumulation of acid organic matter), leaching, eluviation, and illuviation (Meidinger and Pojar, 1991).

Deep organic Folisols are prominent in wetland and permanent seepage areas. Soil profiles observed in the field characteristically featured an LFH (organic litter) horizon underlain by a light gray, eluviated (Ae and Aej) horizon, followed by a light reddish-brown (becoming yellowish with depth) B horizon containing large, coarse fragments in a silty matrix.

### 4.2.3 Terrestrial Environment

#### 4.2.3.1 Vegetation

**Biogeoclimatic Zone Classification**

The Long Bay Wetland Nature Reserve area is classified within the very dry maritime subzone (xm) of the Coastal Western Hemlock Zone (CWH) (Green & Klinka, 1994). The CWHxm has warm, dry summers and moist, mild winters with relatively little snowfall. Climatic factors, in conjunction with existing soil conditions, result in a productive coastal forest with a long growing season.

The Long Bay Wetland Nature Reserve falls within three vegetation (TEM – terrestrial ecosystem mapping) units:

**Long Bay Wetland 1: RScx5**

The TEM code, RScx5, refers to the biogeoclimatic site series CWHxm-5, on coarse textured soils that are drier than average, and a young forest structural stage (trees 50 – 80 years old. This upland polygon was selectively harvested for merchantable timber in 2000, thus resulting in forest cover dominated by large deciduous species and sapling/pole size conifers in a complex structural stage. The residual forest cover is the predominant structure and is characteristic of a young forest. However, the ground cover disturbed during harvest operations and the subsequent increase in light penetration, has resulted in a ground structure synonymous with early stand initiating stages.

The forest cover of this ecosystem unit is mixed, consisting of both deciduous and coniferous species. The predominant tree species include red alder (*Alnus rubra*), bigleaf maple (*Acer marcocephalum*), western redcedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*). Paper birch (*Betula papyrifera*) and Sitka spruce (*Picea sitchensis*) are also present throughout the polygon at low densities. Forest structure is young with an age class of 50-60 years. During the site investigation, a typical red alder measured 55 cm in diameter and 16 m in height. Bigleaf maple is another common species and is characteristically 50-60 cm in diameter and attained heights of 18 m. Coniferous species
were variable in size and ranged from sapling to 50 years in age. Crown closure ranges from 5-20% depending on the extent of timber harvested.

The ground cover of the Brigade Bay Bluffs polygon is a mix of residual forest ground cover and graminoid-dominated stand initiating species. Negligible amounts of shrub species were identified within the polygon. Characteristic herbaceous species include western fescue (*Festuca occidentalis*), bracken fern (*Pteridium aquilinum*), foxglove (*Digitalis purpurea*) and twinflower (*Linnaea borealis*). A list of the vegetation species observed during the 2001 (CERG) inventory can be found in Appendix 5.

**Long Bay Wetland 2: RSp5**

The TEM code, RSp5, refers to the biogeoclimatic site series CWHxm-12, with deep organic soils, and a young forest structural stage (trees 50 – 80 years old). The Long Bay Wetland 2 polygon represents the forested wetlands present within the reserve area. This palustrine system occurs in a slight depression and is characterized by poor drainage that collects water flows from runoff, groundwater and precipitation. The forest cover has recently been selectively harvested, and piles of slash have been left. Tree retention varies throughout the site from cleared to full preservation. Subsequently, the vegetation within the polygon is typical of both stand initiating and young forest stages. The polygon is characterized by its level slope and deep organic soils. The soil moisture regime is subhydric, where water is removed slowly enough to keep the water table at or near the surface for the majority of the year.

The existing forest cover is dominated by young red alder, western hemlock, bigleaf maple, and Sitka spruce. A typical red alder measured 33 cm in diameter and 13 m in height. Merchantable conifers have been removed from the site resulting in a sapling pole structure. A representative western hemlock measured 11 cm in diameter and 7 m in height. Representative shrub species include vine maple, red huckleberry and salmonberry. Shrub composition is changing in areas where overhead canopy has been removed. Increased temperature, light and changes in soil moisture have altered microclimate and resultantly affected shrub distribution. Herbaceous cover within the polygon is dominated by skunk cabbage, lady fern, sword fern, deer fern , and various grass, rush and sedge species.

**Long Bay Wetland 3: RSck5**

The TEM code, RSck5, refers to the biogeoclimatic site series CWHxm-5, with a cool aspect on coarse textured soils, and a young forest structural stage (trees 50 – 80 years old. The eastern upland sections of Long Bay Wetland 3 polygon were also selectively harvested for merchantable timber. Like the preceding polygons, this TEM unit is now of a young deciduous forest stand with stand initiating undergrowth. Characteristic tree species include bigleaf maple, Douglas-fir, red alder, western hemlock and western redcedar. Crown closure in this ecosystem unit ranges from 25-40%. Tree mensuration within the polygon revealed an average age class of 60 years. Typical bigleaf maples measured 40 cm in diameter and 20 m in height. Red alder averaged 35 cm in diameter, and attained heights of 17 m. Coniferous species, though less prevalent, averaged 25 cm diameters for hemlock and 35 cm for Douglas-fir.
The under story of this polygon was also disturbed through harvest activities. The resulting forest floor is characteristic of forb-dominated stand initiating stages. The northern aspect of this polygon coupled with the increased crown closure resulted in a high forb presence. Clusters of sword fern dominate the forest floor landscape. Other species such as western fescue, northern bedstraw and foxglove are present at relatively low densities.

**Rare and Endangered Plant Species**

Sixteen threatened or endangered plant species have the habitat requirements to occur within the moist forested wetland habitats of the Long Bay Wetland Nature Reserve. These include:

- California hedge-parsley (*Yabea microcarpa*)
- Chaffweed (*Anagallis minima*)
- Field fodder (*Cuscuta pentagona*)
- Giant chain fern (*Woodwardia fimbriata*)
- Green-sheathed sedge (*Carex feta*)
- Heterocodon (*Heterocodon rariflorum*)
- Least moonwort (*Botrychium simplex*)
- Menzies’ burnet (*Sanguisorba menziesii*)
- Northern adder’s-tongue (*Ophioglossum pusillum*)
- Nuttall’s quillwort (*Isoetes nuttallii*)
- Pointed broom sedge (*Carex scoparia*)
- Slimleaf onion (*Allium amplectens*)
- Western pearlwort (*Sagina decumbens spp. occidentalis*)
- Western St. John’s-wort (*Hypericum scouleri spp. nortoniae*)
- White adder’s-mouth orchid (*Malaxis brachypoda*)
- Woodland penstemon (*Nothochelone nemorosa*)

A discussion of the habitat requirements of the above rare, endangered or threatened plant species can be found in Appendix 3.

**Natural Succession**

The Long Bay Wetland Nature Reserve area is classified within the very dry maritime subzone (xm) of the Coastal Western Hemlock Zone (CWH) (Green & Klinka, 1994). If undisturbed over the next 10 to 25 years, the forest would mature, with conifers resuming their pre-harvesting dominance. The quality of the habitat will be restored by recreating late-successional forest conditions throughout the nature reserve.

**4.2.3.2 Wildlife and Wildlife Habitats**

Observation of wildlife and wildlife signs were recorded as a component of the cursory site survey conducted by CERG in July 2001. The wildlife investigation was approached from a habitat perspective.

**Birds**

The CWH ecosystem is considered to have the greatest diversity and abundance of habitat elements of British Columbia. This habitat diversity results in the greatest diversity of bird species. The diverse vegetation structure within the upland and riparian/wetland
areas of the Long Bay Wetland Nature Reserve provides habitat for a multitude of avian species. The harvested areas, riparian areas, wetlands and forests, all contain unique habitat structure and associated species. The harvested areas within the study site provide clearings and edge ecotones preferred by white crowned sparrows (Zonotrichia leucophrys), spotted towhee (Pipila maculates), dark eyed junco (Junco hyemalis), olive-sided flycatcher (Contopus borealis) and American robin (Turdus migratorius).

