

**Management Plan for
Singing Woods Nature Reserve,
Bowen Island, BC**

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Approved by the Trust Fund Board
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EXECUTIVE SUMMARY

Islands Trust Fund (ITF) recently acquired 9 hectares of forested land on Bowen Island, for the purpose of establishing a nature reserve. ITF has a mandate to develop management plans for all properties it acquires, and Pottinger Gaherty Environmental Consultants Ltd. (PGL) was retained in May 2000 to provide an overview site inventory, conduct an interest group and public consultation meeting, and develop the management plan for this property.

The principal objectives of this plan are to:

- Provide an overview inventory of environmental attributes of the property.
- Identify management issues.
- Make recommendations for management strategies and actions.

The overview inventory was compiled from existing data sources and field visits. The salient findings of the inventory are:

- The site is part of the headwaters for two creeks flowing into separate drainages: Davies Creek to the east and Dorothy Creek (tributary to Terminal Creek) to the west.
- High fisheries values are present on and adjacent to the site, including valuable habitat for resident cutthroat trout.
- High wildlife values are present on and adjacent to the site, including staging areas for migratory waterfowl and habitat for a number of other species, including large and small mammals, invertebrates, reptiles, amphibians, songbirds, and raptors.
- Several BC Conservation Data Centre (CDC) Rare Element Occurrences have been documented in the vicinity of the site.

The Plan recommendations address management issues and strategies including:

- Interest group involvement.
- Unacceptable use.
- Development of a fire management plan.
- Implementation of a monitoring program.
- Stabilization of erosion on the former logging road.
- Adjustment of the proposed trail location.
- Hazard tree removal.
- Boundary marking maintenance.
- Removal of non-indigenous vegetation.

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1.0 Introduction

“The objective of the Islands Trust is to preserve and protect the Trust area and its unique amenities and environment for the benefit of the Trust area and of British Columbia generally, in co-operation with municipalities, regional districts, improvement districts, other persons and organizations and the government of British Columbia.” The Islands Trust Fund (ITF) assists in implementing this objective by establishing nature reserves and nature sanctuaries and by working with interested landowners to protect special features and values on their lands through voluntary conservation initiatives.

The ITF has recently acquired 9 hectares of forested land on Bowen Island, for the purpose of establishing it as a nature reserve. Pottinger Gaherty Environmental Consultants Ltd. (PGL) was retained in May 2000 to provide an overview site inventory, conduct an interest group and public consultation meeting, and develop a management plan for the property. An ITF management plan provides long-term direction and guidance for the management of values and features of significance on properties owned by the ITF. The management plan includes a biophysical description of the property, an overview of present land use and zoning, identification of management issues, and recommendation of management strategies.

1.1 Purpose

The purpose of this plan is to:

- Provide a summary of environmental attributes of the site.
- Identify management issues.
- Make recommendations for management strategies and actions to address management issues.

1.2 Methods

Information gathered for this report was derived from three sources:

- Site visits.
- A review of relevant scientific and government publications and databases.
- Interest group and public consultation meetings.

PGL staff with expertise in vegetation ecology, fish and wildlife biology, soil science, and environmental planning conducted two site visits in June 2000.

2.0 Background

The nature reserve consists of approximately 9 hectares of forested land at the end and south of Cates Hill Road (Figure 4). The property was donated to ITF in December 1999, by island resident and developer Wolfgang Duntz, for conservation purposes.

The environmentally sensitive property is in the headwater area for two creeks on Bowen Island: Davies Creek flowing east and Dorothy Creek (tributary to Terminal Creek) flowing west. The property, together with adjacent areas, including parks, properties with conservation covenants, and Crown land, comprises an important wildlife corridor.

This is one of two parcels identified through the Cates Hill subdivision process as being important for environmental protection. The second parcel, located east of the adjacent Crown land, was donated to the Greater Vancouver Regional District to be managed by the Bowen Island Parks and Recreation Commission as a nature park.

The ITF has adopted Headwaters Nature Reserve (HNR) as the name for the site.

2.1 Overall Objectives

The objective of the management plan is to provide overall direction that will protect the natural state of the property. The objectives for management of the HNR include:

- Allowing natural ecological processes to function without human interference, except in the case of wildfire.
- Ensuring that permitted uses will not significantly impair the natural condition of the site or impact on special features or resources.
- Allowing, but not promoting, minimal impact use of the reserve in appropriate areas for hiking and nature observation.

2.2 Legal Description

The legal description of the subject property is: Lot 3, Plan 2230, District Lot 1347, New Westminster Group 1 Land District, Except part in LMP7833 & LMP 10622. PID – 010-931-422.

