Management Plan for
David Otter Nature Reserve
Bowen Island, British Columbia

Photo by Ryan Durand, Taara Environmental

Prepared for:

Islands Trust Fund

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Approved by the Trust Fund Board
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Executive Summary

In 2006, the Islands Trust Fund acquired the 3.04 hectare (7.5 acre) property now known as the David Otter Nature Reserve as the result of a generous donation by the previous owners, Neil Boyd and Isabel Otter. A conservation covenant is held on the property by the Bowen Island Municipality.

Islands Trust Fund policy requires that a management plan be developed for all properties that it owns or manages. In January 2007, Taara Environmental was retained to develop a management plan for the David Otter Nature Reserve.

The Islands Trust Fund objectives for the management of the David Otter Nature Reserve are as follows:

- To preserve the natural features and functioning of the site;
- To ensure that permitted uses do not harm the ecological attributes of the site;
- To protect, and enhance where necessary, the natural succession of the plant and animal communities at the site; and
- To provide for educational and research opportunities where deemed appropriate.

The property is characterized by a series of ridges and benches and second growth young to mature western hemlock and western red cedar forest, with occasional Douglas-fir and western red cedar veterans. Several rocky outcrops and two small streams are also found on the property. Two potential blue-listed species may occur within the reserve and two blue-listed ecological communities have been identified.

The property contains an easement running north and south across the reserve for well access in favor of the donors, as well as an informal network of walking trails accessible from private property. The Bowen Island Municipality holds a covenant ensuring that a ten metre green buffer be maintained along Hikers Trail Road and Mount Gardner Road. The reserve's proximity to Hikers Trail Road, adjacent Crown land and Crippen Regional Park increases its value as a natural buffer to these well used natural areas, but off road vehicle access from these parcels has damaged the northwest corner of the reserve.

There is currently no public access to the David Otter Nature Reserve, and as such management needs are limited to maintenance of the existing footpaths used by the donors and monitoring and rehabilitation of an off-road vehicle access point in the northwest corner of the property. It is also advisable to relocate a gate leading up to the Mount Gardner forest lands to deter further trespass into the reserve.

Acknowledgements

The authors would like to thank the Islands Trust Fund staff for their assistance in providing background materials and for their input into this management plan. A special thank you goes out to Neil Boyd and Isabel Otter who had the foresight to donate this property and contribute to the protection of natural heritage on Bowen Island.

Thank you to all other stakeholder groups who provided comments in reference to the management of the David Otter Nature Reserve and review of this plan as it progressed.

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1.0 Introduction

The islands between Vancouver Island and the mainland of British Columbia are recognized as a special place with a unique natural environment and rural character. In recognition of the unique attributes of this area, the Provincial Government established the Islands Trust in 1974. The Islands Trust is a local government created with a special legislated provincial mandate *'to preserve and protect the trust area and its unique amenities and environment for the benefit of the residents of the trust area and of British Columbia generally, in cooperation with municipalities, regional districts, improvement districts, other persons and organizations and the government of British Columbia'* (*Islands Trust Act*).

In 1990, through the enactment of a section of the Islands Trust Act, the Islands Trust Fund (ITF) was established to carry out the *'preserve and protect'* mandate of the Islands Trust. The vision of the Islands Trust Fund is *'to create a legacy of special places, protecting both natural and cultural features in perpetuity in order to sustain the unique character and environment of the Islands Trust Area.'* The goal of the Islands Trust Fund Board is to establish protected areas on all major and many of the associated islands within the Islands Trust Area (The Islands Trust Fund Plan 2003-2007).

The David Otter Nature Reserve was donated for conservation purposes to the Islands Trust Fund in November 2006. The protected property includes a series of ridges and benches with second growth young to mature western hemlock and western red cedar forest, with occasional Douglas-fir and western red cedar veterans. Two streams also cross the property. The reserve is located adjacent to Crippen Regional Park to the east and Mount Gardner to the southwest.

Taara Environmental was retained by the Islands Trust Fund to prepare a management plan for the David Otter Nature Reserve in January 2007.

1.1 Islands Trust Fund Management Plans

Islands Trust Fund management plans are used to provide long term direction and guidance for the protection of values and features of significance on Islands Trust Fund properties. The Islands Trust Fund requires that management plans are developed for all properties that it acquires.

Generally, management plans will address the following:

- The purpose and objectives for the site;
- Background information including the site history and local and regional context;
- Environmental inventory;
- Management issues such as the extent and nature of protection required, appropriate uses and level of use, research guidelines, risk management, special needs at the site; and

- Strategies and actions to achieve the purpose and objectives of the site and to address management issues and needs.

1.2 Nature Reserve Purpose

The purpose of establishing the David Otter Nature Reserve is as follows:

- To preserve and protect the natural values of the site;
- To allow natural succession of the reserve's ecosystems to occur unimpeded; and
- To protect the site in accordance with the objectives of the Islands Trust and Islands Trust Fund.

1.3 Nature Reserve Objectives

The Islands Trust Fund objectives for the management of the David Otter Nature Reserve are as follows:

- To preserve the natural features and functioning of the site;
- To ensure that permitted uses do not negatively impact or cause harm to the ecological attributes of the site;
- To protect, and enhance where necessary, the natural successional processes of the plant and animal communities at the site; and
- To provide for educational and research opportunities where deemed appropriate.

2.0 Site Information

The following section provides a brief overview of the David Otter Nature Reserve including its location and context within a regional and local protected areas network and outlines its unique attributes and features.

2.1 Location

The David Otter Nature Reserve is located in the north-central portion of Bowen Island west of Crippen Regional Park (Figure 1). The property is just to the west of Killarney Lake and to the east of Hikers Trail Road. It is located approximately 3.2 kilometers from the Bowen Island ferry terminal.

Discrepancies were found between the Islands Trust cadastral map and the actual locations of the reserve property lines. In some areas the boundaries differed by as much as 20 metres. Therefore, the property lines of the reserve on maps included within this document were produced using a combination of GPS points and the cadastral and are not considered to be accurate. In particular, the western boundary along Hikers Trail Road and the eastern boundary are off to the west. The other three sides are reasonable depictions of the boundaries; however, the south property line has been moved to the

south to line up with GPS points, not the supplied cadastral map. Approximate property lines were marked with flagging tape; as were all corner pins that were located. Regardless of the property boundaries, locations of streams, trails, vegetation type boundaries and other mapped features are spatially accurate.

2.2 Site Description

David Otter Nature Reserve is a 3.04 hectare (7.5 acre) property which is characterized by a series of ridges and benches and young to maturing western hemlock and western red cedar forest with a fern dominated under-storey. The site may have been logged in the 1930's, but has retained some old-growth forest characteristics with numerous large veterans. Much of lands contained within and surrounding Mount Gardner were logged by early settlers and logging companies in the early 1900's (Howard, 1973).

Two streams cross the property (Figure 3). Winter Creek[1] and Kill Creek cross the property parallel to one another from the southern property boundary and meet north of the reserve, where they then lead to the east. Winter Creek is intermittent, while Kill Creek runs for the majority of the year. Both creek systems are located in fairly deep, steep sided gullies with bedrock outcrops.

The property is accessible from Hikers Trail Road along its eastern boundary, although there is no public access currently developed from the road. The only existing trail system is a network of informal foot paths created by the donor, which originate north of the reserve. In addition, an old road is contained within an easement in favor of the donor to access a well located in the southern portion of the reserve.

The property has varied topography which has resulted in differentiated vegetation types; and the two stream systems crossing the property contribute substantially to its natural biodiversity values. The property's proximity to forested eco-systems found in Crippen Regional Park to the east and Crown lands to the south and west of the reserve also add to its value as a protected area.

2.3 Legal Description

David Otter Nature Reserve includes those lands with Parcel Identification Number 011-875-071 Lot 2, Except Part in Plan BCP27043 District Lot 6015 Group 1 New Westminster District Plan 21899. The property is zoned SR 1 (Settlement Residential) which permits the use of the property as a nature reserve under Bowen Island Municipality Land Use Bylaw No. 57, 2002.

[1] Winter Creek is shown as Gardner Creek on Islands Trust mapping, the authors have chosen to use the local nomenclature provided by the donors.