Birds utilizing the forested wetlands and riparian areas include willow flycatcher (Empidonax traillii), winter wren (Troglodytes troglodytes), western wood pewee (Contopus sordidulus), song sparrow (Melospiza melodia), yellow warbler (Dendroica petechia), and yellow-rumped warbler (Dendroica coronata). The coniferous forests within the study site provide the ideal foraging and nesting opportunities for a wide range of forest birds. Bird species observed in these polygons during site visits include varied thrush (Ixoreus naevius), golden-crowned kinglet (Regulus satrapa), chestnut-backed chickadee (Parus rufescens), pine siskin (Carduelis pinus), red-breasted nuthatch (Sitta Canadensis) and Steller’s jay (Cyanocitta stelleri). Other non-passerine species observed during the site visit include the turkey vulture (Cathartes aura), bald eagle (Aquila chrysaetos), red tailed hawk (Buteo jamaicensis), blue grouse (Dendragapus obscurus), red-breasted sap sucker (Sphyrapicus ruber), and northern flicker (Colaptes auratus). Additional species expected to occur within the study site are listed in Appendix 5.

Mammals
The size of Gambier Island and its inherent barriers to distribution limit the presence and abundance of many wide ranging mammal species. Although large carnivores and omnivores such as wolf (Canis lupus), coyote (Canis latrans), cougar (Puma concolor) and black bear (Ursus americanus) are not expected, the close proximity of the island to mainland does not exclude these mammals from the island. Historical records have only occasionally placed bears on the island. Black tailed deer (Odocoileus hemionus) occur at high density within the study site in absence of a natural predator. Other mammals observed during the site visit include the Douglas squirrel (Tamiasciurus douglassi) and raccoon (Procyon lotor). Smaller, more local species likely to occur include the vagrant shrew (Sorex vagrans), water shrew (Sorex palustris), snowshoe hare (Lepus americanus), deer mouse (Peromyscus maniculatus), and several bat species (Chiroptera).

Amphibians and Reptiles
The permanent and ephemeral water located within the wetland areas provide ideal breeding opportunities for amphibians. Although no adult amphibian species were identified during the site visits, numerous frog and salamander larvae were observed in the wetland areas and ephemeral ponds. Amphibious species expected to occur in the vicinity of seasonal or permanent wetlands include rough-skinned newt (Taricha granulosa), long-toed salamander (Ambystoma macrodactylum), western toad (Bufo boreas), red-legged frog (Rana aurora), and Pacific treefrog (Hyla regilla). Western red-backed salamander (Plethodon vehiculum), Northwestern salamander (Ambystoma gracile) and ensatina (Ensatina eschscholtzi) may occur throughout forested regions (Green and Campbell, 1984).
Reptile species expected to occur include northern alligator lizard (*Gerrhonotus coeruleus*), particularly on rocky outcroppings, common garter snake (*Thamnophis sirtalis*), northwestern garter snake (*T. ordinoides*), and western terrestrial garter snake (*T. elegans*) (Gregory and Campbell, 1984).

**Rare and Endangered Wildlife Species**

Wildlife species of concern in British Columbia have a similar provincial status designation as previously described for the rare and endangered plant species in Section 4.2.3.1. The Long Bay Wetland Nature Reserve provides suitable habitat for one (1) red listed species and eleven (11) blue listed wildlife species. Red listed species (threatened or endangered) that could potentially be found in the reserve area include:

- Keen’s long-eared myotis (*Myotis keenii*)

Blue listed species (vulnerable) that could potentially be found in the Brigade Bay Nature Reserve include:

- Band-tailed pigeon (*Patagioenas fasciata*)
- Black petaltail (*Tanypteryx hageni*)
- Canada Goose, occidentalis spp. (*Branta Canadensis occidentalis*)
- Dun Skipper (*Euphyes vestries*)
- Gleast blue heron (*Ardea herodias fannini*)
- Green heron (*Butorides virescens*)
- Keen’s long-eared myotis (*Myotis keeni*)
- Pacific sideband (*Monadenia fidelis*)
- Painted turtle (*Chrysemys picta*)
- Red-legged frog (*Rana aurora*)
- Western screech-owl, kennicottii superspecies (*Megascops kennicottii kennicottii*)

A discussion of habitat requirements for these species can be found in Appendix 3.

**4.2.3.4 Valued Ecosystem Components**

**Wildlife Trees**

Wildlife trees on site include significant standing snags, veteran trees, and trees with broken tops. These trees are important as perching areas for raptors such as red-tailed hawk (*Buteo jamaicensis*) and bald eagle (*Aquila chrysaetos*), and foraging and nesting sites for woodpeckers, small owls and other cavity nesters. (*Acer marcophyllum*), Douglas-fir (*Pseudotsuga menziesii spp. menziesii*) and western hemlock (*Tsuga heterophylla*) trees are located within the Brigade Bay Bluffs nature Reserve. Occasional large snags with good cavity-nesting potential are scattered throughout, and feeding sign of red-breasted sapsucker (*Sphyrapicus ruber*), and pileated woodpecker were observed in these areas.

**Riparian Areas**

The Long Bay nature reserve area is a wetland. Riparian areas surrounding the wetland are dominated by tree species such as western redcedar, red alder, Sitka spruce and
bigleaf maple. The shrub understory is dominated by red huckleberry and Douglas maple, with a lower abundance of devil’s club, salmonberry and red elderberry. The riparian habitats provide high structural heterogeneity and plant species diversity compared to the relatively uniform adjacent forests. They are very attractive to numerous bird, mammal, and amphibian species. Creek and wetland habitats are utilized as drinking and preening areas for wildlife, and possibly breeding areas for salamanders.

**Wildlife Movement Corridors**

Creeks and riparian habitats are natural movement corridors for wildlife. These areas connect habitats within the subject property to adjacent forested areas found within the Crown land to the south, and the strata common property to the west.

**4.2.4 Aquatic Environment**

The headwaters of two separate drainages can be found within the Long Bay Wetland Nature Reserve.

**Tributary of Long Bay Creek**

The headwaters of a tributary to Long Bay Creek are located at the western boundary of the wetland reserve. The stream begins flowing within the reserve boundary and was heavily impacted by forest harvesting activities in 2000/01. During the initial stream assessment in 2001, any pre-existing channels could not be identified due to heavy machinery impacts from forest harvesting. An additional stream assessment was completed in May 2002, to assess the impacts of the logging operation on the drainage and to develop a rehabilitation/mitigation program. The assessment determined that the unnamed creek originates in three separate drainages (Tributaries 1, 2 and 3 – as per Map 4) within the wetland area. Stream discharge was estimated as 0.002-0.005 m³/s on June 20, 2001 and as 0.01 m³/s on May 28, 2002.

Tributary 1 is the most northern drainage located in the Long Bay Wetland Nature Reserve. This drainage is very unlikely to be fish bearing within the nature reserve due to the lack of sufficient surface flows and a lack of a distinct channel. However, this reach continues to provide food and nutrients to downstream fish bearing reaches such as Long Bay Creek. FISS data indicates recent records of coho (*Oncorhynchus kisutch*) and chum (*Oncorhynchus keta*) salmon in Long Bay Creek, with field observations of Chinook (*Oncorhynchus tshawytscha*) and pink salmon (*Oncorhynchus gorbuscha*) in the 1980s. Although not noted in the records, the stream also provides habitat suitable for cutthroat trout (*Oncorhynchus clarki*). Upon re-establishment of the creek channel during rehabilitation efforts in October 2002 and planting along the banks in October/November 2004, Tributary 1 currently flows as a continuous channel during heavy rain events and intermittent during drier periods. The tree species planted in 2004 have become established and will provide shading of the creek and stabilization of the banks.

Tributary 2 is the central drainage within the wetland and is also unlikely to support fish, however two frog species were observed during the site observations in May 2002. This tributary was noted to be ephemeral in nature, has discontinuous channels, and lacked riparian vegetation in 2002. Currently, Tributary 2 extends approximately 30 to 50 m into
the wetland reserve as a continuous channel and extends further as a series of contiguous pools. The riparian vegetation is primarily tall grasses, ferns, and the occasional large coniferous tree. With the establishment of the planted vegetation, shrub species will soon dominate the understory.