2.3 Site History

The forested property has a history of logging and fires. Most recently (approximately 1985) a 3 hectare portion along the southern boundary of the property was logged (Ecotype F, Figure 4). Historical aerial photography indicates that the lower flat portion of the property (Ecotype A and portions of Ecotype B) was logged during the 1960s. Ecotype E and portions of Ecotypes C and D were most likely logged in the early 1900s.

Wildfire and/or fire associated with logging practices have occurred in Ecotypes C, D, E, and F. Portions of these areas have had repeated fires. A major fire occurred on portions of the HNR and the adjacent ecological reserve in about 1920. There is evidence of fire pre- and post-logging for portions of the area.

2.4 Regional and Local Context

HNR is situated within the east central portion of Bowen Island, with Grafton Lake to the west, Snug Cove to the east and the Provincial Ecological Reserve #48 immediately adjacent and to the south (Figure 1). The property is a unique and important site for nature conservation both regional and locally because it is:

- Part of headwater areas for two creeks flowing into separate drainages: Davies Creek to the east and Dorothy Creek (tributary to Terminal Creek) to the west.
- Providing a significant contribution to the preservation of a unique wildlife corridor extending from Crippen Park to Josephine Lake.
- A vital buffer between Ecological Reserve #48 and a residential area.

HNR is bounded by Ecological Reserve #48 along the southern boundary, Cates Hill Road, Minnows Lane, community water supply comprehensive – 1 zoned land, and rural zoned land on the northern and western boundaries, and Crown land along the eastern boundary (Figure 2). The nature reserve

was created through the development process for the Cates Hill Subdivision, which will be built north of the property.

Ecological Reserve #48 encompasses 397 hectares of second growth, Douglas fir dominated forest land. The purpose of the reserve is preservation of dry subzone forest ecosystems in the Coastal Western Hemlock Zone at a location convenient for research. The combination of Reserve #48 and the HNR provides a larger contiguous, undeveloped area.

In conjunction with the adjacent undeveloped Crown land, the Parks and Recreation Commission Nature Park and Crippen Park, this affords a unique opportunity to preserve an important wildlife corridor and provide trail access along adjacent properties. Some landowners have already placed conservation covenants on their properties, while others have shown an interest in placing conservation covenants on portions of their properties. This contribution has increased the total land base being conserved. Local interest groups are also investigating the possibilities of placing a conservation covenant on the adjacent Crown land. ITF may be interested in acquiring the adjacent vacant Crown land parcel for conservation purposes.

The Official Community Plan (OCP) designations on HNR include Rural and Rural Residential. It is the policy of ITF to request a change to the designation and zoning at the next time the OCP and/or Land Use Bylaw are being amended.

Bowen Island Municipality holds a statutory right of way for trail purposes across the north portion of the property (Figure 6). A trail may be developed and managed, within the right of way, by the Bowen Island Parks and Recreation Commission.

This local context of surrounding natural lands with varying amounts of protection makes the HNR an integral component of a much larger natural area.

3.0 Overview Environmental Inventory

The environmental inventory includes an overview summary of geology and physiography, soils, watercourses, and biological resources.

3.1 Geology and Physiography

The geology and physiography of the area is relatively simple. The area is underlain by pre-Jurassic meta-volcanics of the Bowen Island Group (Roddick, 1965). A variably thick mantle of moraine and localized colluvial deposits (slope deposits) cover the bedrock over most of the nature reserve. Site topography consists predominantly of a north to northwest facing slope having an average slope of approximately 60%. Along the northern boundary, a 20m to 100m wide strip is nearly level to undulating in the low-lying areas. The site elevation ranges from approximately 150m to approximately 300m. The majority of the site is covered with glacial and colluvial deposits with some exposed bedrock, while the areas adjacent to the streams and pond are covered with alluvial and glacio-marine deposits.

3.2 Soils

The soils of HNR are the result of complex events and processes that have occurred throughout geologic time. However, recent periods of glacial and interglacial erosion and deposition have given the region much of its distinctive character. Unconsolidated surficial materials of relatively recent age occupy the majority of the area. Surface material depths range from over 100cm to 10cm with areas of exposed bedrock. These sediments and soils were primarily deposited by glacial and colluvial processes during the last 10,000 years.

The three main soil types in the area are Cannel, Kenworthy, and Murrayville (Luttmerding, 1980). In terms of drainage, the Cannel and Kenworthy soils are classified as well to rapid draining with the Murrayville soil being imperfectly drained, with a perched water table. The Cannel and Kenworthy soils make up 90% of the total area situated on the north-facing slope. The Murrayville soil occupies 10% of the total area on lower slopes and flat areas. A description of the three soil types is shown in Table 1.

