

Lindsay Dickson Nature Reserve Management Plan

Denman Island, British Columbia



PREPARED FOR:



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INITIAL PLAN PREPARED BY: Denman Conservancy Association, 2002

FIRST REVISION APPROVED BY:

**Islands Trust Conservancy, May 26, 2020 by Resolution Number: ITC-2020-014
Denman Conservancy Association, July 20, 2020**

Executive Summary

Islands Trust Conservancy acknowledges and respects that Sla-dai-aich/Ihaytayich (Denman Island) is within the traditional territory of Coast Salish Peoples, whose historical relationship to the land, culture, and spirit of this place continues to this day. Islands Trust Conservancy is committed to honouring the rich history of Indigenous stewardship in the lands and waters of the Islands Trust Area and to building mutually respectful relationships between Indigenous and non-Indigenous partners in conservation. Therefore, this Management Plan for Lindsay Dickson Nature Reserve is a living document that will evolve as opportunities for knowledge sharing arise and understanding grows¹.

Lindsay Dickson Nature Reserve is a 53-hectare forested property centrally located on the east coast of Denman Island between Graham Lake and Lambert Channel. Most of the Reserve is mature coastal Douglas-fir forest, with approximately three hectares of untouched old-growth forest. More than 0.5 kilometres of creek and wetland ecosystems add to the Reserve's biodiversity. Recent inventories revealed five rare species and four rare ecological communities within the Reserve. Another twelve rare species are expected to use the Reserve based on previous observations or because they are present in similar habitats nearby. The Reserve is publicly accessible; the shoreline presents a scenic vista of sandstone formations and pebble beaches, while the upland trails provide pleasing walks under a multilayered forest canopy.

The Reserve is named after the Lindsay-Dickson family, who were the landholders from the early 1900s until shortly after 1990, when the Denman Conservancy Association (DCA) initiated efforts to conserve the property. The original homestead supported a small farm, but much of the land remained largely undisturbed. While most of Denman's old forest was being logged, Mrs. Lindsay-Dickson is said to have insisted on protecting the ancient forest and creek near the house. The Reserve was later divided from the old homesite, and with the assistance of DCA it was purchased by the Province of British Columbia in 2001 and then transferred to the Islands Trust Conservancy. A conservation covenant held by DCA was registered in 2008. The Reserve is managed by DCA under contract to the Islands Trust Conservancy.

This management plan updates the first plan, which was written by DCA in 2002. Seven trails were developed during the intervening years and are actively used by the public today. The logging disturbance in the centre of the Reserve, which occurred immediately prior to the land being protected, is now barely noticeable, and even the log landing site is well vegetated. The ancient forest portion remains much the same, although the very large trees on the ground are reminders of the effects of storms and time. Most of the rest of the forest is more than 100 years old, with many older veteran trees intermixed. Ongoing efforts to control Scotch broom (*Cytisus scoparius*) and English Ivy (*Hedera helix*) have been fairly successful. However, the control of English holly (*Ilex aquifolium*) will require a more specific program, as holly is becoming a major understory component throughout the Reserve under the shaded multi-story forest canopy.

¹ First Nations/reconciliation content written by Lisa Wilcox, Islands Trust

A major long-term management concern will be adjusting to the changing climate. The recent deaths of several western redcedars (*Thuja plicata*) in the Reserve are among the first of many possible ecological impacts of progressively warmer and drier conditions, particularly in summer. Proposed management actions address topics such as monitoring programs, trails, and additional conservation opportunities. Management actions also include envisioning vegetation composition changes, preparing for increased threat of wildfire, and developing new approaches to handle the spread of non-native invasive species, all of which may be necessary as climate change impacts the Reserve.

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Acknowledgements

The Lindsay Dickson Nature Reserve is the flagship property for conservation on Denman Island and, as such, for more than three decades it has received the dedicated support of many individuals and organizations. In particular, the author acknowledges the DCA directors and members and the Denman community for their tireless efforts towards protecting the land in perpetuity. Greatly appreciated are the early proponents and members of the Lindsay Dickson Committee who have since passed away: Dave Fraser, George Ferry, Jim Bohlen, and Glen Snook. Other helpful and now deceased DCA board members include Bill Limin, Jean Allen and Jennifer Inderwick. Support by the former MLA Evelyn Gillespie was also given. Former Lindsay Dickson Committee members who are still supporting various conservation projects include Des Kennedy, Juan Barker, Anne de Cosson, Larry Berg, Bentley Le Baron, Susan-Marie Yoshihara, Larry Lapore, and Jenny Balke.

This revision of the management plan benefited from the work of many, including those who participated in writing the first management plan: Sarah Gibson, Kel Kelly, Jim Matthew, Ted Trueman, Don Chamberlain, Jennifer Balke, Carolyn Stewart, the Lindsay Dickson Committee, and the DCA Board. The author thanks all those who contributed data to this revision (Table 1). As always, my sincere appreciation and apologies to the varied plant and animal occupants of the Reserve for my trampling and voyeurism.