Figure 1. Regional Context Map

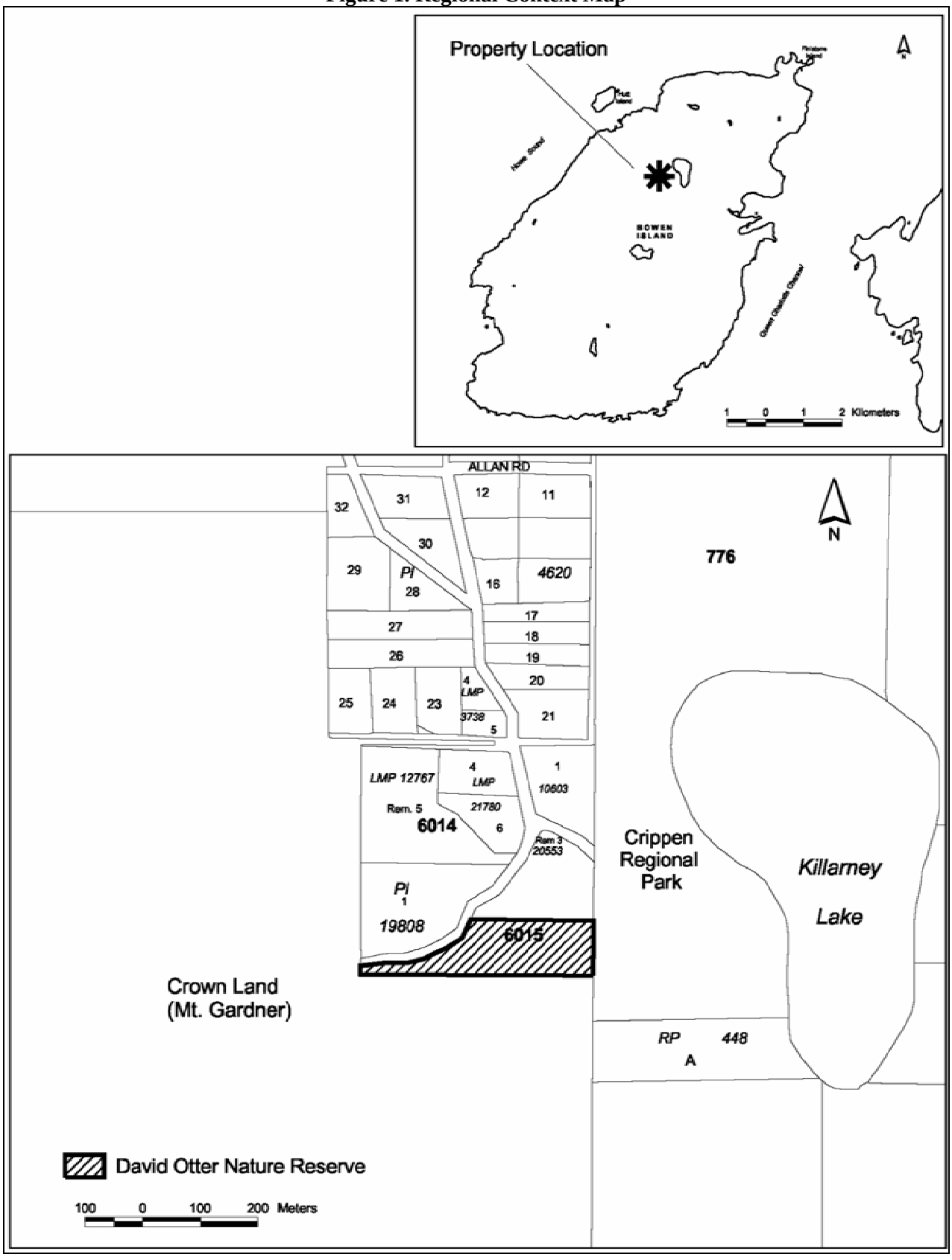


Figure 2. Air Photo Overview of Reserve

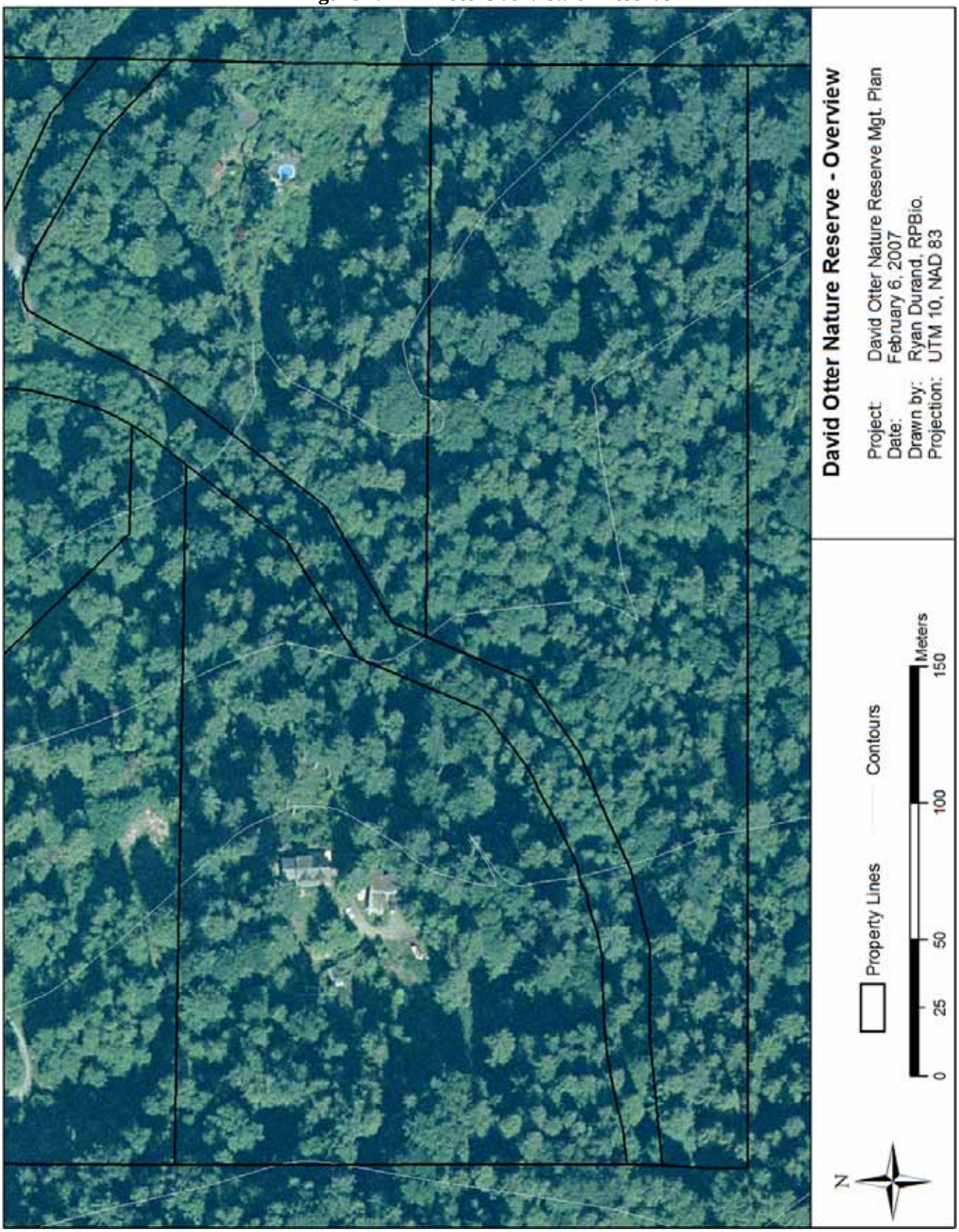
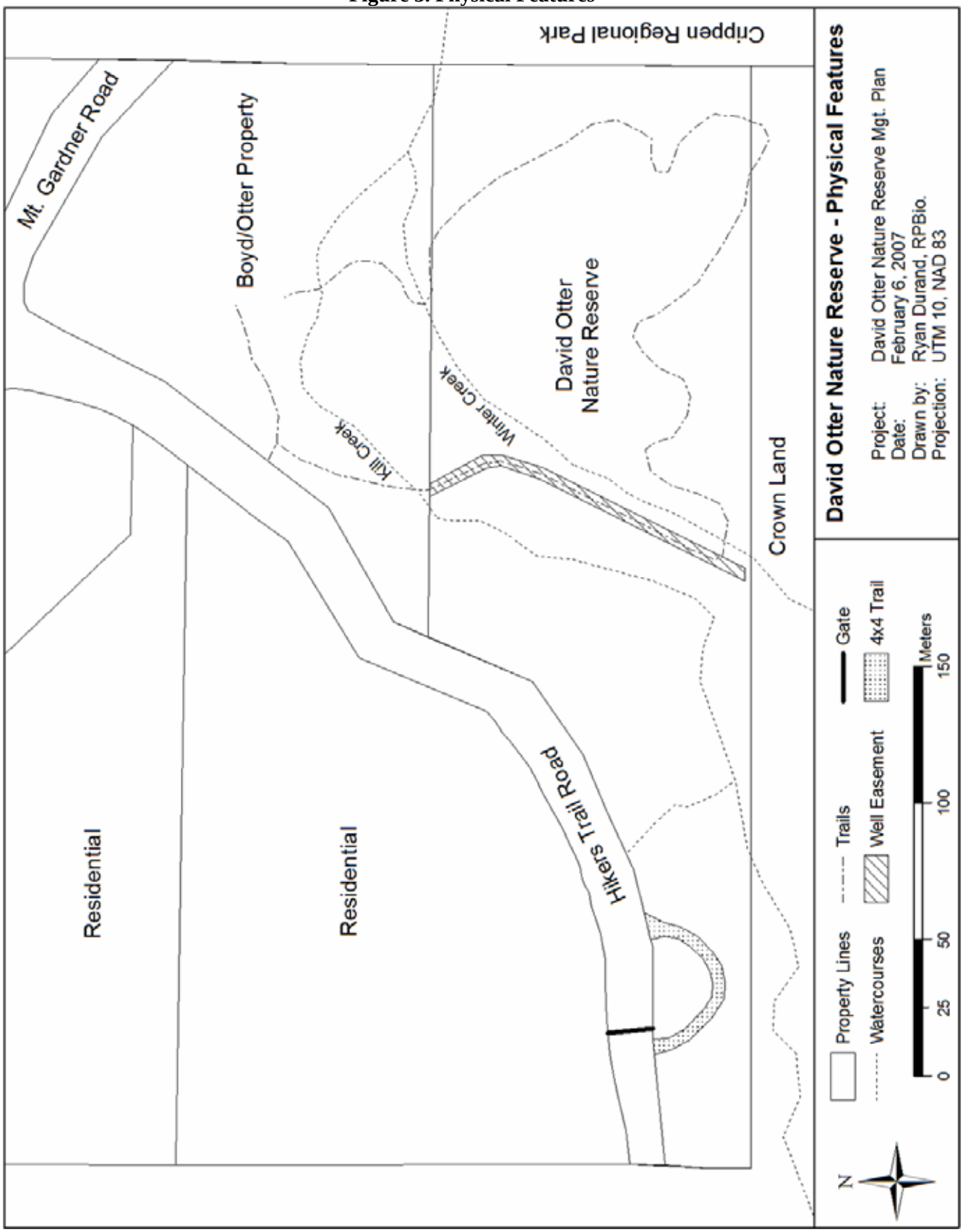