Table 1 – Soil Types and Descriptions for Headwaters Nature Reserve

Soil Name	Symbol	Soil Material ¹	Drainage	Soil Classification
Cannell	CE	10cm to 100cm of moderately coarse – textured, glacial till or colluvium over bedrock.	Well to rapid	Duric Humo-Ferric Podzol
Kenworthy	KW	Moderately coarse – textured colluvium.	Well	Orthic Humo-Ferric Podzol
Murrayville	MY	20cm – 100cm of moderately coarse to medium-textured littoral deposits over fine-textured marine deposits.	Imperfect; perched water table	Gleyed Ferro-Humic Podzol

¹ Fine texture = clays; Moderately fine = silty clay loams to sandy clay loams; Medium = silts to loam; Moderately coarse = sandy loams; Coarse = sands.

3.3 Watercourses

The HNR is characterized by a diversity of watercourses. The nature reserve is part of the headwaters area for two creeks flowing into separate drainages: Davies Creek to the east and Dorothy Creek (tributary to Terminal Creek) to the west. There are two ponds located in the area, one of which lies within the HNR, connected by Minnow's Creek. Additionally, a number of small ephemeral streams traverse the north-facing slope.

3.4 Biological Resources

The biological resources of the reserve are described under the headings of vegetation communities, wildlife and wildlife habitat, and fish and fish habitat.

3.4.1 Vegetation Communities

The site lies within the Dry Maritime Coastal Western Hemlock (CWHdm) biogeoclimatic subzone. The CWHdm occurs at low elevations on the mainland and immediately adjacent islands. It extends from Hardwicke Island in the north to the Chilliwack River in the southeast. The CWHdm has warm, relatively dry summers and winters are typically mild, with significant precipitation with little snowfall (Green and Klinka, 1994).

Historically, most of the property has been disturbed by logging and/or fire. The vegetation community on the site is dominated by second growth Douglas fir (*Pseudotsuga menziesii*), western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), bigleaf maple (*Acer macrophyllum*), and red alder (*Alnus rubra*). Occasional old-growth veteran Douglas fir trees are also present. Bigleaf maple and red alder occur in disturbed areas and adjacent to watercourses. Major understorey species include sword fern (*Polystichum munitum*), salal (*Gaultheria shallon*), dull Oregon grape (*Mahonia nervosa*), red huckleberry (*Vaccinium parvifolium*), and step moss (*Hylocomium splendens*).

3.4.1.1 Vegetation Types

Six major vegetation types were delineated (Figure 4):

- Pole – sapling.
- Mixed forest – skunk cabbage, swamp, marsh.
- Mixed forest – sword fern.
- Douglas fir – sword fern (flat moss).
- Douglas fir – flat moss.
- Clear-cut – shrub/herb.

The six vegetation types are detailed below along with expected successional changes. Please refer to Appendix 1 for the relevant pages of Green and Klinka (1994) for a detailed discussion of the CWHdm subzone and its site series. Site series refers to the plant community associated with a particular combination of soil moisture and soil nutrition.

Vegetation Type	A. Pole – Sapling
Dominant Tree Species	Western hemlock (<i>Tsuga heterophylla</i>), western redcedar (<i>Thuja plicata</i>), and red alder (<i>Alnus rubra</i>)
Age & Height Range	Uneven-aged, 20 – 40 years old, 10m – 20m.
Slope & Aspect	Flat to undulating.
Site Series	06(60%), 12(30%), 01(10%)
Understorey Species	Minimal understorey. Salal (<i>Gaultheria shallon</i>), red huckleberry (<i>Vaccinium parvifolium</i>), salmonberry (<i>Rubus spectabilis</i>), skunk cabbage (<i>Lysichitum americanum</i>).
Disturbance Regime	This type was regenerated after clear-cut logging.
Successional Changes	Competition will continue to cause mortality of the smaller and more suppressed trees, leading to a lower density of larger diameter trees. Some trees will eventually grow to very large sizes.

Vegetation Type	B. Mixed Forest – Skunk Cabbage, Swamp, Marsh
Dominant Tree Species	Western hemlock (<i>Tsuga heterophylla</i>), western redcedar (<i>Thuja plicata</i>), red alder (<i>Alnus rubra</i>), and bigleaf maple (<i>Acer macrophyllum</i>)
Slope & Aspect	Flat to undulating.
Age & Height range	Uneven-aged, 40 – 60 years, 20m – 30m.
Understorey Species	Sword fern (<i>Polystichum munitum</i>), salmonberry (<i>Rubus spectabilis</i>), skunk cabbage (<i>Lysichitum americanum</i>).
Site Series	12(50%), 05(30%), 07(20%)
Disturbance regime	This type was regenerated after clear-cut logging.
Expected changes	Competition will continue to cause mortality of the smaller and more suppressed trees, leading to a lower density of larger diameter trees. Some trees will eventually grow to very large sizes. Western redcedar and western hemlock will eventually comprise the majority of the stand.