Tributary 3 is the southern drainage within the wetland area. Due to the limited ephemeral flows, and lack of pool development within this reach, it is unlikely to be fish bearing, although it would contribute food and nutrients to downstream fish bearing reaches. Currently, Tributary 3 is the longest, most channelized stream in the wetland reserve. It has well defined banks, occasional pools, and established forested riparian vegetation along the left bank. Revegetation efforts along the right bank were primarily coniferous species due to the hummocky terrain adjacent to the creek.

The proponent of the Brigade Bay Development Project voluntarily conducted a rehabilitation project of the unnamed drainage through the wetland, consisting of removal of excessive slash and channel blockages, de-compacting affected soils and revegetation of disturbed riparian areas. In the fall of 2004, 2100 live cuttings were planted (700 willow, 700 red-osier dogwood and 700 black cottonwood), as were 400 Douglas-fir and 400 western redcedar plugs to reestablish larger riparian vegetation of the three tributaries in the wetland.

Unnamed Creek A

Unnamed Creek A, as identified in Map 4, is a permanent stream found on the eastern boundary of the Long Bay Wetland Nature Reserve. The headwaters for this creek are on the toe of Mt. Artaban, which lies to the south of the subject property. This creek was discharging approximately 5-10 l/s on June 20, 2001, flowing into Ramillies Channel. The drainage runs north-east towards the foreshore in the south-eastern section of the reserve over steep slopes and into the ocean. Due to the steep gradients, this stream is classified as non fish bearing.

4.2.5 Wetland Environment

4.2.5.1 Delineation

The wetland areas located within the Long Bay Wetland Nature Reserve are classified as a riverine swamp in accordance with the Canadian Wetland Classification System (NWWG, 1997). However, its connection to the inflow and outflow channels has been altered by forest harvesting activities in 2001. Consequently, wetland characteristics are now patchy and discontinuous. The remaining vegetation community consists of skunk cabbage (Lysichiton americanum), sword fern (Polystichum munitum) small flowered woodrush (Luzula parviflora) as well as various other species of rushes and sedges. The small component of remaining forest structure is characterized by western redcedar (Thuja plicata), western hemlock (Tsuga heterophylla), Sitka spruce (Picea sitchensis), red alder (Alnus rubra), bigleaf maple (Acer macrophyllum).
4.2.5.2 Functionality

The functionality of the Long Bay Wetland is compromised and has been altered by the impacts of forest harvesting in recent years. Functions provided by the wetland include to varying degrees (SCS, 1992):

1. **Sediment Control** – Capture and retain sediments from upstream runoff from logging roads and trails.
2. **Erosion Control** - Help to stabilize adjacent stream channels.
3. **Flood Storage** – Retain overflow and reduce the rate of flow during peak runoff by storm retention.
4. **Food Production** – Provide forage for migrating birds and resident animals, as well as providing food for downstream fisheries production.
5. **Wildlife Habitat** – Provide habitat and rearing habitat for the local wildlife population, including black bears, raccoons, small mammals, songbirds, and herpetofauna.
6. **Open Space** – Significant contributions to the aesthetics of the area as highly visible ecological features.
7. **Recreation** – Opportunities contribute to ecological interpretive programs and trails.

4.3 Management Issues and Recommended Actions

As a result of the public consultation process, stakeholder input, and research, a number of issues were identified and described herein. For each of the identified issues, a management action response is recommended.

4.3.1 Site Issues

**Development of Adjacent Properties**

During the development of the Brigade Bay Subdivision the most south eastern portion of the Long Bay Wetland Nature Reserve (along the subdivision road – as per Map 4) was utilized as a borrow pit. The area needs to be restored to a revegetated state.

The further development of the Brigade Bay subdivision to the east and the Sea Ranch property to the west has the potential to bring more pet and foot traffic into the nature reserve. Most of the reserve is easily accessible from the Brigade Bay subdivision access road and trails in the area. As the boundaries of the reserve are currently not delineated nor have any signage, the general public may enter the nature reserve without knowledge. The Crown land located to the south of the nature reserve (Mt. Artaban) may provide opportunities to expand the boundary of the reserve.

Since this area occupies low lying land, the nature reserve is more accessible to landowners and the general public. As a result, access management is an issue.
⇒ **Action Item 1:** Develop a signage plan to clearly delineate Islands Trust Fund Property and to provide education information regarding preservation and environmental protection efforts.

⇒ **Action Item 2:** Develop a landowner contact program for new lot owners of the Brigade Bay Subdivision.

⇒ **Action Item 3:** Restore denuded area (borrow pit) adjacent to the road using native plant and seed stock.

⇒ **Action Item 4:** Investigate the potential of expanding the Long Bay Wetland Nature Reserve onto the Crown land to the south. With the Halkett Provincial Park in close proximity, it may be possible to acquire the intervening lands as nature reserve, thus creating a larger, more contiguous, ecological unit.

### Access to the Long Bay Wetland Nature Reserve

The Brigade Bay subdivision road serves as the eastern boundary of the majority of the nature reserve. A road easement / trail onto the Sea Ranch property bisects the reserve on the northern part of the property. A hiking trail also bisects the southern portion of the property, tending southwest, linking Brigade Bay to Long Bay, as per Map 4. Participants at the Open House voiced their concern about access to the reserve are from Brigade Bay and Long Bay. Currently there is no signage to advise the general public about the location and access to the reserve from Brigade Bay and Long Bay.

The Long Bay Wetland Nature Reserve has higher interpretive values due to the existing trail system and the presence of wetlands. As a result, management of the site should consider facilitating rather than discouraging access.

⇒ **Action Item 5:** Develop mapping for integration with signage program and place at key strategic locations. These include public facilities (i.e. docks) at New Brighton, Long Bay and Brigade Bay.

### Adjacent Recreational Opportunities

An infrequently used trail from Brigade Bay to Mt. Artaban is located at the southern section of the nature reserve as per Map 2 and 4. To access the trail, users must currently enter private property (at the trailhead) and travel through the nature reserve. Management of the Long Bay Wetlands Nature Reserve should anticipate an increased popularity with this route, as the neighbourhood develops and visitation to Gambier Island increases. Stakeholder comments indicated that they would like this trail retained as part of the formal trail network within the nature reserve. The location of the trailhead on private property has been identified as a management issue.

⇒ **Action Item 6:** Clearly articulate existing trails in all mapping and signage programs.

⇒ **Action Item 7:** Develop an alternative trailhead for Mt. Artaban trail that avoids trespass on private property.
Development of Trail System
Discussions have been initiated with the Sea Ranch community to create a loop trail to link the trails on the northern and southern portions of the reserve, around the wetland.

⇒ **Action Item 8**: In consultation with the Sea Ranch Strata Council, develop an interpretive trail system that takes advantage of existing trails and focuses on the educational and recreational opportunities of the Long Bay Wetland Nature Reserve.

4.3.2 Cultural Environment Issues

First Nations
The reserve lies within the traditional territory of the Squamish Nation. The traditional and current use of the first nation group is currently not known. Initial contact has been made with representatives of the Squamish Nation, and it is hoped that further dialogue will determine the extent of traditional use within the nature reserves. Further, the reserve areas will provide additional protection of riparian areas for First Nation traditional use as adjacent properties currently have covenants protecting the right of access altogether for First Nations. The riparian covenants associated with the adjacent development stipulate that the right of access by members of the Squamish Nation for the purposes related to continuation of current use of lands or resources for traditional purposes shall not be restricted. First Nation traditional use will be permitted within the reserve (Section 219, Land Titles Act Covenant).

⇒ **Action Item 9**: Include Squamish Nation in correspondence relating to the Long Bay Wetland Nature Reserve and continue to solicit input regarding the management of the site.

Recreation/Interpretation
Due to the wetland component and proximity to existing trails, the Long Bay Wetland Nature Reserve presents a number of recreational and interpretive opportunities that the Islands Trust Fund may wish to develop further. One of the seven critical functions provided by wetlands is interpretive / educational and recreational function (SCS, 1992).

⇒ **Action Item 10**: Construct and maintain a loop trail that provides nature viewing and wetland interpretive opportunities for visitors to the Long Bay Wetland Nature Reserve.