Figure 3. Physical Features



2.4 Local and Regional Context

Bowen Island is located at the entrance to Howe Sound, approximately fifteen kilometers North of Vancouver. The proximity to the greater Vancouver area has attracted a primarily year-round population of 3,500 people. Many residents regularly commute into the city for employment, although a small business center exists on the island itself (Cunningham and Rivard Appraisals Ltd., 2006).

The David Otter Nature Reserve is one of several protected areas on Bowen Island, two of which adjoin the reserve along its eastern and southwestern boundaries. Crippen Regional Park is located beside the reserve along its eastern boundary, while a continuous track of Crown land, referred to as Mount Gardner adjoins the reserve along its southwestern boundary. In addition to these adjoining protected areas, a larger ecological reserve is found in the southern end of Bowen Island, as is Apodaca Provincial Park on the southeast coast.

In addition to the David Otter Nature Reserve, the Islands Trust Fund and Bowen Island Conservancy hold covenants or own several additional land holdings on Bowen Island. These include; Singing Woods Nature Reserve, the McIntyre Covenant and Terminal Creek North and South Covenants held in conjunction with the Ministry of Environment. A conservation covenant is held on the David Otter Nature Reserve by the Bowen Island Municipality.

2.5 Site History

The Squamish First Nation may have used the island for summer hunting and fishing but it is not known whether parts of the reserve may have been utilized. Several early anthropologists have identified village sites on Bowen Island belonging to Coastal Salish groups and early settlers described some First Nation housing on the island (Howard, 1973). There is no evidence of First Nation use or occupation of the reserve, but due to its proximity to Killarney Lake and Mount Gardner there is a possibility that it may have been within a route leading to this lookout or to the lake for freshwater resources.

European settlement on Bowen Island began in part due to its timber resources, which were close to sawmills on the mainland and Vancouver Island (Howard, 1973). Much of Mount Gardner has been logged due to its proximity and accessibility. The reserve was likely included in much of this early logging activity, evidenced by several old stumps within the reserve and the old logging trail leading to the well head on the property.

Adjacent to the nature reserve and surrounding Killarney Lake are the lands now contained within Crippen Regional Park. Although originally purchased for agricultural development, the thin soils resulted in the area being developed as a resort for weekend tourists when purchased by the Terminal (Union) Steamship Company in 1902 (Howard,

1973). The area became a regional park under the jurisdiction of the Greater Vancouver Regional District (GVRD) in 1983.

The GVRD was given jurisdiction over the planning of Bowen Island in 1971 and during the re-writing of local by-laws, all interior Crown lands were designated as 'rural'. This designation prohibited development within the Mount Gardner Crown lands with the exception of forestry and agriculture (Howard, 1973).

The reserve was once a part of a larger parcel belonging to Neil Boyd and Isabel Otter who have resided on the property for over twenty-five years. It has remained undeveloped aside from the old logging trail now contained within a well-access easement and a narrow footpath.

The property was donated to the Islands Trust Fund in 2006 as part of a rezoning application to allow for smaller parcel sizes on several neighboring properties including the parent parcel. Bowen Island Municipality also registered a conservation covenant at that time, to protect the property in a natural state.

2.6 Current Use

A narrow footpath on the property is currently utilized and maintained by the donors to walk their dog. Additionally, an easement bisects the property to allow for access to the well head that provides water to the private property to the north of the reserve. A covenant in favor of Bowen Island Municipality provides for a ten metre green buffer along Hikers Trail Road and Mount Gardner Road and an additional covenant is held to protect the property as natural park land. There is currently no public access to the reserve.

Deep ruts were observed in the northwestern corner of the reserve where off road vehicles have used the property to bypass a gate blocking access to the Mount Gardner Crown lands.

2.7 Adjacent Land Use and Connectivity

David Otter Nature Reserve is located adjacent to Bowen Island's most popular recreational destination, Crippen Regional Park. Crippen Regional Park abuts the eastern boundary of the nature reserve and includes trails for walking, horseback riding and cycling, as well as Killarney Lake. Mount Gardner Road runs through the regional park in proximity to the reserve. The reserve acts as a corridor for the Regional Park, allowing species to connect to the large Crown land parcel that encompasses Mount Gardner along the nature reserve's southwestern boundary.

The Crown land adjacent to the David Otter Nature Reserve is part of a network of trails that utilize old logging roads leading up to views from Mount Gardner. These lands contain both young and maturing forest cover. These lands are accessible from Hikers Trail Road, running the length of the nature reserve's western boundary.

The northern boundary of the reserve is adjacent to the private property that was once a part of the parent parcel that has been subdivided to allow for the creation of the nature reserve. The property allows for one residence and an easement bisecting the reserve in a north and south direction, leads to the well head for this property (Boyd and Otter, pers. comm., 2007).

3.0 Environmental Inventory

The following section provides a detailed description of the nature reserve's physical and natural attributes and outlines the reserve's unique features. Information contained in the following section was obtained during fieldwork conducted in early February 2007. Information on the status of flora, fauna and ecological communities was obtained from the British Columbia Conservation Data Center database.

3.1 Geology and Physiology

Bowen Island is characterized by volcanic and sedimentary rock of lower to middle Jurrassic age, referred to as the Bowen Island Group. These are generally comprised of granite, sandstone and conglomerate with a shallow layer of surficial materials and abundant exposures of bedrock (J.M. Tourney, 1996).

The David Otter Nature Reserve contains surficial deposits of Capilano fossiliferous marine and glaciomarine sediments from outwash fans off of Mount Gardner deposited during the Fraser Glaciation (J.M Tourney, 1996).

3.2 Soils

Soils within the David Otter Nature Reserve are part of a group of soils most common to Bowen Island comprised of predominantly morainal deposits. This group is characterized by hummocky complexes of deep soils over till, broken by bare rock outcrops and exposures and areas of shallow till over steeper bedrock slopes. These steeper slopes are found at the foot of Mount Gardner in the reserve's southwestern end (J.M. Tourney, 1996).

3.3 Ecosystems

The following section contains descriptions of the four basic vegetation types identified on the reserve (Figure 4 &Table 1). Appendix A contains detailed information as to the inventory methodology as well as lists of floral species that were identified.