Vegetation Type	C. Mixed Forest – Sword Fern
Dominant Tree Species	Western redcedar (<i>Thuja plicata</i>), western hemlock (<i>Tsuga heterophylla</i>), red alder (<i>Alnus rubra</i>), bigleaf maple (<i>Acer macrophyllum</i>), and Douglas fir (<i>Pseudotsuga menziesii</i>).
Slope & Aspect	70-75%, 340°
Age & Height range	Uneven-aged, with gaps, 50 – 80 years, up to 40m. A few old-growth Douglas fir veterans (Figure 4).
Understorey Species	Sword fern (<i>Polystichum munitum</i>), salal (<i>Gaultheria shallon</i>), dull Oregon grape (<i>Mahonia nervosa</i>), step moss (<i>Hylocomium splendens</i>), red huckleberry (<i>Vaccinium parvifolium</i>).
Site Series	05, 03(10%)
Disturbance regime	This type has been selectively logged and has a history of fire.
Expected changes	The deciduous component will eventually be replaced with western redcedar and western hemlock. Douglas fir will remain a secondary species.

Vegetation Type	D. Douglas fir – Sword Fern
Dominant Tree Species	Douglas fir (<i>Pseudotsuga menziesii</i>), western redcedar (<i>Thuja plicata</i>), western hemlock (<i>Tsuga heterophylla</i>), with a minor component of red alder (<i>Alnus rubra</i>) and bigleaf maple (<i>Acer macrophyllum</i>).
Age & Height range	Even-aged, 90 – 120 years, up to 40m.
Understorey Species	Sword fern (<i>Polystichum munitum</i>), salal (<i>Gaultheria shallon</i>), dull Oregon grape (<i>Mahonia nervosa</i>), step moss (<i>Hylocomium splendens</i>), red huckleberry (<i>Vaccinium parvifolium</i>).
Site Types	05, 01(20%), 03(10%)
Disturbance regime	This type has been logged and has a history of fire.
Expected changes	Douglas fir will continue to dominate the stand. Western redcedar and western hemlock will become a larger component of the stand.

Vegetation Type	E. Douglas fir – Flat Moss
Dominant Tree Species	Douglas fir (<i>Pseudotsuga menziesii</i>), western hemlock (<i>Tsuga heterophylla</i>), with a minor component of western redcedar (<i>Thuja plicata</i>).
Age & Height range	Even-aged, 60 to 80 years, up to 35m.
Understorey Species	Salal (<i>Gaultheria shallon</i>), red huckleberry (<i>Vaccinium parvifolium</i>), step moss (<i>Hylocomium splendens</i>), and sword fern (<i>Polystichum munitum</i>)
Site Types	01(50%), 05(40%), 03(10%)
Disturbance regime	This type has been clear-cut logged and has a history of fire.
Expected changes	Douglas fir will continue to dominate the stand. Western hemlock will become a larger component of the stand.

Vegetation Type	F. Clear-cut – Shrub/Herb
Dominant Trees Species	Western hemlock (<i>Tsuga heterophylla</i>), western redcedar (<i>Thuja plicata</i>), Douglas fir (<i>Pseudotsuga menziesii</i>).
Age & Height range	Uneven-aged stand, up to 30 years, up to 5m.
Understorey Species	Salal (<i>Gaultheria shallon</i>), red huckleberry (<i>Vaccinium parvifolium</i>), sword fern (<i>Polystichum munitum</i>), step moss (<i>Hylocomium splendens</i>).
Site Series	05, 01, 03
Disturbance Regime	Clear-cut approximately 15 years ago.
Expected changes	Some advanced regeneration of western hemlock and western redcedar exist. Regeneration is patchy with a prominent shrub layer. Eventually a stand of western cedar, western hemlock, and Douglas fir will occupy the site. Crown closure may not be reached for 30 years.

3.4.1.2 Wetlands

Two dominant wetland communities (marsh and swamp) have been identified at HNR (Galinsky, 2000). These are located in vegetation type B (Figure 4).