4.3.3 Physical Environment Issues

Safety Issues
Although the Long Bay Wetland Nature Reserve does not contain cliffs and hazard associated with falls, the land is rugged and there is open water. There may be liability associated with injury during visitation. Due to the presence of a trail system emergency egress from the site is less of a concern on the reserve.

⇒ **Action Item 11**: Address issues regarding liability and safety by integrating this information with the signage/interpretative program as appropriate.
Action Item 12: To mitigate liability and risk to public safety adequate signage should be installed at key access points to inform the public of safe practices (i.e., staying on designated trails) when entering the reserve.

Fire Management
Gambier Island does not have a formal fire department (volunteer or otherwise). Gambier does have a “Gambier Fire Protection Group” that was established for the purpose of acquiring and training in the use of fire suppression equipment. Members of the group contribute time or money for fire suppression equipment (Watson, May 2005). While it is recognized that wildfires are an integral part of the forest ecology, there may be risk to adjacent properties. No camp fires should be permitted within the Long Bay Wetland Nature Reserve.

Action Item 13: Develop a fire protection plan in consultation with the Gambier Fire Protection Group.

Action Item 14: Include permanent fire ban information within the signage program.

4.3.4 Terrestrial Environment Issues

Forest Development
As indicated earlier, a cornerstone object of the Islands Trust Board is “to let nature take its course” (Islands Trust Fund, 2002a). With this in mind, and recognizing that the site was selectively harvested, the stand is healthy and regenerating. Forest development will continue to proceed along its current successional path. Non-native grasses planted post harvesting for erosion control will yield to forest cover over time. The piles of slash left along the periphery of the wetland will be left to natural decomposition and for small mammal habitat. Efforts to remove the pile will likely result in excessive damage to the soils and vegetation. Any need for thinning or stand management efforts are not anticipated. In the interests of achieving natural conditions, as opposed to a working forest, no interceding management efforts are recommended at this time.

Invasive Plant Species
As the majority of the reserve area was disturbed by logging activities, there is the possibility of invasion by (non-native) plant species. Two species identified as high risk in this area are Himalayan blackberry (Rubus discolor) and Scotch broom (Cytisus scoparius). These species are highly opportunistic and lack any natural competition. As a result, once established these species out-compete natural vegetation and can dominate and upset the natural ecology of the landscape (http://www.ucfv.bc.ca/biology/Biol210/1999/Exotic/Exotic_plant.htm#blackberry http://www.ucfv.bc.ca/biology/Biol210/1999/Exotic/Exotic_plant.htm#broom).

Limiting access into the reserve from the general public to the designated trail system will discourage the transportation of invasive species into the area. However, the
transportation of seed material by birds and wildlife cannot be controlled. Removal of the invasive species by manual and biological methods is preferable to chemical methods.

⇒ **Action Item 15:** Inspect the reserve area on a regular basis (every 2 to 5 years) for the presence of invasive plants and remove as necessary using mechanical or biological means.

**Wildlife**

Generally, there are no wildlife issues identified with the site. However, it is understood that the reserve does and will continue to provide wildlife habitat as the forest regenerates to its successional status and integrates with the natural landscape. There is a significant deer population on Gambier Island and it is understood that hunting is allowed. As a nature reserve, hunting will not be permitted within the Long Bay Wetland Nature Reserve.

⇒ **Action Item 16:** Include “No Hunting” information in the signage program around the perimeter of the Long Bay Wetland Nature Reserve.

**Rare and Endangered Species**

Although potentially occurring, no rare or endangered plants or animals were encountered over the course of conducting inventories. No action is required at this time.

⇒ **Action Item 17:** Encourage students, academic institutions, and/or naturalist clubs to conduct rare or endangered species surveys within the reserve.

**4.3.5 Aquatic and Wetland Environment Issues**

Currently there is a limited trail network within the reserve area. There is a concern that without a formal marked trail system, pedestrian and pet traffic into the wetland areas could compromise the integrity of the ecosystem. The construction of boardwalk in wet areas and a formal trail system in dry areas will aid in the protection of the ecosystem.

⇒ **Action Item 18:** As detailed in Action Item 8, construct and maintain a loop trail that provides nature viewing and wetland interpretive opportunities for visitors to the Long Bay Wetland Nature Reserve while avoiding adverse environmental impacts. Utilize appropriate trail construction techniques in sensitive areas (i.e. boardwalks).

**4.3.6 Other Issues**

**Management Group**

A stewardship group should be designated for the onsite management of the Long Bay Wetland Nature Reserve. The responsibility of the stewardship group is to conduct regular site inspections and report any issues or problems to the ITF. In addition the stewardship group should insure that adequate signage is positioned in key areas.

⇒ **Action Item 19:** Solicit expressions of interest by individuals and/or existing non-profit stewardship groups for the management of the Long Bay Wetland Nature Reserve.
⇒ **Action Item 20**: Develop a set of operating guidelines and principles for the stewardship group.

⇒ **Action Item 21**: Explore with the local management / stewardship group the need for placing a conservation covenant on title.

### Monitoring Program

A number of monitoring sites were identified as part of this management planning exercise. The monitoring sites are delineated in Appendix 4, Map 6, with supporting photo documentation. The monitoring sites should be incorporated into a monitoring program to be conducted by the stewardship group. Further, additional monitoring locations may be determined over time as required.

⇒ **Action Item 22**: In consultation with the stewardship group, develop a viable monitoring program to measure ecosystem health within the Long Bay Wetland Nature Reserve. Key measurement tools should be quantitative in nature and should include photo point records, wildlife sightings, vegetation surveys, and water quality monitoring.

### Signage

As detailed above, directional, safety and interpretive signage is currently lacking for the Long Bay Wetland Nature Reserve. Directional and informational signage is needed at public access areas of Gambier Islands including the public wharfs/docks at New Brighton, Long Bay and Brigade Bay. Signage is required at key access points along the Brigade Bay subdivision access road to mark reserve area boundaries.

⇒ **Action Item 23**: Install signs at key points around the periphery of the property and at public staging areas. Refer to Action Items 1, 5, 6, 11, 12, 14 and 16 above for information to include within the signage program.

### Education

Several youth camps operate on Gambier Island. These include Camp Artaban, Camp Fircom and a Latona Beach Camp. The Brigade Bay Bluffs Nature Reserve provides opportunities for ecological learning. Working with the stewardship group, the youth groups could assist in the development of an interpretive program (in conjunction with the Long Bay Wetland Nature Reserve) and signage for educational use.

⇒ **Action Item 24**: Develop an interpretive program for education of youth and general public.

⇒ **Action Item 25**: Working with the youth camps and academic institutions exploit educational opportunities as afforded by the wetlands.
4.4 MANAGEMENT DIRECTIONS AND ACTION STRATEGIES

4.4.1 General Management Direction
The general management direction of the Long Bay Wetland Nature Reserve is to allow natural successional processes to continue with low impact recreational use permitted. With the exception of fire, natural disturbance factors due to wind (windthrow), pest infestation, disease and wildlife use should proceed without intervention. Only the removal of hazard trees around the trail system and invasive plant species are permitted. Further development of the trail system including the creation of a loop around the wetland could be permitted.

The Long Bay Wetland Nature Reserve provides opportunity for low-intensity recreation uses. Low impact observational use such as nature appreciation, wildlife viewing, bird watching and photography will be permitted within the reserve on a network of trails. Trails with interpretive signage should be constructed on existing trails, and along access roads.

4.4.2 Immediate Strategies
Immediate action strategies need to be completed within six months or as soon as possible.

Management / Stewardship Group

⇒ Action Item 19: Solicit expressions of interest by individuals and/or existing non-profit stewardship groups for the management of the Long Bay Wetland Nature Reserve.

⇒ Action Item 20: Develop a set of operating guidelines and principles for the stewardship group.

Restoration of Impacted Area

⇒ Action Item 3: Restore denuded area (borrow pit) adjacent to the road using native plant and seed stock.

4.4.3 Short Term Strategies (1-2 years)
Short term action strategies include initiatives that should be implemented during the first two years of management of the Long Bay Wetland Nature Reserve.