Figure 4. Vegetation Types

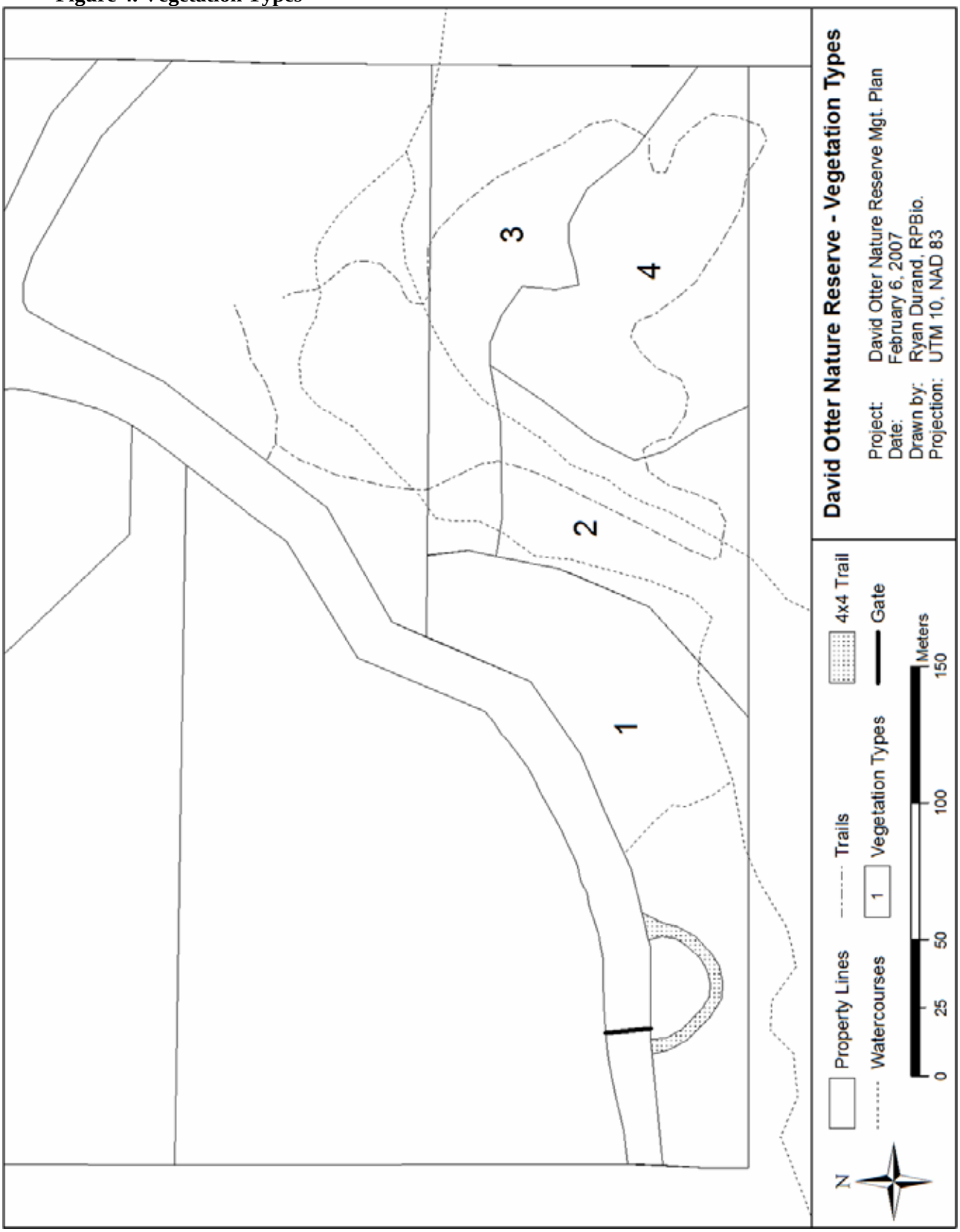


Table 1. Summary of Vegetation Types

Veg. Type	Site Series	Description
1	CWHdm05	Maturing conifer forest lacking veterans. Salal and dull Oregon grape common.
2	CWHdm05	Maturing conifer forest lacking veterans. Salal and dull Oregon grape absent.
3	CWHdm07	Mature mixed forest with veterans on steep lower slopes. Sword fern dominant herb cover.
4	CWHdm05	Mature conifer to mixed forest with veterans on upper slope bench.

3.3.1 Vegetation Type 1

Vegetation Type 1 encompassed a narrow area to the west of the reserve between Hikers Trail Road and Kill Creek. It had a moderate slope (15 degrees) to the east towards Kill Creek. The area was characterized by a maturing two-storied conifer forest with a crown closure of 70%. Dominant tree species included western red cedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*) with lesser amounts of Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*). A suppressed sub-canopy of western red cedar, red alder (*Alnus rubra*) and western hemlock occurred sporadically throughout the area. Rare occurrences of veteran western red cedar and Douglas-fir were also observed along the creek.

The shrub layer contained a moderate (45%) cover of salal (*Gaultheria shallon*) and dull Oregon grape (*Mahonia nervosa*) with occasional occurrences of red huckleberry (*Vaccinium parvifolium*) and English holly (*Ilex aquifolium*). This was the only vegetation type that contained significant amounts of salal; the main distinguishing factor between it and Vegetation Type 2.

Herbaceous cover was low (25%) with sword fern (*Polystichum munitum*) the only species identified. Numerous other species are expected to occur during warmer seasons. Moss formed a moderate (40%) cover on the forest floor and large woody debris. Species included step moss (*Hylocomium splendens*), Oregon beaked moss (*Eurhynchium oreganum*) and flat moss (*Plagiothecium undulatum*).

The western portion of the vegetation type contained a significant disturbance (photo points 9 to 12); a large, well used off-road vehicle trail that leads through the forest to bypass a gate on Hikers Trail Road. Use of the trail has damaged the general ecology of the forest and is a potential route for disease infection, and invasive species. As well, several small trees had recently been cut down along the constructed trail within reserve boundaries.

Wildlife habitat in this area was considered to be limited to amphibian, small mammals and avian species. Proximity to Hikers Trail Road and the disturbance caused by the off-road vehicle trail likely has a negative impact on habitat use. There is the potential for establishment of invasive species in this area due to the high use and proximity of Hikers Trail Road.

Over time it is expected that the forest will mature into a conifer forest dominated by western red cedar and western hemlock. Little if any of the deciduous species are likely to persist as conifer cover increases. Douglas-fir veterans will become even rarer and are not expected to be replaced as no young Douglas-fir was observed. Salal, dull Oregon grape, sword fern and existing moss species are expected to occur in a similar composition.

3.3.2 Vegetation Type 2

Vegetation Type 2 encompassed a relatively flat (5 degree slope to north east) bench between Kill and Gardner Creeks. The area was dominated by a young to mature two-storied mixed forest. Dominant tree species included western red cedar, western hemlock, Douglas-fir, red alder and big-leaf maple (*Acer macrophyllum*) with sporadic occurrences of mature western red cedar.

The shrub layer contained a sparse (5%) cover of western hemlock and western red cedar saplings along with sporadic red huckleberry and English holly. Kill Creek marked a distinct change from a salal dominated shrub layer to the west to virtual salal absence to the east.

Herbaceous cover was moderate (40%) and limited to sword fern. It is expected that numerous other species occur during warmer months of the year. The moss layer was diverse and contained a moderate (40%) cover of flat moss, Oregon beaked-moss, step moss and rare occurrences of coastal leafy moss (*Plagiomnium insigne*) and electrified cat's tail moss (*Rhytidiadelphus triquetrus*).

A narrow north/south running easement runs through the middle of this vegetation type along an old road. An infrequently used walking trail (used by the donors) runs along the old road. This disturbance is minimal and other than the potential for minor localized erosion, it had no apparent affect on the ecological integrity of the area.

As the vegetation type encompasses two creeks, wildlife habitat potential is high. Several avian species were observed in this area, as were deer signs. Excellent amphibian habitat was observed as large decaying woody debris was a common occurrence along the creeks.

Over time this area is expected to mature into a conifer forest dominated by western red cedar and western hemlock. Small amounts of red alder and bigleaf maple may persist along the stream corridors, but most is expected to die out as conifer cover increases. Shrub species will likely remain the same, with a possible increase of salal. Herbaceous and moss cover and species composition is not expected to significantly change.

3.3.3 Vegetation Type 3

Vegetation Type 3 encompassed a steeply (20 to 30 degrees) sloping area between the upper slope bench of Vegetation Type 4 and Gardner Creek. It was characterized by a

mixed, multi-storied mature forest with a crown closure of 50%. Dominant species included western red cedar and western hemlock with pockets of red alder and big-leaf maple. Well spaced veteran western hemlock and Douglas-fir were common. Of particular interest were several young Sitka spruce (*Picea sitchensis*) found in the area.

The shrub layer was sparse (5% cover) and limited to rare patches of vine maple (*Acer circinatum*) and individual occurrences of red huckleberry.

Herbaceous cover was dominated by an extensive (75%) cover of continuous sword fern. Sporadic occurrences of deer fern (*Blechnum spicant*) and occasional bracken (*Pteridium aquilinum*) was observed on the lower slopes. Numerous other species are expected to occur in this area.