Table 2 – Wetland Plant Communities Identified at HNR

Wetland Class	Wetland Form	Wetland Type
marsh	terminal basin marsh	tall rush
swamp	flat swamp	coniferous treed

Generally, the vegetation in the marsh is dominated by small flowering bulrush (*Scirpus microcarpus*) with lesser amounts of Pacific water parsley (*Oenthe sarmentosa*), cattail (*Typha latifolia*), American brooklime (*Veronica beccabunga spp. americana*), skunk cabbage (*Lysichitum americanum*), common horsetail (*Equisetum arvense*), bluejoint grass (*Calamagrostis canadensis*), and false lily-of-the-valley (*Mianthemum dilatatum*).

Coniferous forested swamp is interspersed throughout vegetation type B and surrounds the marsh. The swamp is dominated by western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and red alder (*Alnus rubra*). The understory vegetation is dominated by skunk cabbage (*Lysichitum americanum*).

3.4.1.3 CDC Rare Element (Plant) Occurrences

Rare and endangered species in British Columbia are designated as either red- or blue-listed. Red includes any indigenous species or subspecies considered to be extirpated, endangered, or threatened in BC and blue includes any indigenous species or subspecies considered to be vulnerable in BC.

No red or blue listed plant species were noted during the site visits. This should not be considered conclusive, based on two brief visits, and further inventory may be conducted over time. The following blue-listed plant species, though not observed on the nature reserve, do occur elsewhere on Bowen Island:

- Winged Water – Starwort (*Callitriche marginata*).
- Beaked Spike – Rush (*Eleocharis rostellata*).
- Bitter Cherry (*Prunus emarginata*) (Record Tree).

3.4.2 Wildlife and Wildlife Habitat

Portions of the reserve are considered to have high wildlife values, including:

- Habitat for a number of migratory and non-migratory birds and a variety of mammals.
- Significantly increased biodiversity in selected areas of the reserve as a result of the “edge effect” (watercourse/marsh/ swamp/forest).
- Provision of connectivity between a variety of habitat types (forest/marsh/aquatic).
- Provision of a local scale wildlife movement corridor from Crippen Park to Josephine Lake.

3.4.2.1 Wildlife Features

The following wildlife features were observed throughout the reserve:

- Wildlife trees including significant standing snags, veteran Douglas fir trees, and trees with broken tops.
- Snags with evidence of pileated woodpecker activity (generally found only in old-growth forests).
- Evidence of mule (black-tailed) deer (droppings, trails, and browsing).
- Potential raptor nest trees (old-growth Douglas fir trees).
- Good quality barred owl habitat, especially in wetland areas.

3.4.2.2 Birds

The variety of habitats within the reserve attracts a large number of bird species. Veteran Douglas fir, Douglas fir, bigleaf maple, and red alder provide nesting opportunities for cavity-nesting bird species. A list of birds identified during the site visits is presented in Table 3.

Table 3 – Birds Identified Onsite at HNR

Common Name	Latin Name
American Robin	<i>Turdus migratorius</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Band-tailed Pigeon	<i>Columbia fasciata</i>
Brown Creeper	<i>Certhia americana</i>
Chestnut-backed Chickadee	<i>Para rufescens</i>
Common Raven	<i>Corvus corax</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
Golden-crowned Kinglet	<i>Regulus satrapa</i>
Hairy Woodpecker	<i>Picoides villosus</i>
Huttons Vireo*	<i>Vireo huttoni</i>
Mallard	<i>Anas platyrhynchos</i>
Northern Flicker	<i>Colaptes auratus</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>
Red-breasted Nuthatch	<i>Sitta canadensis</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Stellar's Jay	<i>Cyanocitta stelleri</i>

*CDC blue listed species.

3.4.2.3 Other Vertebrates

The most common mammal species occurring within the area are:

- Black-tailed deer.
- Douglas' squirrel.

Deer signs were noted throughout the reserve area and Douglas' squirrels were observed on a few occasions. A number of other small mammal species are expected to occur within the area.

Amphibians and reptiles observed include:

- Red-legged frog (*Rana aurora*).
- Garter snake (species unknown).

Red-legged frog (*Rana aurora*) tadpoles were observed in pools of standing water in vegetation type B (Figure 4) (Galinsky, 2000).

3.4.2.4 Invertebrates

Time allotted to identifying invertebrate species during the site visit was minimal. However, Galinsky (Galinsky, 2000) noted Lorquin's Admiral butterfly (*Limentis lorquini*) and the CDC indicated presence of the blue-listed dragonfly the Blue Dasher (*Pachydiplax longipennis*) on Bowen Island.

3.4.2.5 CDC Rare (Wildlife) Element Occurrences

The following blue-listed bird was identified on the reserve by neighbouring residents:

- Great Blue Heron (*Ardea herodias*).