Table 1. Management Plan Contributors

Name	Position/Affiliation	Professional Accreditation or subject expertise	Contribution
Jennifer Balke	Principal, Ecofocus Environmental Consultants	Registered Professional Biologist	Ecological inventory, Trimble and Garmin data collection, GPS mapping, historic data, document additions and review
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Lisa Wilcox	Senior Intergovernmental Policy Advisor	B.A. Psychology Indigenous Knowledge Holder	Reconciliation/Indigenous Knowledge Holder and editing
Erika Bland	DCA Land Manager	M.A. Environmental Studies (Political Ecology)	Facilitation and write-up of the community consultation, and document review
Denman Conservancy Association	DCA Lands Committee, DCA Board, and other members of the Denman Island Community	Varied	Contribution to information gathering, and document review (DCA Lands Committee)

1 Introduction

Sla-dai-aich/Ihaytayich (Denman Island) is situated within the traditional and treaty territories of the Coast Salish Peoples, who share a rich history of stewardship in the lands and waters of the Islands Trust Area that inspires the work of Islands Trust Conservancy (ITC) and its partners. Lindsay Dickson Nature Reserve was established by the Islands Trust Conservancy in 2001. The land is further protected by a conservation covenant held by the Denman Conservancy Association (DCA). The long engagement of the community to protect the land created a legacy of community interest and partnership in the stewardship of the Reserve. This document is the first revision of the original management plan, which was completed in 2002.

Lindsay Dickson Nature Reserve is located on central Denman Island and extends from the east coast, along Lambert Channel, almost to the shore of Graham Lake. The Reserve protects old-growth and mature forests of the Coastal Douglas-fir moist maritime biogeoclimatic zone (CDFmm) (Photo 1), one of the rarest ecosystem types in British Columbia. Five rare species and four rare ecological communities were recently identified in the Reserve. A creek system meanders through a flat portion of the Reserve, creating a mosaic of wet riparian habitat with an interconnected, partly open-water wetland. The 500-metre length of oceanfront comprises gently sloping, low coastal bluffs that drop down to picturesque sandstone cliffs and boulders, as well as pebble beaches.



Photo 1. Old growth forest in the Lindsay Dickson Nature Reserve.

A network of walking trails on and adjacent to the property is enjoyed by the public. Five connected trails within the reserve can be accessed from the main entrance. Additional trails adjacent to the southwest corner of the Reserve lead to Graham Lake and are well used in summer to reach a popular swimming dock. Two more trails lead from East Road through the Reserve to the ocean shoreline. Walking trails pass interesting features (Figure 1) such as the

'Buddy Trees' (Photo 2)², which are mixed-species groups of large trees growing together on either side of a scenic colonnade-like section of the main trail (Photos 2 and 3).



Photo 2. The 'Buddy Trees' along the Main Trail colonnade in the middle of the Reserve.



Photo 3. Colonnade of trees on the Main Trail.

1.1 Islands Trust Conservancy

Since time immemorial, the lands and waters between Vancouver Island and mainland British Columbia have been home to the Coast Salish People, whose ecological, cultural, and spiritual connections to this place continue to this day. In 1974, the Province of British Columbia recognized this region as a special place within the province where the unique beauty, rural character and diverse ecosystems should be protected for future generations. Through the *Islands Trust Act*, the province established the Islands Trust, a local government, with the following mandate (known as the Object of the Islands Trust):

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 2019a)

² The location of all photographs is given in Appendix 1.

In 1990, through the enactment of a section of the *Islands Trust Act*, the Province established the Islands Trust Fund, now called the Islands Trust Conservancy, as a conservation land trust to assist in carrying out the “preserve and protect” mandate. Part 6 of the *Islands Trust Act* establishes the corporate status, responsibilities, and governance structure of the Islands Trust Conservancy. The Board of the ITC is one of the sixteen corporate entities³ charged to uphold the Object of the Islands Trust. Since 1990, the ITC has protected over 1,300 hectares (3,220 acres) of land as nature reserves and conservation covenants.