Monitoring Program

⇒ Action Item 22: In consultation with the stewardship group, develop a viable monitoring program to measure ecosystem health within the Long Bay Wetland Nature Reserve. Key measurement tools should be quantitative in nature and should include photo point records, wildlife sightings, and vegetation surveys.
Signage

⇒ **Action Item 1**: Develop a signage plan to clearly delineate Islands Trust Fund Property and to provide education information regarding preservation and environmental protection efforts.

⇒ **Action Item 5**: Develop mapping for integration with signage program and place at key strategic locations. These include public facilities (i.e. docks) at New Brighton, Long Bay and Brigade Bay.

⇒ **Action Item 6**: Clearly articulate existing trails in all mapping and signage programs.

⇒ **Action Item 11**: Address issues regarding liability and safety by integrating this information with the signage/interpretative program as appropriate.

⇒ **Action Item 12**: To mitigate liability and risk to public safety adequate signage should be installed at key access points to inform the public of safe practices (i.e. staying on designated trails) when entering the reserve.

⇒ **Action Item 14**: Include permanent fire ban information within the signage program.

⇒ **Action Item 16**: Include “No Hunting” information in the signage program around the perimeter of the Long Bay Wetland Nature Reserve.

⇒ **Action Item 23**: Install signs at key points around the periphery of the property and at public staging areas. Refer to Action Items 1, 5, 6, 11, 12, 14, and 16 above for information to include within the signage program.

Fire Protection Plan

⇒ **Action Item 13**: Develop a fire protection plan in consultation with the Gambier Fire Protection Group.

Consultation with Local Groups

⇒ **Action Item 24**: Develop an interpretive program for education of youth and general public.

⇒ **Action Item 2**: Develop a landowner contact program for new lot owners of the Brigade Bay Subdivision.

4.4.4 Medium Term Strategies (3-5 years)
Medium term management strategies include initiatives that should be completed within three to five years.
Consultation with First Nations

⇒ **Action Item 9**: Include Squamish Nation in correspondence relating to the Long Bay Wetland Nature Reserve and continue to solicit input regarding the management of the site.

Conservation Covenant

⇒ **Action Item 21**: Explore with the local management / stewardship group the need for placing a conservation covenant on title.

Development of Trail Network

⇒ **Action Item 7**: Develop an alternative trailhead for Mt. Artaban trail that avoids trespass on private property.

⇒ **Action Item 8**: In consultation with the Sea Ranch Strata Council, develop an interpretive trail system that takes advantage of existing trails and focuses on the educational and recreational opportunities of the Long Bay Wetland Nature Reserve.

⇒ **Action Item 10**: Construct and maintain a loop trail that provides nature viewing and wetland interpretive opportunities for visitors to the Long Bay Wetland Nature Reserve.

⇒ **Action Item 18**: As detailed in Action Item 8, construct and maintain a loop trail that provides nature viewing and wetland interpretive opportunities for visitors to the Long Bay Wetland Nature Reserve. Utilize appropriate trail construction techniques in sensitive areas (i.e. boardwalks).

Monitoring of Invasive Plant Species

⇒ **Action Item 15**: Inspect the reserve area on a regular basis (every 2 to 5 years) for the presence of invasive plants and remove as necessary using mechanical or biological means.

Rare and Endangered Species Surveys

⇒ **Action Item 17**: Encourage students, academic institutions, and/or naturalist clubs to conduct rare or endangered species surveys within the reserve.

**4.4.5 Long Term Strategies (6-10 years)**
Long term strategies include initiatives that should be implemented between six to ten years.
Expansion of Brigade Bay Bluffs Nature Reserve

⇒ **Action Item 4:** Investigate the potential of expanding the Long Bay Wetland Nature Reserve onto the Crown land to the south. With the Halkett Provincial Park in close proximity, it may be possible to acquire the intervening lands as nature reserve, thus creating a larger, more contiguous, ecological unit.

Education Programs

⇒ **Action Item 25:** Working with the youth camps and academic institutions exploit educational opportunities as afforded by the wetlands.

It should be noted that all action items described in this plan are restricted by annual budget amounts approved by Trust Council and the capacity of the management group.
5.0 CONCLUSION

The donation of the Brigade Bay Bluffs and Long Bay Wetland nature reserves by Coastland Wood Industries Ltd. and Mike Jenks in January 2005 facilitates the Islands Trust Fund’s long term goal of protecting at least 25% of the remaining Coastal Douglas-fir and Coast Western hemlock ecosystems in the Islands Trust Area (ITF, 2002b). According to the ITF, the two areas are significant for the following reasons (ITF, 2002a):

- Have a potential to contain rare or endangered plant and animal species
- Are found within the Coastal Western Hemlock biogeoclimatic zone
- Contain wildlife habitat and corridors
- Contain wetlands and streams (Long Bay Wetland)
- Provide watershed and groundwater recharge values (Long Bay Wetland)
- Contain inland cliffs (Brigade Bay Bluffs)

The management issues and actions described within this management plan provide long term guidance and direction for the protection of these significant characteristics within the Long Bay Wetland and Brigade Bay Bluffs nature reserves. In cooperation with local stewardship groups and individuals, the Islands Trust Fund can ensure that the nature reserves are maintained and enhanced so that these significant features are not compromised, providing a legacy for future generations.
6.0 REFERENCES


http://www.islandtrustfund.bc.ca/general/strategicplan.htm.


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APPENDIX 1: ADDITIONAL HISTORIC INFORMATION

The Sunshine Coast Conservation Association

Brigade Bay Nature Reserves Dedicated on Gambier Island
by Lois Kennedy

The lands around Brigade Bay were some of the most beautiful on Gambier Island: a protected bay with a large intertidal zone, rich in biodiversity and with a small fish-bearing stream emptying into it. Remnants of an old farm and orchard lent a special tranquility to the upland area. It was a popular destination for kayakers, campers, hikers and boaters alike.

Salmon spawning area at the mouth of Brigade Bay Creek.

Photo courtesy Gambier Island Streamkeepers

Although it is private property, the owners had always allowed this public recreational use of their lands. When the properties were sold, a palpable shudder ran through the whole community.

Despite a cautionary warning to the new owners from the neighboring Sea Ranch community at Long Bay, the large wetland which is the headwaters for the Long Bay stream was trashed by heavy logging machinery and left strewn with slash. Water running from the wetland into the stream turned brown. Silt covered prime spawning habitat, potentially suffocating eggs, alevins and fry. Logging and poor road building damaged seven streams emptying into Brigade Bay so badly that winter rains left the ocean muddy.

Two streams were barely recognizable. Rare coastal plants were destroyed by an illegal barge loading ramp. Gas and oil pooled in tire tracks just metres from the ocean. Our hearts were broken and we were outraged! So why bother to tell this story? After all, the planet is covered with much worse environmental holocausts than this one. But this story is also about the important role of local stewardship groups.
The Gambier Island Streamkeepers had been doing stream mapping and fish-habitat rehabilitation in this area for years. Together, the Sea Ranch community and I, as the Streamkeepers coordinator, lodged a complaint with Fisheries and Oceans Canada, documenting the destruction of fish habitat. This brought results! After several FOC site visits, a remediation plan crafted by a private environmental consultant became a condition for final subdivision approval.

Streamside areas were cleared of slash and replanted with thousands of healthy young trees. Streams that had been obliterated were reconstructed. Culverts and bridges were replaced properly. The wetland had thousands of cuttings and saplings planted to enhance its natural regeneration. Three years later, it is already looking beautiful again—a testimony to the resilience of nature. This wetland, almost 40 hectares in size, has now been donated by the owners as a nature reserve to the Islands Trust Fund. A management plan is in the works and a local stewardship group will be established to oversee the plan. No one will ever hurt this wetland again. My heart sings.