The following blue-listed wildlife species were not observed on the reserve during our site visits, but do occur elsewhere on Bowen Island:

- Blue Dasher (*Pachydiplax longipennis*).
- Townsend's Big-Eared Bat (*Plecotus townsendii*).

3.4.3 Fish and Fish Habitat

Portions of the reserve are considered to provide high fish values, including:

- Fish-bearing watercourses. Cutthroat trout were observed in the pond and stream in Ecotype B (Figure 4).
- Fish habitat. Watercourses traversing the reserve (fish bearing and non-fish bearing) contribute significant food and nutrients to downstream fish populations.

The wetland areas are of considerable importance for fish habitat due to the diversity of habitat they contain (large woody debris, deep pools, and abundant cover). The deep pools were excavated in the mid 1980's as part of the subdivision project.

4.0 Management Plan

Management plans are used to provide long-term direction and guidance for the management of values and features of significance on properties owned by the ITF. Management issues and strategies for HNR were identified and developed by:

- Conducting site visits.
- Interviewing knowledgeable individuals.
- Conducting an interest group and public consultation meeting.
- Reviewing pertinent literature.

Interest group and public consultation meetings were held on August 14, 2000 to gather input to help develop this management plan for ITF. Many of the management issues and strategies included are suggestions made by attending interest group members. Interest groups represented include:

- Bowen Island Nature Club.
- Bowen Island Conservancy.
- Bowen Island Parks and Recreation Commission.
- Bowen Island Heritage Preservation Society.
- Bowen Island Trails Committee.

ITF typically outlines a management plan for its properties and then works with a local management group to implement the plan.

Section 4.1 identifies management issues while section 4.2 outlines management strategies and associated action items.

4.1 Management Issues

The management issues identified for HNR include:

- Interest group involvement.
- Acceptable/unacceptable activities.
- Monitoring program.
- Stabilization of logging road.
- Boundary marking maintenance.
- Removal of non-indigenous vegetation.
- Trail location.
- Signage.
- Hazard tree removal.
- Fire management.

4.1.1 Interest Group Involvement

A number of the above named interest groups (section 4.0) played an active role in the formation of the HNR. The concept of establishing a reserve at this site was originally proposed to the owners in the late 1980's by the Bowen Island Nature Club. All the above-named interest groups will continue to have a stake in the general management and use of the property; however, it is important to clearly designate groups or individuals to implement management strategies/actions and to maintain a conservation covenant on the property. The group(s) and/or individual(s) that implement management strategies will be referred to as the "management group".

4.1.2 Acceptable/ Unacceptable Activities

ITF policy states that nature reserves are for day use and foot traffic only. Acceptable uses within the HNR include walking and quiet appreciation of nature. Camping, partying, biking, fishing, hunting, tree cutting, and any use that could reasonably pose a threat to wildlife, wildlife habitat, fish and fish habitat are prohibited within the nature reserve. The general public should be made aware of these permitted and prohibited uses in some way (brochure, flyer, conservation information night, or newspaper articles).

The management group will need to establish a regular monitoring program to check the property and ensure only acceptable uses are occurring in the nature reserve. Such a program may include enlisting community support and establishing a neighbourhood watch or volunteer monitors from the surrounding area. In addition, relationships should be established with the RCMP to ensure their assistance when necessary.

4.1.3 Monitoring Program

An annual site visit should be conducted to monitor the condition of the HNR. Criteria to be monitored are addressed in section 4.2.1.3.

4.1.4 Logging Road Stabilization

An old logging road crosses into the subject property approximately at the toe of the slope. It meanders through the property with a switchback and then ends at the clear-cut. The approximate location of the road is indicated on Figure 4. Some portions of the road are overgrown, although a trail does exist. It is recommended that public use of this trail be eliminated as it allows for access into Ecological Reserve #48 and portions of the road have been eroded at ephemeral stream crossings. If the erosion continues, sediment being deposited in the sensitive wetlands at the bottom of the slope will cause unacceptable environmental degradation.

Natural successional processes will continue on the logging road with the establishment of pioneering species, primarily red alder. Two options for the management group to consider with respect to managing vegetation on the logging road include:

1. Managing for open areas by maintaining portions of the logging road free of trees but allowing shrubs, herbs and grasses to stabilize the road.
2. Allowing the natural successional process to continue resulting in red alder dominated vegetation. Initially there would be a high number of stems, which would thin out over time to an approximate density of 1200 stems per hectare.