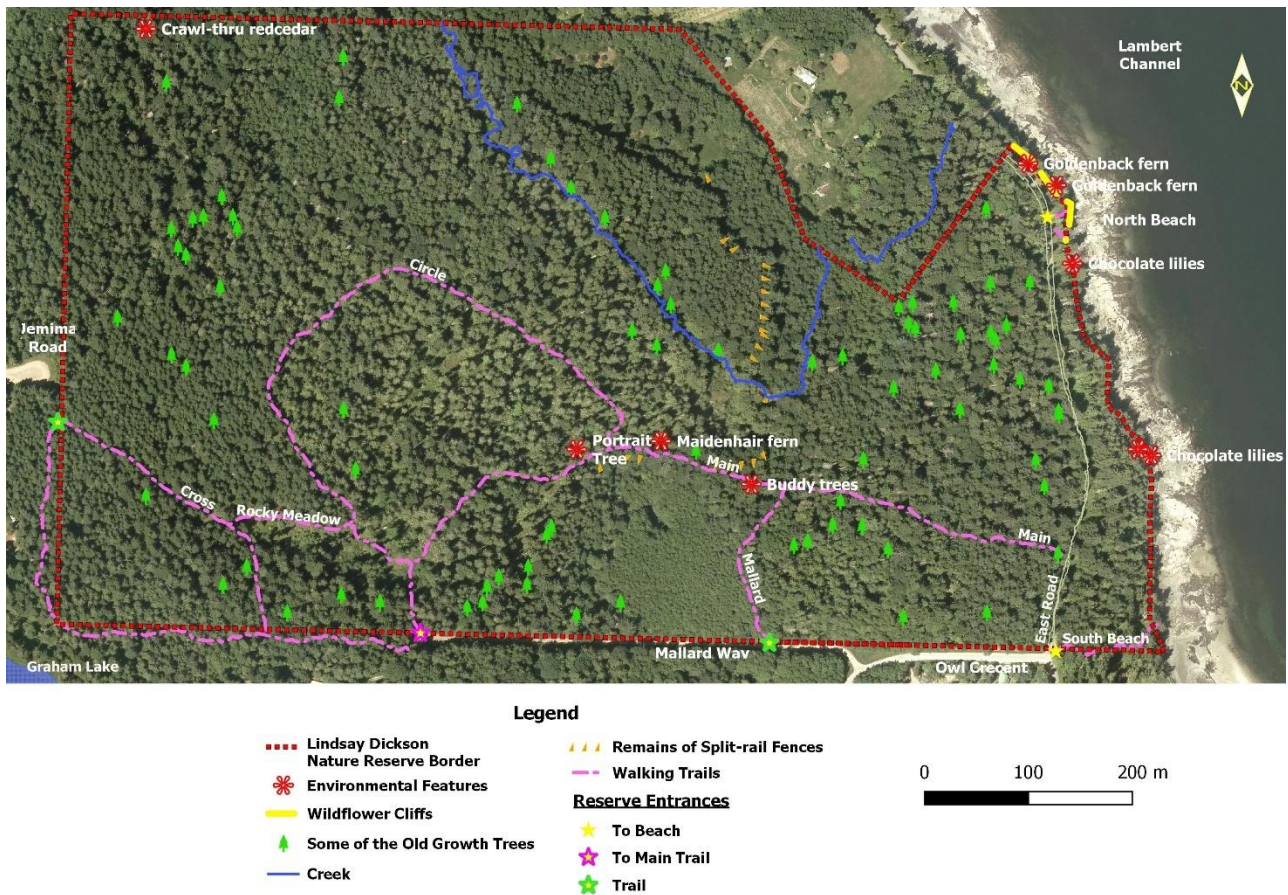


Figure 1. Major scenic features and trails in the Lindsay Dickson Nature Reserve.

The vision of the ITC is that the islands and waters of the Salish Sea will be a vibrant place of culture and ecology where humans live and work in harmony with the natural world. This special place will have a network of protected areas that preserve in perpetuity the native species and natural systems of the islands. Engaged residents and conservation partners will work together to protect large natural areas and key wildlife habitat. Viable ecosystems will flourish alongside healthy island communities.

³The corporate entities charged to uphold the Object of the Islands Trust are the Trust Council, the Executive Committee, twelve local trust committees, one island municipality and the Islands Trust Conservancy Board.

The mission of the ITC is to protect special places by encouraging, undertaking, and assisting in voluntary conservation initiatives within the Islands Trust Area. ITC nature reserves are managed to maintain, preserve and protect the natural features and values of ecosystems.

1.2 Purpose of Islands Trust Conservancy Management Plans

ITC management plans provide background information and set out the direction of property management as follows:

- Provide general and descriptive information on the property, including location, history, and land use.
- Set out the conservation goals and objectives for the property.
- Identify the property's ecological and/or cultural values and features.
- Describe the management issues associated with the property.
- Providing short-, medium- and long-term management recommendations (action items or tasks) on issues such as: species at risk protection, ecological restoration, public access, educational and research opportunities, invasive species management, and signage needs.
- Preserve and protect cultural, spiritual, and sacred locations.

Once the management plan process is complete, the ITC will work to carry out the management actions or strategies identified in the plan, as resources allow. Following general practice and as outlined in the conservation covenant and statutory right of way, the ITC will revise the Management Plan every ten years.

1.3 The Scope of ITC Management Plans

Consistent with the Islands Trust Reconciliation Declaration (Islands Trust 2019b), the ITC recognizes that nature reserves may be places of great cultural and spiritual significance to First Nations. Cooperative management of these protected places will provide opportunities to establish and maintain mutually respectful relationships between the Islands Trust Conservancy and First Nations, as well as upholding the guiding principles of United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)⁴ and the Truth and Reconciliation (TRC) Calls to Action. Relationship-building, knowledge-sharing, healing, and establishment of trust takes time. Islands Trust Conservancy is committed to developing a parallel *Management Plan for Areas of Cultural Heritage and Sacred Significance*. This parallel Management Plan sets out guiding principles for cooperative collaboration between ITC and First Nations with traditional and treaty territories and cultural interests in the area defined by one or more nature reserve. Moreover, the Management Plan defines the common vision, objectives, policies, and best

⁴ The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) is an international instrument adopted by the United Nations on September 13, 2007, to enshrine (according to Article 43) the rights that “constitute the minimum standards for the survival, dignity and well-being of the indigenous peoples of the world.” The UNDRIP protects collective rights that may not be addressed in other human rights charters that emphasize individual rights, and it also safeguards the individual rights of Indigenous people. Canada signed in 2010.

management practices for the nature reserve(s) to ensure that its natural values and cultural heritage and sacred significance are maintained for future generations.

1.4 Protected Area Purpose

The purpose of Lindsay Dickson Nature Reserve is to preserve, in perpetuity, the shoreline, rocky outcrops, creek, wetlands, and other natural values of the Reserve, the rare Coastal Douglas-fir ecosystems, including the significant old-growth portion of the forest, and to maintain the biodiversity of the site for the benefit of the flora and fauna of the Reserve, the residents of the island, First Nations, and the province generally. The land will be protected as a nature reserve in accordance with the objectives of the Islands Trust and the ITC.