One of the most heartening consequences was the least expected. There were contractors on the site who were also dismayed by the environmental damage. One took me on a private tour of the entire property, revealing much more extensive damage than I had previously seen. Another contributed 30 hours of machine time to begin the rehabilitation of the wetland. More than five hectares of steep forested bluff have also been donated to the Islands Trust Fund as a nature reserve, and a large grassy area is being dedicated as a public recreation park, likely to be owned and managed by the Sunshine Coast Regional District. A portion of the upland foreshore area of the bay has been preserved for public use. Through road and trail designations, public access from Brigade Bay to Halkett Bay Provincial Marine Park, Long Bay, Mount Artaban, Lost Lake and Douglas Bay has been retained. The Brigade Bay subdivision is now a nexus in the island-wide network of trails being developed and maintained by the Gambier Island Conservancy.

In a perfect world this devastation would never have occurred. But even in our imperfect world, there are still success stories. This subdivision is a testament to the powers of local environmental knowledge, determined community advocacy and stewardship, and negotiation among all the stakeholders involved in land-use planning.
APPENDIX 2: BRIGADE BAY BLUFFS ADDITIONAL INFORMATION

Table 1: Vegetation Found within the Brigade Bay Bluffs Nature Reserve

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trees</strong></td>
<td></td>
</tr>
<tr>
<td>Red alder</td>
<td>Alnus rubra</td>
</tr>
<tr>
<td>Paper birch</td>
<td>Betula papyrifera</td>
</tr>
<tr>
<td>Bigleaf maple</td>
<td>Acer macrophyllum</td>
</tr>
<tr>
<td>Sitka spruce</td>
<td>Picea sitchensis</td>
</tr>
<tr>
<td>Western redcedar</td>
<td>Thuja plicata</td>
</tr>
<tr>
<td>Western hemlock</td>
<td>Tsuga heterophylla</td>
</tr>
<tr>
<td><strong>Forbs</strong></td>
<td></td>
</tr>
<tr>
<td>Common foxglove</td>
<td>Digitalis purpurea</td>
</tr>
<tr>
<td>Western fescue</td>
<td>Festuca occidentalis</td>
</tr>
<tr>
<td>Twinflower</td>
<td>Linnaea borealis</td>
</tr>
<tr>
<td><strong>Ferns and Horsetails</strong></td>
<td>Pteridium aquilinum</td>
</tr>
</tbody>
</table>

Table 2: Potential Rare and Endangered Plant Species, Brigade Bay Bluffs Nature Reserve

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Habitat Requirements</th>
<th>List Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrostis pallens</td>
<td>Dune bentgrass</td>
<td>Dry sand dunes, meadows, rock outcrops and rocky slopes in lowland zone</td>
<td>Blue</td>
</tr>
<tr>
<td>Cuscuta pentagona</td>
<td>Field fodder</td>
<td>Parasitic, especially on legumes in lowland zone</td>
<td>Blue</td>
</tr>
<tr>
<td>Senecio macounii</td>
<td>Macoun's groundsel</td>
<td>Dry open forests, disturbed area and rock outcrops or limestone quarries in lowland zone</td>
<td>Blue</td>
</tr>
<tr>
<td>Toxicodendron diversilobum</td>
<td>Poison oak</td>
<td>Dry to mesic rocky slopes in lowland zone</td>
<td>Blue</td>
</tr>
<tr>
<td>Claytonia rubra spp. depressa</td>
<td>Redstem springbeauty</td>
<td>Moist to dry sand dunes, meadows, open forests and rock outcrops in lowland, steppe and montane zones</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Source: BC Species and Ecosystems Explorer for the Sunshine Coast Forest District (MSRM and MWLAP, 2005)
### Table 3: Potential Rare and Endangered Wildlife Species, Brigade Bay Bluffs Nature Reserve

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Habitat Requirements</th>
<th>List Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patagioenas fasciata</td>
<td>Band-tailed pigeon</td>
<td>Coastal areas – coniferous forests</td>
<td>Blue</td>
</tr>
<tr>
<td>Pachydiplax longipennis</td>
<td>Blue dasher</td>
<td>n/a</td>
<td>Blue</td>
</tr>
<tr>
<td>Myotis keenii</td>
<td>Keen’s long-eared myotis</td>
<td>Apparently restricted to coastal coniferous forests</td>
<td>Red</td>
</tr>
<tr>
<td>Monadena fidelis</td>
<td>Pacific sideband</td>
<td>Deciduous, coniferous or mixed forests and open woods and grassy areas west of the Coast and Cascade mountains</td>
<td>Blue</td>
</tr>
<tr>
<td>Falco peregrinus anatum</td>
<td>Peregrine falcon</td>
<td>Cliff ledges overlooking wetlands, open areas</td>
<td>Red</td>
</tr>
<tr>
<td>Falco peregrinus pealei</td>
<td>Peregrine falcon</td>
<td>Cliff ledges overlooking wetlands, open areas on the coast</td>
<td>Blue</td>
</tr>
<tr>
<td>Progne subis</td>
<td>Purple martin</td>
<td>Open to partially open situations near water, around towns, crevices in rocks, tree cavities</td>
<td>Red</td>
</tr>
<tr>
<td>Corynorhinus townsendii</td>
<td>Townsend’s big-eared bat</td>
<td>Lowland areas in southern BC near caves or Cave-like structure</td>
<td>Blue</td>
</tr>
<tr>
<td>Megascops kennisctii kennisctii</td>
<td>Western screech-owl, kennisctii subspecies</td>
<td>Coniferous / mixed riparian areas in lowland zone</td>
<td>Blue</td>
</tr>
<tr>
<td>Colias occidentalis</td>
<td>Western sulphur</td>
<td>Ocean bluffs, forest openings, mountain slopes</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Source: BC Species and Ecosystems Explorer for the Sunshine Coast Forest District (MSRM and MWLAP, 2005)
### APPENDIX 3: LONG BAY WETLAND ADDITIONAL INFORMATION