4.1.5 Boundary Marking Maintenance

Property boundaries for the HNR are difficult to locate. Currently the eastern, western, and southern boundaries have been flagged with pink ribbon. Legal survey iron pins are situated at each corner and have been flagged with pink and orange ribbon. The boundary flagging should be maintained to allow for use in future monitoring programs.

4.1.6 Removal of Non-indigenous Vegetation

A number of holly bushes were identified during the site visit in Ecotype B (see Figure 4). This non-indigenous vegetation should be removed from the property.

4.1.7 Trail Construction

A trail adjacent to wetlands and/or streams could negatively impact fish habitat and water quality in the reserve. Extreme care should be taken during trail construction in these environmentally sensitive areas to prevent:

- Sediment movement into streams or wetlands.
- Loss of overhanging vegetation.
- Loss of wetland edge and streambank stability.
- Loss of active bird nests. (A bird nest survey should be conducted prior to removal of trees, and tree removal should occur outside the bird nesting season of April – July).

A minimalist approach to trail construction should be taken. Access to trails in the reserve should be restricted to pedestrian traffic only. The trail location is best situated at the toe of the slope, which may require that portions of the trail be situated outside of the legal trail right-of-way. All parties involved should negotiate and determine the best possible location for the trail and adjust the trail right-of-way accordingly. Ongoing trail maintenance will fall within the jurisdiction of the Bowen Island Parks and Recreation Commission (BIPRC).

4.1.8 Signage

This management plan recommends that no signage be posted on the property. The primary objective for the property is conservation and signs may encourage the use of the property. Once trails have been constructed, we recommend that signs be established at strategic locations.

4.1.9 Hazard Tree Removal

It is important to ensure the safety of all trail users. Hazard trees within the vicinity of the trail may pose a threat to hiker safety. It is anticipated that minimal hazard trees will be identified as the stand is comprised of young to mature second growth.

4.1.10 Fire Management

A detailed fire management plan and initial response plan for the property are preventative measures that will decrease the risk of fire and ensure a timely response in the event of a fire. There is a need for the establishment of a relationship with the Bowen Island Volunteer Fire Department (BIVFD), as they will be the primary initial response.

4.2 Management Strategies

Management of HNR has been grouped into short-term and mid- to long-term management strategies and actions.

4.2.1 Short-term Management Strategies

Short-term management strategies include initiatives that should be implemented during the first year of management. Short-term initiatives include interest group involvement, controlling unacceptable use of the reserve, implementing a monitoring program, logging road erosion documentation, and fire management.

4.2.1.1 Interest Group Involvement

It is important for ITF to clearly designate groups or individuals to:

- Implement management strategies/actions (management group).
- Maintain a conservation covenant on the property.

Action Item 1: ITF will work with the noted interest groups to establish which group will be site managers and which groups will hold the conservation covenant.

The management group representatives will be required to meet with ITF representatives annually to review progress on management plan implementation.

4.2.1.2 Controlling Unacceptable Use

Action Item 2: The management group will establish a group (sub-committee or volunteer group) to monitor the site on a regular basis to ensure only acceptable uses are occurring. A management group contact person will be designated to be the initial contact for the site.

Action Item 3: The management group will notify appropriate agencies, particularly RCMP, of the location of the nature reserve and permitted uses. The management group contact person's name and phone number will be provided and the group will work with the agencies to establish procedures to be followed if inappropriate uses are occurring and enforcement assistance is necessary.

Action Item 4: The management group will establish some means to educate the public, particularly the Cates Hill neighbourhood, about the sensitivity of the HNR.

4.2.1.3 Monitoring Program

Action Item 5: ITF will arrange for an annual site visit to monitor the condition of the HNR. Monitoring activities will assess and document:

- Occurrence of inappropriate use.
- Condition of the logging road and extent of erosion.
- Condition of veteran old-growth Douglas fir trees.

- **Occurrence of windthrow, particularly in ecotype B – Mixed Forest Wetland (Figure 4).**
- **Regeneration status and successional stage of ecotype F – Clear-cut Shrub/Herb (Figure 4).**
- **Water levels and general condition of pond and watercourses on the property.**

4.2.1.4 Logging Road Erosion Documentation

Action Item 6: The management group will document, using maps and photos, the extent and location of erosion on the logging road.

4.2.1.5 Fire Management

Action Item 7: The management group will notify the BIVFD of the location of the Reserve, establish a relationship with the BIVFD, and develop an initial response plan in the event of a fire.

4.2.2 Mid- to Long-term Management Strategies

Mid- to long-term management strategies include initiatives that should be implemented within two to ten years. Mid- to long-term initiatives that should be undertaken include logging road stabilization, boundary marking maintenance, removal of non-indigenous vegetation, trail construction, signage, fire management and hazard tree removal.