1.5 Protected Area Objectives

The objectives for Lindsay Dickson Nature Reserve are to:

1. Preserve and protect the ecological communities, biological diversity, species at risk and natural values of the Reserve;
2. Restore plant and animal communities and ecological processes where necessary;
3. Allow for low-impact public access and nature enjoyment in areas where such uses are appropriate and compatible with protection of ecological values and in compliance with the conservation covenant held by Denman Conservancy Association;
4. Support and protect continued use of areas of sacred and cultural significance by First Nations as per Section 35 of the Constitution Act⁵ and UNDRIP;
5. Support ongoing inventory, mapping and monitoring to guide management actions, provided these activities do not have a major impact on native species or the natural ecological functioning of the Reserve;
6. Allow natural ecological processes and functions to proceed unimpeded, except in the case of wildfire or other exceptional situations where remediation is considered imperative; and
7. Remove invasive species throughout the Reserve where they compromise natural values.

2 Property Information

The Lindsay Dickson Nature Reserve comprises 53 hectares (131.3 acres) of old-growth and mature Coastal Douglas-fir forest, three hectares (seven acres) of which have never been logged. The Reserve is strategically located between Graham Lake, a large freshwater reservoir, and the sea. The approximately 530 m of coastline along Lambert Channel consists of nearly 430 m of pebble beaches (Photo 4) stretching between three sandstone points. The northeast shoreline features 100 m of 2 to 3 m-high, continuous sandstone cliffs (Photo 5). The property's underlying sandstone is exposed all along the foreshore and has been eroded into oddly shaped sandstone outcrops (Photo 6). The Reserve also includes more than 500 m of creek and intermittently flooded riparian habitat, with one partially open wetland along the creek and

⁵ Section 35 of the Constitution Act, 1982 recognizes and affirms the existing aboriginal and treaty rights of the aboriginal peoples of Canada and the courts have stated that aboriginal rights include aboriginal title.

many small sedge-wetland patches. The Reserve is bisected by East Road, a public road running along the east coast of Denman, at a varying distance of approximately 10 to 100 m from the shore.



Photo 4. Pebble beaches along the shoreline of the Reserve.



Photo 5. Cliffs along the northern shoreline.

Photo 6. Sandstone outcrop on Reserve shoreline.



2.1 Location

To access the main entrance to the Reserve from the BC Ferries Terminal at Denman West, travel up the 'ferry hill' for 0.4 km and bear right at the junction with Northwest Road. Continue around the curve, staying on Denman Road and bearing left at the junction with Lacon Road. Proceed up a second hill. Travel east for a distance of 4.5 km across the island to the end of Denman Road, to face Lambert Channel. Follow the road as it turns right, becoming East Road. Travel south for 2.8 km, and then turn right at Owl Crescent, which borders the south boundary of the Reserve. Travel 0.1 km on Owl Crescent to the intersection with Mallard Way, and turn right. Continue 0.4 km to the end of Mallard Way, where a sign at the main entrance on the north side of the cul-de-sac provides a map of the property. A trail to Graham Lake runs straight west from this point on a public right-of-way along the southern border of the Reserve.

A second frequently-used public access is located on the west side of the Reserve at the end of Jemima Road. This entrance can be accessed by travelling only 0.4 km south along East Road and turning right at Corrigal Road. Then, travel 0.7 km south to where the road bears right becoming Marcus Road, and travel 0.4 km west to the left turn on to Jemima Road. Continue 1.3 km south on Jemima to the cul-de-sac at the end, where a sign marks the entrance to the Reserve. The trail at this cul-de-sac leads east into the Reserve, with a fork running south along a public access to Graham Lake. A third entrance to the Reserve is located near the east end of Mallard Way, close to the junction with Owl Crescent. This entrance starts at a metal grate over the roadside ditch and leads into the Mallard Way Trail.

2.2 Legal Description

The property consists of two parcels, with the following Parcel Identification Numbers and legal descriptions:

1. Eastern parcel: PID 009-706-071; The SE 1/4 of Sec. 14, Denman Island, Nanaimo District, Except part in plan VIP70081.
2. Western parcel: PID 009-705-911; The SW 1/4 of Sec. 14, Denman Island, Nanaimo District Except the Northerly 40 acres and part in Plan VIP70081.

2.3 Legal Access

Legal access to the property is via road to the cul-de-sac at the west end of Mallard Way. This entrance leads into a network of walking trails within the Reserve that connects to Jemima Road, East Road, and a point further east along Mallard Road, as well as into the trail leading to Graham Lake.

2.4 Landscape Context

Denman Island is situated in the Strait of Georgia, just over 1 km east of Vancouver Island. The northern tip of Denman is approximately 8 km south of the shore of the city of Comox in the

Comox Valley on Vancouver Island. The Reserve is located on the east coast about 12 km south of the northern tip of Denman Island (Figure 2). The Reserve is part of 640 hectares (1580 acres) of protected land on Denman and provides a valuable wildlife corridor between the freshwater in Graham Lake and the sea in Lambert Channel.