Table 4: Vegetation Found within the Long Bay Wetland Nature Reserve

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trees</strong></td>
<td></td>
</tr>
<tr>
<td>Red alder</td>
<td>Alnus rubra</td>
</tr>
<tr>
<td>Paper birch</td>
<td>Betula papyrifera</td>
</tr>
<tr>
<td>Bigleaf maple</td>
<td>Acer macrophyllum</td>
</tr>
<tr>
<td>Pacific crabapple</td>
<td>Malus fusca</td>
</tr>
<tr>
<td>Sitka spruce</td>
<td>Picea sitchensis</td>
</tr>
<tr>
<td>Shore pine</td>
<td>Pinus contorta contorta</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>Pseudotsuga menziesii</td>
</tr>
<tr>
<td>Western redcedar</td>
<td>Thuja plicata</td>
</tr>
<tr>
<td>Western hemlock</td>
<td>Tsuga heterophylla</td>
</tr>
<tr>
<td><strong>Shrubs</strong></td>
<td></td>
</tr>
<tr>
<td>Saskatoon</td>
<td>Amelanchier alnifolia</td>
</tr>
<tr>
<td>Red-osier dogwood</td>
<td>Cornus stolonifera</td>
</tr>
<tr>
<td>Western teaberry</td>
<td>Gaultheria ovatfolia</td>
</tr>
<tr>
<td>Devils club</td>
<td>Oplopanax horridus</td>
</tr>
<tr>
<td>Falsebox</td>
<td>Pachistima myrsinites</td>
</tr>
<tr>
<td>Black gooseberry</td>
<td>Ribes lacustre</td>
</tr>
<tr>
<td>Salal</td>
<td>Gaultheria shallon</td>
</tr>
<tr>
<td>Thimbleberry</td>
<td>Rubus parviflorus</td>
</tr>
<tr>
<td>Ocean spray</td>
<td>Holodiscus discolor</td>
</tr>
<tr>
<td>Salmonberry</td>
<td>Rubus spectabilis</td>
</tr>
<tr>
<td>Red Elderberry</td>
<td>Sambucus racemosa</td>
</tr>
<tr>
<td>Black raspberry</td>
<td>Rubus lecdermis</td>
</tr>
<tr>
<td>Nootka Rose</td>
<td>Rosa nutkana</td>
</tr>
<tr>
<td>Pacific Ninebark</td>
<td>Physocarpus capitatus</td>
</tr>
<tr>
<td>Vine maple</td>
<td>Acer cirinatum</td>
</tr>
<tr>
<td>Sitka mountain ash</td>
<td>Sorbus sitchensis</td>
</tr>
<tr>
<td>Black huckleberry</td>
<td>Vaccinium membranaceum</td>
</tr>
<tr>
<td>Red huckleberry</td>
<td>Vaccinium parvifolium</td>
</tr>
<tr>
<td><strong>Forbs</strong></td>
<td></td>
</tr>
<tr>
<td>Common foxglove</td>
<td>Digitalis purpurea</td>
</tr>
<tr>
<td>Western fescue</td>
<td>Festuca occidentalis</td>
</tr>
<tr>
<td>Foamflower</td>
<td>Tiarella trifoliata</td>
</tr>
<tr>
<td>American vetch</td>
<td>Vicia Americana</td>
</tr>
<tr>
<td>Wall lettuce</td>
<td>Lactuca muralis</td>
</tr>
<tr>
<td>Sweet scented bedstraw</td>
<td>Galium triflorum</td>
</tr>
<tr>
<td>Twinflower</td>
<td>Linnaea borealis</td>
</tr>
<tr>
<td>Skunk cabbage</td>
<td>Lysichitum americanum</td>
</tr>
<tr>
<td>Sedges</td>
<td>Scirpus spp., Carex spp.</td>
</tr>
<tr>
<td>Clasping twistedstalk</td>
<td>Streptopus amplexifolius</td>
</tr>
<tr>
<td>Cattail</td>
<td>Typha latifolia</td>
</tr>
<tr>
<td><strong>Ferns and Horsetails</strong></td>
<td></td>
</tr>
<tr>
<td>Lady fern</td>
<td>Athyrium filix-femina</td>
</tr>
<tr>
<td>Common horsetail</td>
<td>Equisetum arvense</td>
</tr>
<tr>
<td>COMMON NAME</td>
<td>SCIENTIFIC NAME</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Deer fern</td>
<td>Blechnum spicant</td>
</tr>
<tr>
<td>Licorice fern</td>
<td>Polypodium glycyrrhiza</td>
</tr>
<tr>
<td>Oak fern</td>
<td>Gymnocarpium dryopteris</td>
</tr>
<tr>
<td>Maidenhair fern</td>
<td>Adiantum pedatum</td>
</tr>
<tr>
<td>Sword fern</td>
<td>Polystichum munitum</td>
</tr>
<tr>
<td>Bracken fern</td>
<td>Pteridium aquilinum</td>
</tr>
</tbody>
</table>

**Mosses and Lichens**

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cladina spp.</td>
<td></td>
</tr>
<tr>
<td>Flat moss</td>
<td>Plagiominum insignе</td>
</tr>
<tr>
<td>Step moss</td>
<td>Hlycoipium splendens</td>
</tr>
<tr>
<td>Red-stemmed feathermoss</td>
<td>Pleuroziunm schreberi</td>
</tr>
<tr>
<td>Grey frayed cat’s-tail moss</td>
<td>Rhacomidium canescens</td>
</tr>
</tbody>
</table>

**Table 5: Potential Rare and Endangered Plant Species, Long Bay Wetland Nature Reserve**

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>COMMON NAME</th>
<th>HABITAT REQUIREMENTS</th>
<th>LIST STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yabea microcarpa</td>
<td>California hedge-parsley</td>
<td>Moist vernal sites and stream banks in lowland zone</td>
<td>Red</td>
</tr>
<tr>
<td>Anagallis minima</td>
<td>Chaffweed</td>
<td>Moist to wet river banks, salt marshes, vernal pools and pond margins</td>
<td>Blue</td>
</tr>
<tr>
<td>Cuscuta pentagona</td>
<td>Field fodder</td>
<td>Parasitic, especially on legumes in lowland zone</td>
<td>Blue</td>
</tr>
<tr>
<td>Woodwardia fimbriata</td>
<td>Giant chain fern</td>
<td>Wet forests and seepy coastal cliffs in lowland zone</td>
<td>Blue</td>
</tr>
<tr>
<td>Carex feta</td>
<td>Green-sheathed sedge</td>
<td>Ditches, marshes and wet meadows in lowland and montane zones</td>
<td>Red</td>
</tr>
<tr>
<td>Heterocodon rariforum</td>
<td>Heterocodon</td>
<td>Moist seepage areas in lowland and montane zones</td>
<td>Blue</td>
</tr>
<tr>
<td>Botrychium simplex</td>
<td>Least moonwort</td>
<td>Moist to wet vernal pools and ephemeral seepages in lowland and montane zones</td>
<td>Blue</td>
</tr>
<tr>
<td>Sanguisorba menziesii</td>
<td>Menzies' burnet</td>
<td>Fens, bogs, marshes and wet meadows in lowland and montane zones</td>
<td>Blue</td>
</tr>
<tr>
<td>Ophioglossum pusillum</td>
<td>Northern adder's-tongue</td>
<td>Periodically flooded meadows, vernal pools and lake margins in lowland and montane zones</td>
<td>Blue</td>
</tr>
<tr>
<td>Isoetes nuttallii</td>
<td>Nuttall's quillwort</td>
<td>Vernal pools and ephemeral winter seepage areas in lowland zone</td>
<td>Blue</td>
</tr>
<tr>
<td>Carex scoparia</td>
<td>Pointed broom sedge</td>
<td>Moist to wet ditches, lakeshores, marshes and meadows in lowland and montane zones</td>
<td>Blue</td>
</tr>
<tr>
<td>Allium amplexens</td>
<td>Slimleaf onion</td>
<td>Vernally moist rocky bluffs and meadows in lowland zone</td>
<td>Blue</td>
</tr>
<tr>
<td>Sagina decumbens spp. occidentalis</td>
<td>Western pearlwort</td>
<td>Moist to mesic vernal pool margins, forest openings and open slopes in lowland zone</td>
<td>Blue</td>
</tr>
<tr>
<td>Hypericum scouleri spp. nortoniae</td>
<td>Western St. John's-wort</td>
<td>Moist to wet stream sides, estuaries, marshes, and open slopes in all zones except steppe and alpine</td>
<td>Blue</td>
</tr>
<tr>
<td>Malaxis brachypoda</td>
<td>White adder’s-mouth orchid</td>
<td>Moist forests, mudflats, fens and streambanks in lowland and montane zone</td>
<td>Blue</td>
</tr>
<tr>
<td>SCIENTIFIC NAME</td>
<td>COMMON NAME</td>
<td>HABITAT REQUIREMENTS</td>
<td>LIST STATUS</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Nothochelone nemorosa</td>
<td>Woodland penstemon</td>
<td>Moist forests and rocky slopes in lowland and montane zones</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Source: BC Species and Ecosystems Explorer for the Sunshine Coast Forest District (MSRM and MWLAP, 2005)

Table 6: Potential Rare and Endangered Wildlife Species, Long Bay Wetland Nature Reserve