Moss was moderately abundant (40% cover) with common species including coastal leafy moss, palm tree moss and flat moss along with numerous other unidentified species.

Potential wildlife habitat was considered to be high as the area is largely within the riparian area of Gardner Creek. The proximity to permanent water and abundance of decaying large woody debris provides potential amphibian and small mammal habitat.

Over time this area is expected to be dominated by a conifer forest. Red alder and big-leaf maple are in the process of dying out and will soon be completely out shaded by conifers. Douglas-fir is not expected to be a long lasting component of the canopy as no young trees were observed. Vine maple may become better established, while other shrub species will continue to occupy limited areas. Herbaceous cover will continue to be dominated by thick sword fern while mosses are expected to diversify and include species such as Oregon beaked-moss and step moss.

3.3.4 Vegetation Type 4

Vegetation Type 4 encompassed the upper slopes of the south eastern portion of the reserve. It was gently to moderately sloping (5 to 20 degrees) to the north east. Numerous rocky outcrops occurred along the southern and northern edges of the vegetation type. The area was characterized by a mature, multi-storied conifer forest (50% crown closure) with old-growth features. Well spaced veteran Douglas-fir and occasional western red cedar occurred throughout the area. The main canopy was dominated by western red cedar and western hemlock with lesser occurrences of Douglas-fir, red alder and big-leaf maple.

The shrub layer was sparse (10% cover) and contained sporadic clumps of individual red huckleberry, dull Oregon grape, English holly and western red cedar and western hemlock saplings.

Herbaceous cover was dominated by extensive (65% cover) sword fern and occasional bracken. Moss was abundant (60% cover) and was dominated by Oregon beaked-moss and lesser occurrences of flat moss, step moss and various other species.

Deer browse and woodpecker use was the main wildlife use noted in the area. The numerous rocky outcrops contain potential reptile habitat while the veteran conifer trees may provide habitat for specific old-growth species.

Over time this area is expected to be dominated by conifers, mainly western red cedar and western hemlock. As with the other areas of the reserve, most of the red alder and big-leaf maple is already dying out as conifers decrease light availability. Douglas-fir is not expected to be a significant part of future forest stands as no young trees were observed. Shrub, herbaceous and moss cover and species are expected to remain similar, however the total cover of dull Oregon grape may increase and salal may become established.

3.4 Invasive Species

English holly is the only invasive weed confirmed on the reserve (Table 2 & Figure 5). It is likely that other herbaceous species are present, but not extensively established. Spring and summer inventories are required to create a comprehensive list of species and their respective locations.

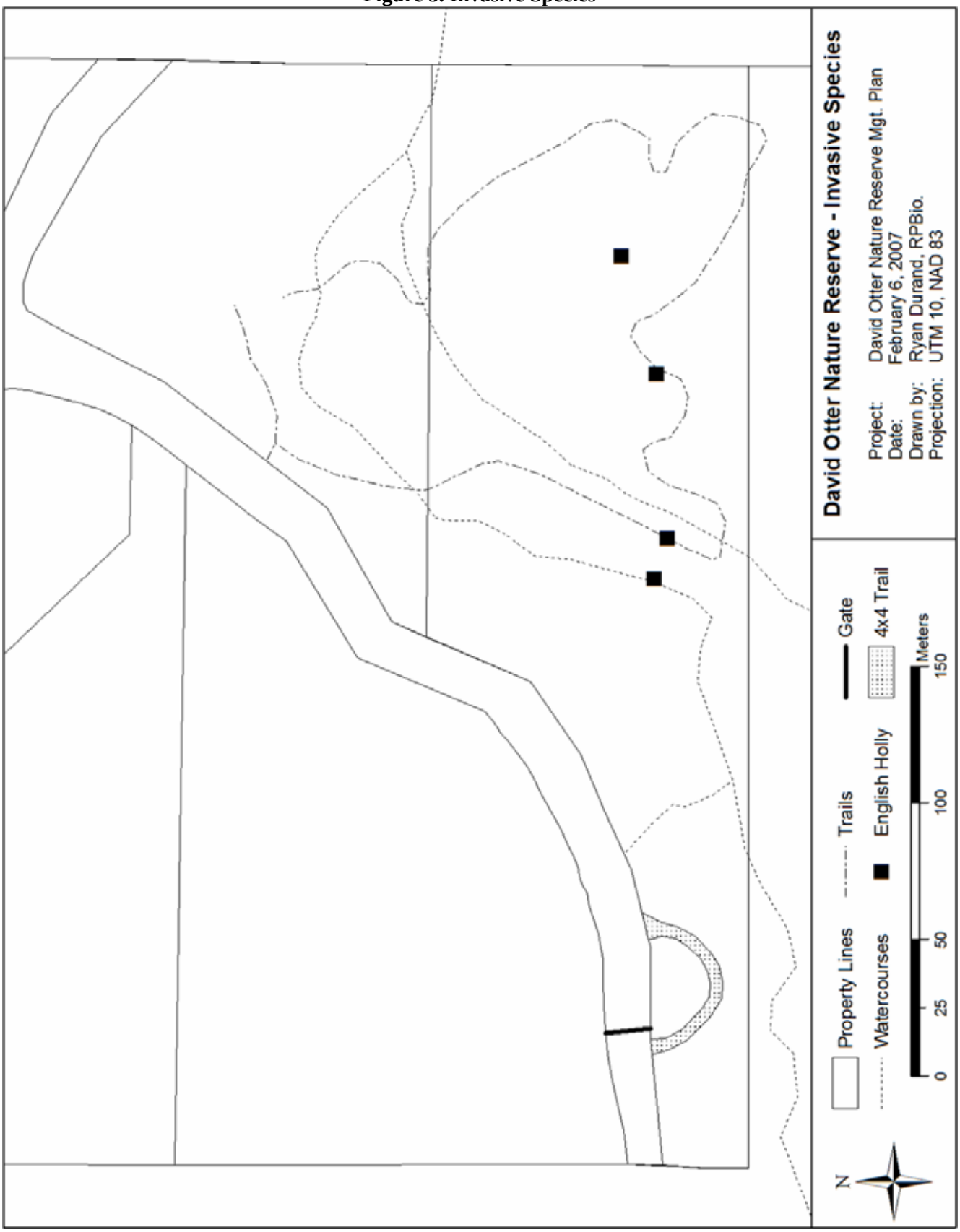
Table 2. Invasive Floral Species

Common Name	Scientific Name	Severity	General Locations
English holly	*Ilex aquifolium*	Moderate	Common throughout the upper slopes of the reserve.

Based on the moderate severity of English holly, its ability to become further established in the reserve (based on existing and predicted ecological conditions), and its potential impact on native biodiversity, it is considered to be a medium priority.

This small ornamental tree was observed throughout the southern portion of the reserve. English holly out-competes native vegetation and readily reproduces via root suckers and berries that are often spread by birds. Although a valuable avian food source, the bright red berries are poisonous to humans (Municipality of Saanich, 2005).

Figure 5. Invasive Species



3.5 Rare Plants, Animals and Ecological Communities

The reserve has a high potential for the occurrence of rare species based on the amount of mature forest with old-growth characteristics and permanent water sources. No records of rare species, that would occupy habitat types found on the reserve, were found on the BC Conservation Data Centre tracking lists. However, suitable habitat was identified for two blue-listed species (Table 3). The donors reported that the creeks used to contain trout, but the installation of a culvert under Gardner Mountain Road obstructed their upstream access (Boyd and Otter, personal communication, 2007).

Table 3. Potential Rare Animals

Common Name	Scientific Name	BC Status	BC List	COSEWIC Status
coastal cutthroat trout	*Oncorhynchus clarki clarki*	S3S4	Blue	
red-legged frog	*Rana aurora*	S3S4	Blue	SC (Schedule 1, 2004)

Two rare ecological communities occur on the reserve based on identified BEC site series (Table 4) (BC Conservation Data Centre, 2007); therefore, the entire reserve is classified as a rare ecosystem.

Table 4. Rare Ecological Communities

Site Series	Common Name	Scientific Name	BC Status	BC List	Veg. Type(s)
CWHdm05	western red cedar / sword fern Dry Maritime	*Thuja plicata / Polystichum munitum* Dry Maritime	S2S3	Blue	1, 2, 4
CWHdm07	western red cedar / three-leaved foamflower Dry Maritime	*Thuja plicata / Tiarella trifoliata* Dry Maritime	S2S3	Blue	3

3.6 Wildlife and Wildlife Habitat

The reserve contains favourable habitat for a wide variety of wildlife including large and small mammals, amphibians, and reptiles. As the reserve is bordered by intact forested areas to the south and west, there is a high potential for many species to utilize the reserve at various times of the year. Additional wildlife inventories are required to access specific species. Table 5 contains a list of wildlife species observed during the inventory.