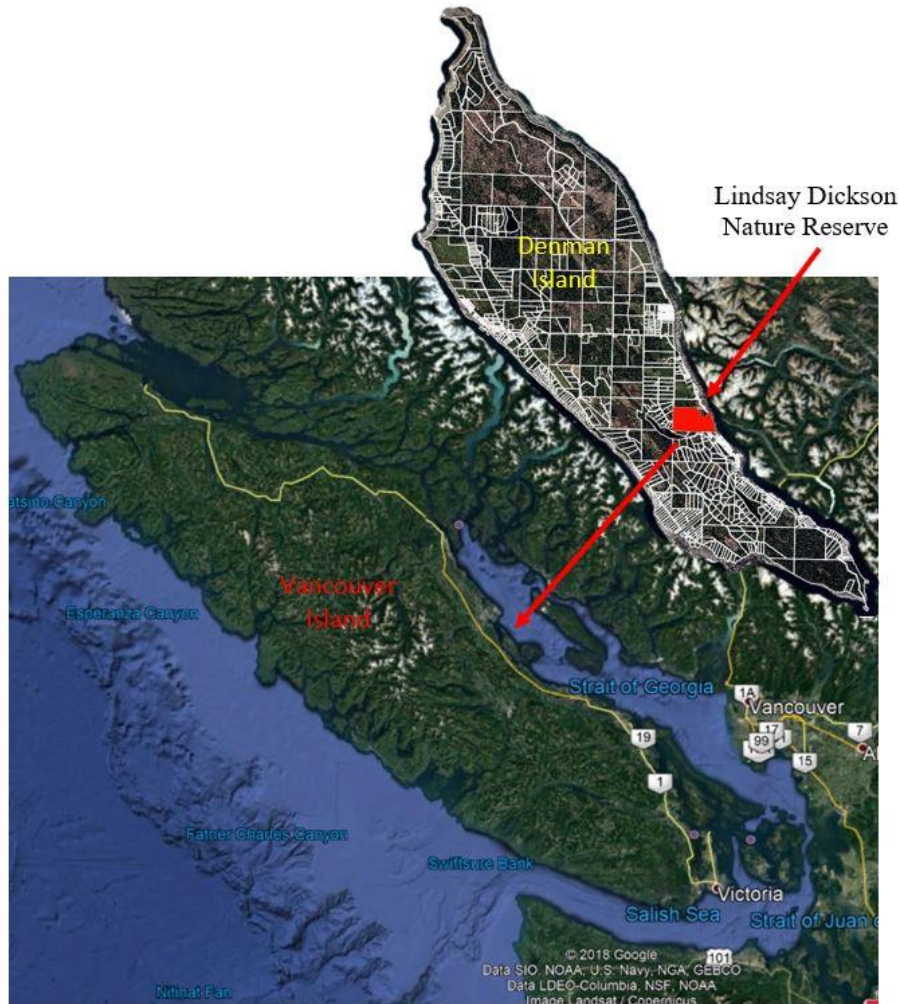


Figure 2. Location of the Lindsay Dickson Nature Reserve.

Denman Island is within the traditional and treaty territories of Cowichan, Halalt, Homalco, K'ómoks, Ts'uubaa-asatx (Lake Cowichan), Lyackson, Penelakut, Qualicum, Snaw-naw-as (Nanoose), Stz'uminus (Chemainus), Tla'amin, We Wai Kai (Cape Mudge), Wei Wai Kum (Campbell River).

Lots surrounding the Reserve vary in size (Figure 3). Directly adjacent to the north of the Reserve are two large lots in the Agricultural Land Reserve; specifically, a 15.8-ha (39-acre) apple orchard and a 4.1-hectare (10-acre) farm that was the early Lindsay-Dickson homestead. Although the rest of the lots bordering the property are smaller, they are all separated from the Reserve by either Mallard Way or an undeveloped dedicated road access. Specifically, to the south are two lots zoned Residential (R1, minimum lot size 1 ha), of 1.1 ha and 0.2 ha, and two

lots zoned Rural Residential (R2, minimum lot size 4 ha), both of about 4 ha. To the west are three lots zoned Rural Residential, ranging from 1.4 to 4 ha in size. Just beyond the southwest corner is a small triangle of land and the lake, which are part of a 59.8-hectare lot zoned 'Forestry' (F, minimum lot area permitted by subdivision is 64 ha). The eastern boundary is the coastline. The Reserve represents the first protected parcel in this area of Denman and, as already noted, is buffered from the nearby land parcels by the adjacent undeveloped dedicated road allowance (DRA),⁶ the lake, and the sea.