<table>
<thead>
<tr>
<th>SCIENTIFIC NAME</th>
<th>COMMON NAME</th>
<th>HABITAT REQUIREMENTS</th>
<th>LIST STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patagioenas fasciata</td>
<td>Band-tailed pigeon</td>
<td>Coastal areas – coniferous forests</td>
<td>Blue</td>
</tr>
<tr>
<td>Tanypteryx hageni</td>
<td>Black petaltail</td>
<td>Seepage areas and bogs, streams</td>
<td>Blue</td>
</tr>
<tr>
<td>Pachydiplax longipennis</td>
<td>Blue dasher</td>
<td>n/a</td>
<td>Blue</td>
</tr>
<tr>
<td>Branta Canadensis occidentalis</td>
<td>Canada Goose, occidentalis spp.</td>
<td>Breeds in freshwater marsh with tall vegetation cover</td>
<td>Blue</td>
</tr>
<tr>
<td>Euphyes vestries</td>
<td>Dun Skipper</td>
<td>Moist meadows, fields, right of ways</td>
<td>Blue</td>
</tr>
<tr>
<td>Ardea herodias fannini</td>
<td>Gleet blue heron</td>
<td>Forested locations in proximity to wetland feeding areas</td>
<td>Blue</td>
</tr>
<tr>
<td>Butorides virescens</td>
<td>Green heron</td>
<td>Sheltered thickets of ponds, sloughs, lakes, marshy areas, slow-moving rivers</td>
<td>Blue</td>
</tr>
<tr>
<td>Myotis keenii</td>
<td>Keen’s long-eared myotis</td>
<td>Apparently restricted to coastal coniferous forests</td>
<td>Red</td>
</tr>
<tr>
<td>Monadenia fidelis</td>
<td>Pacific sideband</td>
<td>Deciduous, coniferous or mixed forests and open woods and grassy areas west of the Coast and Cascade mountains</td>
<td>Blue</td>
</tr>
<tr>
<td>Chrysemys picta</td>
<td>Painted turtle</td>
<td>Slow moving, shallow water, streams, marshes, ponds</td>
<td>Blue</td>
</tr>
<tr>
<td>Rana aurora</td>
<td>Red-legged frog</td>
<td>Wetland areas and ponds</td>
<td>Blue</td>
</tr>
<tr>
<td>Megascops kennicottii kennicottii</td>
<td>Western screech-owl, kennicottii superspecies</td>
<td>Coniferous / mixed riparian areas in lowland zone</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Source: BC Species and Ecosystems Explorer for the Sunshine Coast Forest District (MSRM and MWLAP, 2005)
APPENDIX 4: PHOTO LOG OF KEY MONITORING LOCATIONS

Map 5 Photo Log and Locations: Brigade Bay Bluffs Nature Reserve

Photo 1: SE Property Pin, UTM 0475530/5482230

Photo 2: NE Property Pin, UTM 0475541/5482279

Photo 3: Corner Pin, view E, UTM 0475507/5982296

Photo 4: Corner Pin, view S, UTM 0475507/5982296
Management Plan
Brigade Bay Bluffs and Long Bay Wetland Nature Reserves

Photo 5: Corner Pin view W, UTM 0475507/5982296

Photo 6: Corner Pin view N, UTM 0475507/5982296

Photo 7: View of Bluffs through Park, UTM 0475717/5482394
Map 6: Photo Log and Locations: Long Bay Wetland Nature Reserve

Photo 1: NE Property Pin, View SW, UTM 0475488/5481924

Photo 2: Road bisecting wetland, UTM 047555/5481841

Photo 3: Iron pin, View W on road, UTM 0475400/5481639

Photo 4: Iron pin, View N upslope, UTM 0475400/5481639
Management Plan
Brigade Bay Bluffs and Long Bay Wetland Nature Reserves

Photo 5: Western boundary, Group Walk, UTM 0475370/5481623

Photo 6: Western boundary, View S, UTM 0475370/5481623

Photo 7: Western Boundary, View E, UTM0475371/5481428

Photo 8: Creek at Western Boundary, View W, UTM 0475385/5461201
Management Plan
Brigade Bay Bluffs and Long Bay Wetland Nature Reserves

Photo 9: SW Property Pin, View ENE, UTM 0475366/5480887

Photo 10: Trail, View WSW, UTM 0475504/5480981

Photo 11: View SSE from Trail, UTM 0475504/5480981

Photo 12: Trail, View ENE, UTM 0475504/5480981
Management Plan
Brigade Bay Bluffs and Long Bay Wetland Nature Reserves
Management Plan
Brigade Bay Bluffs and Long Bay Wetland Nature Reserves

Photo 17: Eastern Property Boundary, View N, UTM
0475673/5481413

Photo 18: Eastern Property Boundary, View W, UTM
0475673/5481413

Photo 19: Eastern Property Boundary, View NE, UTM
0475651/5481436

Photo 20: Eastern Property Boundary, View S, UTM
0475640/5481505
Photo 21: Eastern Property Boundary, View N, UTM 0475640/5481505

Photo 22: Eastern Property Boundary, View W, UTM 0475640/5481505

Photo 23: South-eastern Property Boundary, View NW, UTM 0476039/5481071
Photo 24: South-eastern Property Boundary, View NW, UTM 0476156/5480883

Photo 25: South-eastern Property Boundary, View W, UTM 0476156/5480883
## APPENDIX 5: LIST OF STAKEHOLDERS

### Participants at Open House:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION</th>
<th>CONTACT INFO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kim Benson</td>
<td>Islands Trust</td>
<td></td>
</tr>
<tr>
<td>Barb Buxton</td>
<td>Camp Artaban / Brigade Bay</td>
<td><a href="mailto:buxtoncb@dccnet.com">buxtoncb@dccnet.com</a></td>
</tr>
<tr>
<td>Peter Scholefield</td>
<td>Gambier Island Conservancy</td>
<td><a href="mailto:hpscholefield@telus.net">hpscholefield@telus.net</a></td>
</tr>
<tr>
<td>Michele Hall-McCaffrey</td>
<td>Gambier Island Sea Ranch</td>
<td><a href="mailto:hall-mccaffrey@wilcoxgroup.com">hall-mccaffrey@wilcoxgroup.com</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="mailto:council@qisr.org">council@qisr.org</a></td>
</tr>
<tr>
<td>Helen Davies</td>
<td>Owner at New Brighton</td>
<td></td>
</tr>
<tr>
<td>Neville Grey</td>
<td>Owner at New Brighton</td>
<td></td>
</tr>
<tr>
<td>Lois Kennedy</td>
<td>Gambier Island Conservancy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Islands Trust APC</td>
<td><a href="mailto:loiskennedy@onelink.ca">loiskennedy@onelink.ca</a></td>
</tr>
<tr>
<td>Peter Hassan</td>
<td>Brigade Bay Owner</td>
<td><a href="mailto:pETER@MASTERPLANPRODUCTIONS.COM">pETER@MASTERPLANPRODUCTIONS.COM</a></td>
</tr>
</tbody>
</table>

### Other Contacts:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION</th>
<th>CONTACT INFO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jim Green</td>
<td>Brigade Bay Subdivision</td>
<td></td>
</tr>
<tr>
<td>Daniel Bouman</td>
<td>Sunshine Coast Conservancy</td>
<td><a href="mailto:daniel_bouman@hotmail.com">daniel_bouman@hotmail.com</a></td>
</tr>
<tr>
<td>Kathy McTaggart</td>
<td>SCRD</td>
<td><a href="mailto:k_mctaggart@sunshine.net">k_mctaggart@sunshine.net</a></td>
</tr>
<tr>
<td>Donald Rose</td>
<td>Sea Ranch Strata Council</td>
<td><a href="mailto:donald.rose@aon.ca">donald.rose@aon.ca</a></td>
</tr>
<tr>
<td>Scott Kennedy</td>
<td>Sea Ranch Strata Council</td>
<td><a href="mailto:sKEnnedy@cornerarch.com">sKEnnedy@cornerarch.com</a></td>
</tr>
<tr>
<td>Rick Rees</td>
<td>Sea Ranch Strata Council</td>
<td><a href="mailto:rick-diana@shaw.ca">rick-diana@shaw.ca</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="mailto:council@qisr.org">council@qisr.org</a></td>
</tr>
<tr>
<td>Wendy Harry, Chief</td>
<td>Squamish Nation Council</td>
<td><a href="mailto:wendy_harry@squamish.net">wendy_harry@squamish.net</a></td>
</tr>
<tr>
<td>Gibby Jacobs, Randall</td>
<td></td>
<td>604-892-5166</td>
</tr>
<tr>
<td>Lewis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rick Gustavson</td>
<td>Brigade Bay Realtor</td>
<td><a href="mailto:rick@rickgustavson.com">rick@rickgustavson.com</a></td>
</tr>
<tr>
<td>Joyce Clegg</td>
<td>Gambier Island Community</td>
<td>604-886-2763</td>
</tr>
<tr>
<td></td>
<td>Association</td>
<td></td>
</tr>
<tr>
<td>Stuart Watson</td>
<td>Gambier Fire Protection Group</td>
<td>604-886-7901</td>
</tr>
</tbody>
</table>
APPENDIX 7: 2001 INITIAL ENVIRONMENTAL ASSESSMENT FOR THE BRIGADE BAY SUBDIVISION