Table 5. List of Wildlife Species

Common Name	Scientific Name
Mammals	
black-tailed deer	*Odocoileus hemionus*
Amphibians	
Pacific tree frog	*Hyla regilla*

The reserve contains an abundant supply of woody debris (including old stumps) of various sizes and states of decay which provide potential habitat for amphibians, small mammals and invertebrates. Rocky outcrops, steep rocky slopes, and rock piles form favourable reptile habitat on the upper slopes of the reserve.

Deer browse and bedding sites were observed throughout the reserve. Browse was generally light to moderate indicating that the local population is not overcrowded.

The two streams that flow through the reserve contain potential fish habitat and may be inhabited by species such as blue listed coastal cutthroat trout (*Oncorhynchus clarki*). However, the previously discussed downstream obstruction likely prevents access to the reserve.

3.7 Bird Species

Evidence of high avian use, particularly woodpeckers, was noted. Numerous freshly excavated (by pileated woodpeckers and northern flickers) snags were observed on the reserve. The reserve lacked ecotypes (such as wetlands, shrub dominated areas, grasslands, etc.) required by many species, so overall avian diversity may be limited.

Table 6 lists the avian species identified during the inventory. Additional surveys during more appropriate times of the year are required to create a comprehensive list.

Table 6. List of Bird Species

Common Name	Scientific Name
bald eagle	*Haliaeetus leucocephalus*
golden-crowned kinglet	*Regulus satrapa*
northern flicker	*Colaptes auratus*
northwestern crow	*Corvus caurinus*
pileated woodpecker	*Dryocopus pileatus*
winter wren	*Troglodytes troglodytes*
common raven	*Corvus corax*

4.0 Stakeholder Meeting and Input

A meeting with local stakeholders was held on the afternoon of February 19th, 2007 at the Snug Café on Bowen Island in regards to the future management of the David Otter Nature Reserve. Personal invitations were sent prior to the meeting to Islands Trust local trustees and staff, members of the Bowen Island Conservancy, Greater Vancouver Regional District parks staff, staff members of the Bowen Island Municipality, the donors and adjacent residents.

The meeting was attended by four individuals, in addition to two staff members from Taara Environmental. A draft copy of the management plan and additional materials were provided at the meeting for discussion purposes. Additional comments were received

from two neighbours and the Bowen Island Conservancy by phone and electronic correspondence. Comments on the draft management plan were accepted verbally and in written form until March 19th, 2007.

5.0 Management Plan

The following section provides an overview of the management issues as identified by the consultant, the Islands Trust Fund, the donor and additional stakeholders as identified in Section 4.0 above, and provides options and management strategies to address those issues.

5.1 Issues and Discussion

Based on input from the community and sources as listed in Section 4.0, the following management issues regarding the David Otter Nature Reserve have been identified:

Trail Use and Location
Trail Maintenance
Permitted Uses
Parking
Exotic and Invasive Species
Protection of Sensitive Ecosystems and Species at Risk
Fire Management
Capacity

5.1.1 Trail Use and Location

There is a small footpath that originates from the private property to the north of the reserve and circles the reserve's interior before exiting onto the same property to the north. The trail uses the existing easement that runs north and south of the property and crosses streams in three locations. Two of these stream crossings occur on that portion of the trail that is contained within the donor's property. A small section of the trail may also cross into the Crown land parcel to the south of the reserve. Stream crossings are not used during the wet season due to unpredictable stream flow and during the summer months the streams are dry or small enough to cross without the need for constructed improvements.

The trail is not accessible to the public or other users of the reserve due to its origin on private property and therefore does not receive use aside from that of the donor. Use of the trail system is limited to that of the donor and Islands Trust Fund staff and/or agents.

The donor observed that members of the public incorrectly assume the trail leading from their property into the reserve off of Hikers Trail Road is the trail to access the Mount Gardner trail head. Placing a sign at the trail entrance to indicate that it is private property and that trespass is prohibited should deter the further use of this trail by the public.

An off-road vehicle path has been constructed through the western corner of the nature reserve to by-pass a gate that is meant to prohibit entry of vehicles into the Crown lands south and west of the reserve. Considerable damage has occurred to the soils and trees within this area. Additionally, parking of vehicles along Hikers Trail Road has blocked the driveways of both the Boyd and Patrick residences. The gate falls under the jurisdiction of the Bowen Island Municipality. Cooperative efforts to relocate the gate farther west up the road to an area that would be more difficult to by-pass due to topography or other natural barriers should be explored. Several optional locations exist along Hikers Trail Road and a suitable location will need to be investigated further in cooperation with the Municipality based on the costs of relocation.

The damage to the reserve caused by off-road vehicle trespass should be rehabilitated by filling in the ruts that have been created and closing the current access through the use of signage and barriers at both ends. Multiple strategies are required to successfully prohibit entry by off-road vehicles and no single solution exists. In addition to signage indicating that motorized vehicles are prohibited within the reserve and indicating that the site is a private property protected for conservation purposes, access should be blocked by various obstacles. Barriers could include a combination of concrete barriers or large boulders placed at regular intervals along the roadway, spaced so that vehicles can not gain entry. In conjunction with this strategy, the use of downed woody debris along the road created through the reserve; will further deter trespass (Wildlands League and Sierra Legal Defense Fund, 2003). Native vegetation growth may be assisted by roughing up the ground in areas that have been compacted by tire traffic, with care taken toward damage and exposure of roots. The planting of native vegetation, if required, should follow successful closure of the trail to four wheel drive access to avoid damage of young plants.

5.1.2 Trail Maintenance

Trail maintenance and safety includes the clearing of brush along trails, the removal of downed trees across trails and other actions as deemed appropriate and necessary to keep trails cleared and safe for pedestrian use.

During heavy rains and wind, trees may blow down across trails, creating safety hazards or making the trail impassable. In instances where blow down has occurred and the trail has been made impassable, it is recommended that only that part of the tree that lies across the trail be removed. The remainder of the tree should be left to further contribute to the biodiversity of the reserve as downed woody debris, if deemed safe to do so. Downed woody debris contributes to biodiversity by providing cover for small mammals and amphibians and adding to structural diversity in the forest ecosystem. The donors have been maintaining the trail system using the least invasive means necessary to keep trails cleared. If and when the donors cease to use the trail system, it is recommended that maintenance of the trail system cease and nature take its course. Future access by the Islands Trust Fund and its staff will need to be considered at that time. Options may include cooperative use of the easement accessing the well head currently on the title of the donated parcel.

5.1.3 Permitted Uses

There is currently no public trail access to the David Otter Nature Reserve. Use of the western corner of the reserve by off-road vehicles will be prohibited through the use of signage and barriers, and rehabilitation of the path that they have constructed through this area. The gate on Hikers Trail Road should be moved to a point closer to the boundary of the Crown lands south and west of the nature reserve to discourage further trespass and to assist in the elimination of parking issues at its current location.

The donors will be permitted to continue to use the footpaths that originate from their property. In cooperation with the donors, signage should be placed at the trail access off of Hikers Trail Road to discourage public use of the donor's property.

5.1.4 Parking

Parking at the gate on Hikers Trail Road has become disruptive to residents along the road due to congestion and the blocking of driveways to residences. The relocation of the gate to a more appropriate location will be investigated in cooperation with the Bowen Island Municipality. The relocation of the gate farther west in closer proximity to the Crown lands to the south and west of the reserve should deter the use of this area for parking by the public.

5.1.5 Exotic and Invasive Species

English holly was observed to be moderately established throughout the reserve and was observed in at least four locations. English holly is easily spread through an area by distribution of its berries by wildlife and through suckering of its root system or branches. Young plants can be pulled from moist soil or cut during drier conditions before plants produce berries. Larger plants can be cut below the root crown and piled on tarps or other material to reduce the amount of berries or debris left behind before removal. Removed plants should not be composted and should be brought to a facility with experience in safely disposing of invasive and exotic plant species.

A more comprehensive plant inventory during the spring and summer months may identify additional invasive species. Likely, additional species would be limited in distribution to roadsides and where disturbance has occurred in the western corner of the reserve.

5.1.6 Protection of Sensitive Ecosystems and Species at Risk

The David Otter Nature Reserve contains two blue-listed ecological communities and may support additional rare or threatened faunal and floral species. Its proximity to Crippen Regional Park and additional mature forest communities contained within the Crown lands to the south and west of the reserve make it a potentially important corridor and buffer for these adjacent areas. Access to the reserve by blue-listed cutthroat trout was identified as potentially being obstructed by the installation of a culvert downstream

of the reserve. A comprehensive survey of fish utilizing the watershed downstream of the reserve may result in the identification of this species and/or other species of concern. If identified, options to provide access to additional habitat on and/or off of the reserve should be explored in cooperation with Fisheries and Oceans Canada and the Ministry of the Environment.