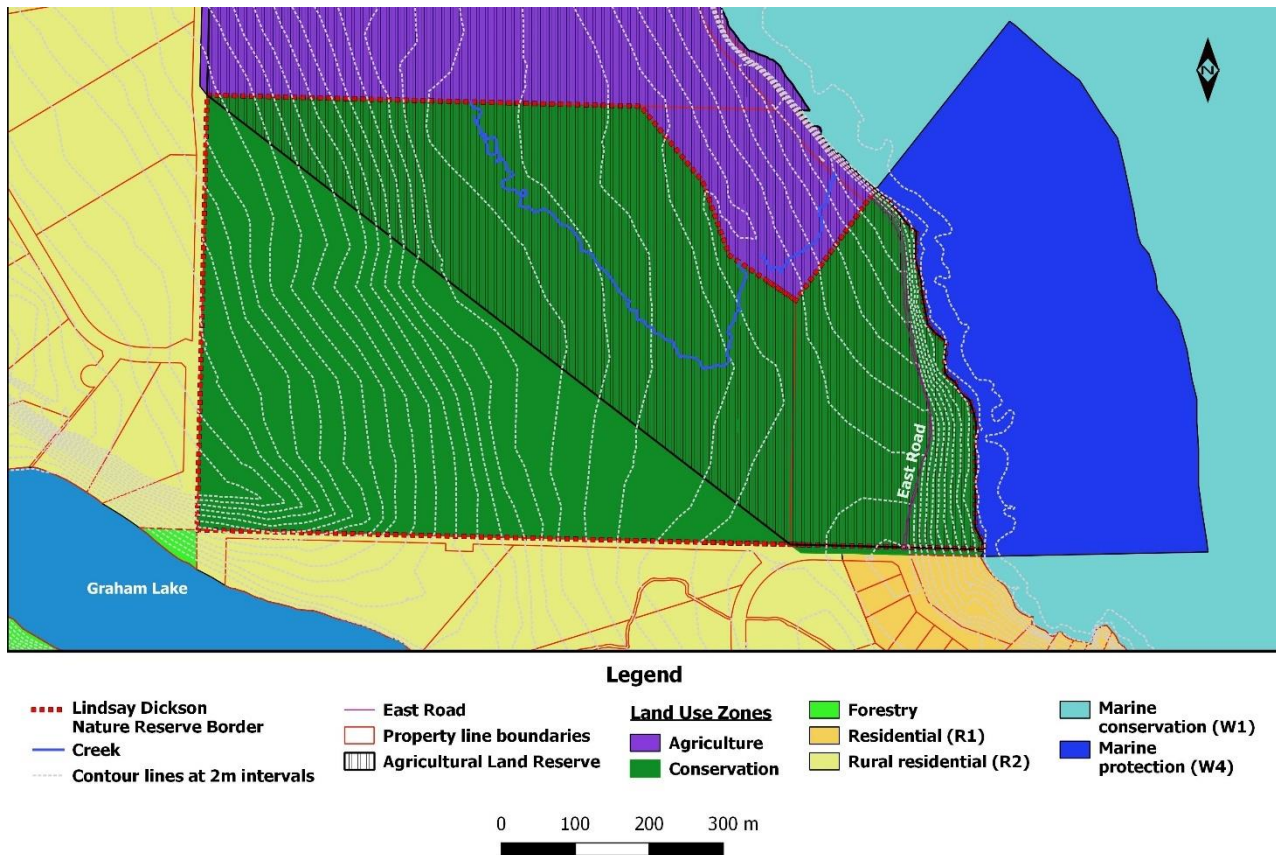


Figure 3. Lands surrounding the Lindsay Dickson Nature Reserve.

2.5 Site History

Denman Island is located within the treaty and traditional territories of the Coast Salish People and the Kwakwaka'wakw. The island has since time immemorial been the homeland and gathering place for First Peoples including the Cowichan, Halalt, Homalco, K'ómoks, Ts'uubaa-asatx (Lake Cowichan), Lyackson, Penelakut, Qualicum, Shíshálh (Sechelt), Snaw-naw-as (Nanoose), Snuneymuxw (Nanaimo), Tla'amin, We Wai Kai (Cape Mudge), Wei Wai Kum (Campbell River); this rich history and cultural heritage continues to this day.

⁶ The term "dedicated road allowance" (DRA) refers to an allowance (normally 66 feet in width) for a road laid out by a Crown surveyor and dedicated to public use.

tuwa ak^ws χοχο† ?a x^w yiχmetet (?a) k^wʊms hēhaw tōms gļē
"Care takers of the 'land of plenty' since time immemorial"
(Language: ?aʔaʔuθəm (eye-uhh-juu-eth-em) Island Comox)

For thousands of years Indigenous People occupied the shoreline of eastern Vancouver Island in a place referred to as, "the land of plenty". This Land of Plenty stretched from what is known today as Kelsey Bay south to Hornby and Denman Island and included the watershed and estuary of the Puntledge River.

The K'ómoks First Nation is located in the heart of the Comox Valley on Vancouver Island. Membership is currently 336 members within four clans: Sathloot, Sasitla, leeksun or Eiksan and Puntledge. Two cultures are identified in their community: Coast Salish (Island-Comox speaking peoples and Pentlatch-speaking peoples) and Kwakwaka'wakw (Kwák wala speaking peoples). K'ómoks people originally occupied sites in Kelsey Bay, Quinsam, Campbell River, Quadra Island, while Pentlatch people occupied sites around Comox Harbour, Baynes Sound and Hornby and Denman islands (K'ómoks First Nation).

Oral history and archaeology describe a rich and bountiful relationship between the K'ómoks and Land of Plenty. Salmon, seal, octopus, herring, cod, deer, ducks, shellfish and a plethora of berries filled the tummies of the young and old alike. The technologies that were applied in harvest, preparation and cultivation of local resources were appropriate to the environment, resource and spiritual beliefs. Fish weirs, duck nets, berry picking techniques and clothing design met the needs of the K'ómoks and for generations provided variety, utility and sense of cultural uniqueness. Mask dances and rhythmic songs filled the winter nights and season. Property was distributed to guests in potlatches and elaborate naming ceremonies honoured the youth, leaders and elders of the communities.