4.2.2.1 Logging Road Stabilization

All areas of the road that are at high risk of continued erosion should be stabilized through a program of slope stabilization and revegetation.

Action Item 8: The management group, in consultation with ITF, will arrange for a professional to develop prescriptions and plans for erosion control which could be implemented by volunteers or appropriately skilled labour as per the professional's best judgement.

Action Item 9: The management group will allow natural successional processes to continue, resulting in red alder dominated vegetation.

4.2.2.2 Boundary Marking Maintenance

Action Item 10: The management group will maintain boundary flagging to assist in future monitoring programs.

4.2.2.3 Removal of Non-indigenous Vegetation

Action Item 11: The management group will establish and implement a program to remove non-indigenous shrubs, in particular holly, from Ecotype B.

4.2.2.4 Trail Construction

Action Item 12: The management group, along with other interest groups, will determine the best possible location for the trail. BIPRC will maintain trails once constructed.

Action Item 13: The management group will conduct, or organize in consultation with ITF, a bird nesting survey prior to trail construction and associated tree removal. All tree removal should occur outside of the bird-nesting season between April and July.

4.2.2.5 Signage

Action Item 14: Once a trail has been constructed, signs will be established at strategic locations identifying the site as an ITF nature reserve, permitted uses, and BIPRC as trail managers. The management group will work with BIPRC to determine appropriate locations and design, with ITF standards as a guide.

4.2.2.6 Fire Management

Action Item 15: The management group will develop a fire management plan.

4.2.2.7 Hazard Tree Removal

Action Item 16: A hazard tree assessment will be conducted by a certified arborist, in conjunction with any trail development. All hazard trees will be cut and left on site to naturally decompose.

5.0 Conclusions

The HNR is a unique and important site for nature conservation, both regionally and locally. The variety of habitat found within the HNR area includes sensitive wetlands, mixed deciduous coniferous forests, mature coniferous forests, and pioneer seral stage areas. Significant features include veteran old-growth Douglas fir trees, a pond and stream with resident fish, a number of cliffs, and a logging road.

The combined variety in habitat and significant features make the HNR important habitat for wildlife and fish. Furthermore, the HNR makes a significant contribution to the preservation of a unique wildlife movement corridor that extends from Crippen Park, on the eastern shore of the island, to Josephine Lake.

A number of action items, as outlined in Section 4.2.1 should be implemented within the next year to ensure the integrity of HNR is maintained. These include:

- Action Item 1: ITF will work with the noted interest groups to establish which group will be site managers and which groups will hold the conservation covenant.
- Action Item 2: The management group will establish a group (sub-committee or volunteer group) to monitor the site on a regular basis to ensure only acceptable uses are occurring.
- Action Item 3: The management group will notify appropriate agencies, particularly RCMP, of the location of the nature reserve and permitted uses.
- Action Item 4: The management group will establish some means to educate the public, particularly the Cates Hill neighbourhood, about the sensitivity of the HNR.
- Action Item 5: ITF will arrange for an annual site visit to monitor the condition of the HNR.
- Action Item 6: The management group will document, using maps and photos, the extent and location of erosion on the logging road.

- Action Item 7: The management group will notify the BIVFD of the location of the Reserve, establish a relationship with the BIVFD, and develop an initial response plan in the event of a fire.

A number of mid- to long-term management action items were identified in section 4.2.2. The majority of the mid- to long-term action items should be implemented within the next two to five years. These include:

- Action Item 8: The management group will arrange for a professional to develop prescriptions and plans for erosion control which could be implemented by volunteers or appropriately skilled labour as per the professional's best judgement.
- Action Item 9: The management group will allow natural successional processes to continue, resulting in red alder dominated vegetation.
- Action Item 10: The management group will maintain boundary flagging to assist in future monitoring programs.
- Action Item 11: The management group will remove non-indigenous shrubs from Ecotype B.
- Action Item 12: The management group, along with other interest groups, will determine the best possible location for the trail.
- Action Item 13: The management group will conduct a bird nesting survey prior to trail construction and associated tree removal.
- Action Item 14: Once a trail has been constructed, signs will be established at strategic locations identifying the site as an ITF nature reserve, permitted uses, and BIPRC as trail managers.
- Action Item 15: The management group will develop a fire management plan.
- Action Item 16: A hazard tree assessment will be conducted by a certified arborist, in conjunction with any trail development.

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APPENDIX 1

SITE PHOTOGRAPHS

APPENDIX 2

CWHdm SITE SERIES DESCRIPTIONS

APPENDIX 3

HISTORICAL AERIAL PHOTOGRAPHY