Protection of the ecological integrity of the reserve is best achieved by prohibiting public use of the site. Limiting the use of the site will allow for ecological processes to occur unimpeded and limits damage from recreational uses. Additionally, signage indicating that the area is a nature reserve and protected for its conservation values may deter trespass and further damage to the site.

5.1.7 Fire Management

The David Otter Nature Reserve is close to residences and frequently used recreational areas. Fire suppression is advised for the protection and safety of recreational users on adjacent park and public lands and for the protection of adjacent private properties and improvements. Fire protection is provided for by the Bowen Island Fire Department.

5.1.8 Capacity

The Islands Trust Fund has limited staffing capabilities to undertake long term management of the properties it owns and has in the past relied heavily upon local groups and organizations to undertake management and monitoring activities under various partnership arrangements. Monitoring of Islands Trust Fund properties occurs on an annual basis and a proposed monitoring route is included as an appendix to this report. Annual monitoring of this property is deemed adequate to assess the success of most proposed management actions.

In regards to the implementation of management actions, such as the rehabilitation of off-road vehicle damage and invasive species removal, additional volunteer labour should be recruited. There are very few long term management actions required for this property and the Bowen Island Conservancy and the donors (current neighbor) of the property are good options as local management bodies to carry out short term recommendations. The donors have expressed an interest in providing support in this capacity.

5.2 Management Strategies

The following section outlines the priorities for management and recommendations as outlined above. General management direction for the David Otter Nature Reserve is to allow for natural ecological processes to continue without human intervention unless intervention is required for safety reasons.

Immediate Management Strategies
Immediate management strategies are intended to be completed within one year; or as soon as resources permit.

Action Item 1: Erect signage at the entrance to the easement off of Hikers Trail Road to deter trespass by the public. This access point is located on the private property to the north of the reserve (belonging to the donors).

Action Item 2: Move gate on Hikers Trail Road to deter off-road vehicle use of the reserve and to discourage parking in this location in cooperation with the Bowen Island Muncipality. Re-location of gate should be to an area in which localized topography (such as steepness of bank) prohibits vehicles from by-passing the gate and in an area that does not encourage similar parking issues.

Action Item 3: Erect signage indicating that the trail made by off-road vehicles in the western corner of the reserve is closed to vehicle usage and erect barriers at both access points off of Hikers Trail Road to deter further use of this area.

Short-term Management Strategies
Short-term management strategies are intended to be initiated within the first two years; or as resources permit.

Action Item 4: Begin a long term removal strategy to address English holly within the reserve.

Action Item 5: Conduct a spring/summer vegetation and wildlife inventory to further identify potential rare species and/or invasive and exotic species. Address the removal of any invasive/exotic species if identified.

Medium-term Management Strategies
Medium-term management strategies are those that should be initiated within three to five years; or as resources permit.

Action Item 6: Explore options to rehabilitate damage by previous off-road vehicle usage to the western corner of the reserve, if natural regeneration is deemed inadequate. The damaged area is highly compacted and lacks open canopy, which may slow the natural regeneration process. Any planting of native vegetation will require soil preparation and the use of shade tolerant species.

Long-term Management Strategies
Long-term management strategies are those that should be initiated within five to ten years, or as resources permit.

Action Item 7: Continue monitoring the success of English holly removal and any other additional exotic or invasive species that have been identified for removal within the reserve.

Action Item 8: Assess the success of rehabilitation efforts in the western corner of the reserve damaged by off-road vehicles and re-examine management strategies if deemed unsuccessful.

6.0 Conclusion

The David Otter Nature Reserve was donated to the Islands Trust Fund by a landowner with a long term vision for its natural conservation value and significance to the Bowen Island community. This property will protect in perpetuity several rare and endangered plant communities. In time, the reserve will be valued as an important link in a protected areas network that includes Crippen Regional Park and the Mount Gardner Crown lands.

7.0 References

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8.0 Appendices

Appendix A. Environmental Inventory Data

A basic inventory of the reserve was conducted on January 31, 2007. The inventory was completed following the Islands Trust Fund Natural Area Protection Tax Exemption Program (NAPTEP) guideline and the provincial Biogeoclimatic Ecosystem Classification (BEC) system.

Methodology

A basic inventory of indicator species from each vegetation type was completed. Data were collected from $40m^2$ plots for shrubs, herbs and mosses, while tree data were collected from visual approximations of one hectare plots (where possible). The species lists are not considered to be comprehensive.

Note that the vegetation species and percent cover indicated in the following descriptions are a reflection of the time of year in which the survey was completed. Herbaceous vegetation was identified, but percent cover was generally not estimated as it was not considered to be accurate. As well, crown closure was estimated based on the expected full summer canopy cover.

Classification of the vegetation types to the BEC site series level was completed was based on slope position, aspect and indicator vegetation. Soil moisture and nutrient regimes were estimated from the previously described features as soil pits were not dug.

Floral Species Lists

The following tables contain floral species identified in each vegetation type.

Table 7. Species List for Vegetation Type 1

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A1	<1	30m+	1m+
western red cedar	*Thuja plicata*	A1	<1	30m+	1m+
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A2	5	30-45cm	25m+
western hemlock	*Tsuga heterophylla*	A2	15	30-45cm	25m+
western red cedar	*Thuja plicata*	A2	20	30-45cm	25m+
red alder	*Alnus rubra*	A3	3	15-25cm	10-20m
western hemlock	*Tsuga heterophylla*	A3	7	15-25cm	10-20m
western red cedar	*Thuja plicata*	A3	20	15-25cm	10-20m

Shrubs (*invasive)					
dull Oregon grape	*Mahonia nervosa*	B	20		
English holly*	*Ilex aquifolium*	B	<1		
red huckleberry	*Vaccinium parvifolium*	B	5		
salal	*Gaultheria shallon*	B	20		
Herbs					
sword fern	*Polystichum munitum*	C	25		
Moss and Lichen					
flat moss	*Plagiothecium undulatum*	D	5		
Oregon beaked moss	*Eurhynchium oreganum*	D	23		
stepmoss	*Hylocomium splendens*	D	7		
unidentified mosses		D	5		

Table 8. Species List for Vegetation Type 2

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
western red cedar	*Thuja plicata*	A1	<1	30m+	80cm
bigleaf maple	*Acer macrophyllum*	A2	3	20-25m	25-40cm
red alder	*Alnus rubra*	A2	7	20-25m	25-40cm
western hemlock	*Tsuga heterophylla*	A2	15	20-25m	25-40cm
western red cedar	*Thuja plicata*	A2	20	20-25m	25-40cm
red alder	*Alnus rubra*	A3	5	15-20m	10-20cm
western hemlock	*Tsuga heterophylla*	A3	2	15-20m	10-20cm
western red cedar	*Thuja plicata*	A3	3	15-20m	10-20cm
Shrubs (*invasive)					
English holly*	*Ilex aquifolium*	B	<1		
red huckleberry	*Vaccinium parvifolium*	B	<1		
western hemlock	*Tsuga heterophylla*	B	2		
western red cedar	*Thuja plicata*	B	3		
Herbs					
sword fern	*Polystichum munitum*	C	40		
Moss and Lichen					
coastal leafy moss	*Plagiomnium insigne*	D	<1		
electrified cat's-tail moss	*Rhytidiadelphus triquetrus*	D	<1		
flat moss	*Plagiothecium undulatum*	D	5		
Oregon beaked moss	*Eurhynchium oreganum*	D	25		
stepmoss	*Hylocomium splendens*	D	5		
unidentified mosses		D	5		

Table 9. Species List for Vegetation Type 3

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A1	2	30m+	1.7m
western hemlock	*Tsuga heterophylla*	A1	3	30m+	1.7m
bigleaf maple	*Acer macrophyllum*	A2	3	25-30m	25-40cm
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A2	7	25-30m	25-40cm
western hemlock	*Tsuga heterophylla*	A2	15	25-30m	25-40cm
western red cedar	*Thuja plicata*	A2	10	25-30m	25-40cm
red alder	*Alnus rubra*	A3	10	12-16m	15-20cm
Sitka spruce	*Picea sitchensis*	A3	<1	12-16m	15-20cm
western hemlock	*Tsuga heterophylla*	A3	5	12-16m	15-20cm

western red cedar	*Thuja plicata*	A3	5	12-16m	15-20cm
Shrubs					
red huckleberry	*Vaccinium parvifolium*	B	<1		
vine maple	*Acer circinatum*	B	<1		
Herbs					
bracken fern	*Pteridium aquilinum*	C			
deer fern	*Blechnum spicant*	C			
sword fern	*Polystichum munitum*	C	75		
Moss and Lichen					
coastal leafy moss	*Plagiomnium insigne*	D	10		
flat moss	*Plagiothecium undulatum*	D	5		
palm tree moss	*Leucolepis acanthoneuron*	D	5		
unidentified mosses		D	20		