Following contact with Europeans northern groups started a southerly move into K'ómoks territory. A period of conflict displaced the K'ómoks southward to their relatives the Puntledge. Followed by a period of colonial policy and practices, the K'ómoks families have endured hardship and loss of land, resources and cultural connection. Modern leaders are striving to reclaim cultural expression and relationship to the "the land of plenty". According to Island Comox cultural traditions, the origin of the people began at the meeting of the Quinsam (kwaniwsam) and Campbell Rivers. Mary Clifton, the last speaker of the Island Comox dialect, has conveyed the origin story of a man named Shalhk'em and woman named Tisitl'a that "dropped down from the sky" at kwaniwsam (Quinsam) in present-day Campbell River. With them, they brought the mask and garments of the Xwayxway and together became the first ancestors of the Island Comox people. For the descendants of the Shalhk'em and Tisitl'a, kwaniwsam remains the central location in which Island Comox territory moves outward to Salmon River in the north, Cape Lazo in the south, and the islands in the Salish Sea (formally the Strait of Georgia) (K'ómoks First Nation).

At this time no archeological impact assessment or cultural knowledge inventory has been conducted within the Reserve.

European settlement began on adjacent Hornby Island and in the Comox Valley in the 1860s, but it was not until 1874 that the first British settlers homesteaded on Denman. Their farm was in the Madigan area, across the island from Lindsay Dickson Nature Reserve. In 1878, John Graham settled on what became the Lindsay-Dickson property. The Grahams were from New Brunswick and made their living by logging and farming. The family hand-logged the property in the early 1900s, established a small orchard and, for a while, ran a small dairy farm. Despite these activities, most of the land was left untouched.

The Reserve includes most of the remaining forested portion of the family holding purchased around the turn of the century by Dr. Frederick Lindsay-Dickson. Lindsay-Dickson and his wife had been on Denman Island while visiting from England, and he took an interest in the John Graham place. He was a keen sportsman and was particularly interested in Graham Lake, which bordered the property. He built a new house and lived there in retirement for a number of years, before turning the farm over to his son Gerald and returning to England.

Gerald Lindsay-Dickson married a Denman islander, Laura Keenan, and they lived on the farm while their three sons and two daughters were growing up, after which they moved to Victoria and let hired help run the farm on Denman. The A. Chafer, Bill Schmidt, and Henderson families were employed there for a number of years. Later, Gerald Lindsay-Dickson, his wife, and their youngest son Clive returned and farmed in a small way. Clive continued to live in the old home, which was built around 1920 (Isbister 1976).

The process of establishing the Reserve began in 1984 when Glen Snook, elected representative for Denman Island with the Islands Trust, approached the Lindsay Dickson family about conservation possibilities. Several years later, a Comox Valley logger began talking to the family about a possible purchase. In 1989, a group of community members came together to try to protect the property, and met with the family members. That same year the logger's offer of \$375,000 was accepted by the family, but a sale was not finalized due to various complications. DCA was formed in 1990 with a mandate to acquire the property, and in 1991, offered to purchase the property for \$400,000, an offer that was rejected by the family. A renewed offer by the logger triggered a series of court actions, which ended with the logger achieving clear title to the land in 1993. The new land holder expressed a tentative willingness to sell or trade the land, but negotiations over the price and other conditions became complicated.

Over the next several years, six different provincial Ministers of the Environment were actively petitioned for their support. Scientists, journalists, funding agencies, park representatives, government representatives, and other interested parties visited and inspected parts of the forest, and all championed conservation of the forest. Islanders raised over \$200,000 towards the purchase of the property. When negotiations reached an impasse in 2000, the new land

holder brought in logging equipment and began cutting and removing trees from the centre of the property, as described in section 2.6. The project became an exercise in patience and perseverance, as the land holder and the government negotiated the value of the property. DCA, supported by the island as a whole, acted as a go-between, mediator, and cheerleader. A deal was finally reached in 2001.

2.6 Anthropogenic Features

As already noted, First Nations occupied Denman Island in various locations over many thousands of years. Shell middens are found over much of Denman's shoreline, including within Lindsay Dickson Nature Reserve. A western redcedar tree in the old-growth portion of the forest bears an old scar from the removal of a strip of bark, thus appearing to be a culturally modified tree (Photo 7). An archeological survey of the inland portions of the Reserve has not been completed.

There are no buildings on the Reserve, but the last remains of old split-rail fences can be seen in several places (Photo 8). Various known anthropogenic features are summarized in Table 2 and a map of these features, Figure A2-1, is presented in Appendix 2. The property near the old homesite was ditched when the land was first farmed and then again later, as discussed in section 3.4. Evidence of the original logging by the first European settlers is present in the form of huge spring-board stumps throughout most of the property (Photo 9). These are noticeably absent from the old-growth forest. Many of the old spring-board stumps and remaining veteran old-growth trees are heavily burn-scarred, and at least some of this burning was likely caused by humans. A neighbour bordering the Reserve also noted that in the 1970's a portion of the north-central Reserve, to the west of the creek, was messily clearcut by a contractor hired by the Reserve's owners. Thus, the species composition and tree age varies in this area with more mature red alder among older coniferous patches. Evidence of the 2000–2001 logging includes outlines of log skidder trails and low-cut second-growth stumps (Photo 10), but some old reforested, stump-free tracks may date from earlier use. Figure 4 shows the areas where logging occurred in the Reserve. A caged-tree study, begun in 2014 by former DCA Land Manager Andrew Fyson and continued in 2016 by DCA, protected 44 regenerating tree seedlings with wire-fencing (Photo 11), primarily in and near the main entrance to the Reserve (Figure A2-1).