Table 10. Species List for Vegetation Type 4

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A1	5	30m+	1.7m
western red cedar	*Thuja plicata*	A1	1	30m+	1.7m
bigleaf maple	*Acer macrophyllum*	A2	5	20-25m	25-35cm
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A2	5	20-25m	25-35cm
red alder	*Alnus rubra*	A2	5	20-25m	25-35cm
western hemlock	*Tsuga heterophylla*	A2	10	20-25m	25-35cm
western red cedar	*Thuja plicata*	A2	15	20-25m	25-35cm
western hemlock	*Tsuga heterophylla*	A3	5	10-15m	15-20cm
western red cedar	*Thuja plicata*	A3	10	10-15m	15-20cm
Shrubs (*invasive)					
dull Oregon grape	*Mahonia nervosa*	B	<1		
English holly*	*Ilex aquifolium*	B	1		
red huckleberry	*Vaccinium parvifolium*	B	5		
western hemlock	*Tsuga heterophylla*	B	2		
western red cedar	*Thuja plicata*	B	2		
Herbs					
bracken fern	*Pteridium aquilinum*	C			
sword fern	*Polystichum munitum*	C	65		
Moss and Lichen					
electrified cat's-tail moss	*Rhytidiadelphus triquetrus*	D	<1		
flat moss	*Plagiothecium undulatum*	D	5		
Oregon beaked moss	*Eurhynchium oreganum*	D	40		
stepmoss	*Hylocomium splendens*	D	10		
unidentified mosses		D	10		

Appendix B. Photos

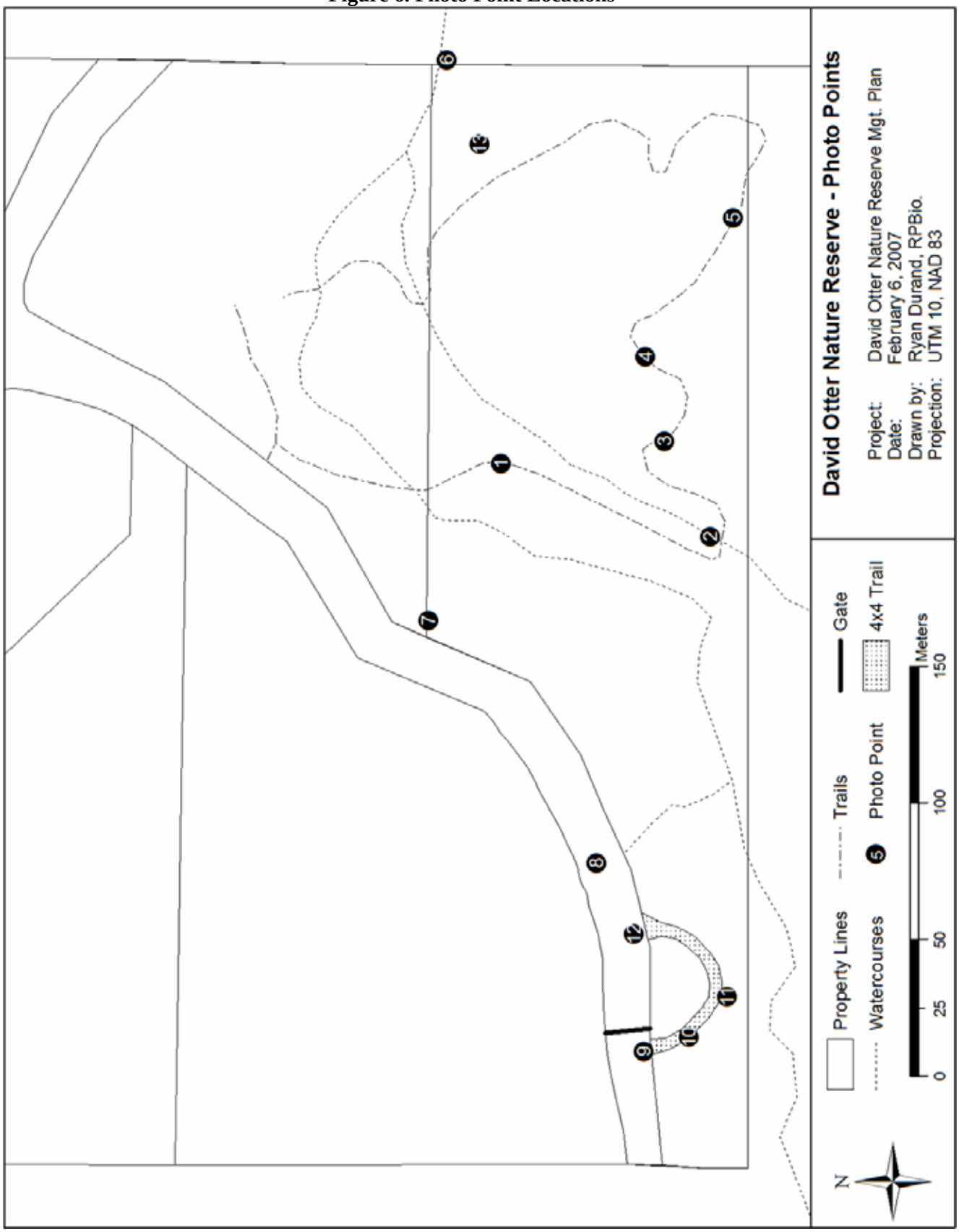
Photographs were taken during the vegetation inventory on January 31, 2007 with a Pentax *stD 6.1 megapixel Digital SLR Camera (Table 11). Photos were not taken from marked locations and a tripod was not used. Focal length and all other variables were adjusted as required to document the given feature. Locations of all photos were mapped with a differential GPS with an accuracy of 1 to 5 metres (Figure 6). Digital copies of all photos are held by the Islands Trust Fund.

Where applicable, the general direction in which the photo was taken is given. Note that *NA* indicates that the direction of the photo was not recorded.

Table 11. List of Photos

Photo Point	File Name(s)	Direction	Description
1	1626 – 1629	S, SW, N, NE	Start of trail on old skid road (well easement) used by previous owners for dog walking.
2	1630 – 1634	NE, N, SW, W, NA	Trail crossing over intermittent stream near well. Some minor erosion from trail, significant natural erosion (bed down grading).
3	1635	NA	Example of sporadic veteran Douglas-fir.
4	1636 – 1639	NW, S, SW, N	Example of well used snag and general shots of forest.
5	1640	NW	Example of trail maintenance – cut blow down.
6	1641 – 1643	W, S, SW	Creek at north eastern IP.
7	1644 – 1646	NE, E, S	Example of forest at north western reserve IP.
8	1647 – 1649	E, SE, SW	Ditch from culvert that drains into reserve and creek. Recently excavated gravel on bank.
9	1650 – 1652	E, S, SW	Gate across Hikers Trail Road and shots of 4x4 road and down Hikers Trail Road.
10	1653 - 1655	N, SE, SE	End of 4x4 showing deep recent ruts and cut hemlock sapling.
11	1656 - 1659	NE, SE, NW	Middle of 4x4 trail.
12	1660	S	Entrance to 4x4 Road from Hikers Trail.
13	1661 - 1664	NW, N, SE, S	Example of Veg. Type 3 on steep slope above creek.

Figure 6. Photo Point Locations



Appendix C. Proposed Monitoring Route

The following section and map (Figure 7) describe key monitoring points on the reserve. If the recommendations presented in this management plan are enacted, then the monitoring route will require revisions. As well, general observations (such as trail condition) are required in addition to the six key sites.

Key monitoring sites (list numbers correspond to numbered sites on Figure 7) are as follows:

1. Access point from private property. Ensure that signs are in place and assess their general condition.

2. Access point. Start of trail on easement. Assess general condition of trail by walking the entire circuit. Also look for signs of appropriate trail maintenance, invasive species, and appearance of reserve along property lines.

3. Stream crossing. Check condition of trail at stream crossing to ensure use is not damaging stream.

4. Culvert and ditch drain. Check culvert that drains ditch system into reserve. Ensure it is properly maintained and functioning (i.e. not blocked, causing erosion, etc.). Check for evidence of sediments or other harmful material that may be entering streams.

5. Entrance to 4x4 trail. Check to see if prescribed methods for blocking 4x4 access and restoration efforts are in place and functioning. Ensure signage is in place and has not been vandalized.

6. Exit from 4x4 trail. Check to see if prescribed methods for blocking 4x4 access and restoration efforts are in place and functioning. Ensure signage is in place and has not been vandalized.

Figure 7. Proposed Monitoring Route