Photo 7. Possible culturally modified tree.

Photo 8. Remains of old split-rail fences.



Photo 9. Springboard stump from historic logging.

Photo 10. Low-cut stump from recent logging.



Photo 11. Caged-tree restoration in Landing, Ecological Community 14.

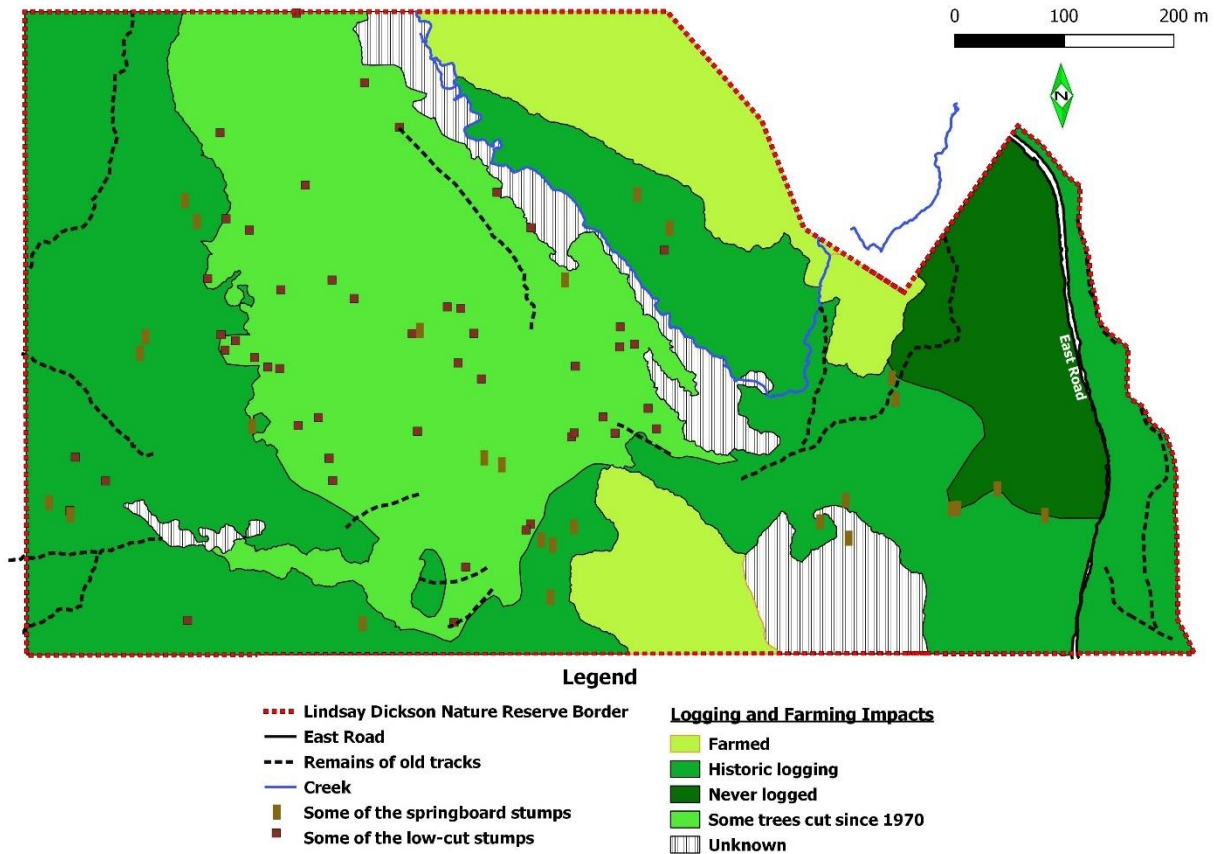


Figure 4. Areas of the Reserve where logging and farming occurred.

Walking trails have been developed in the Reserve (Photo 12, Table 2). Trail routes are shown in Figure 1 in the Introduction, and photos of the trails are provided in Appendix 2. The Circle Trail has a few wooden arrows to indicate the route, but most trails are unmarked. Trail surfaces are the available natural substrate with packed tracks, most about 0.3 m wide, although cuts made through fallen logs are usually 0.5 m wide.

Photo 12. Eastern portion of Main Trail.



Table 2. Anthropogenic features in Lindsay Dickson Nature Reserve

Feature	Location	Description Condition/Surface	Photograph Location
Possible culturally modified tree	In old-growth forest polygon	Western redcedar	Photo 3
Split rail fences	Various locations	Remains of rails, most are rotting	Photo 4
Springboard stumps	Throughout Reserve	On western redcedar and Douglas-fir trees of varying sizes	Photo 5
Low-cut stumps and skidder trails	Mainly in centre of Reserve	Stumps from 2000 logging; narrow, wandering trails	Photo 6
Caged tree study	Mainly in landing polygon	Wire fencing and wooden stakes around young trees	Photo 10
Main Trail	From main Reserve entrance on Mallard Way to East Rd	Firm/grass, dirt, roots, few pebbles, track 0.3-1 m wide, old log over trail near entrance	A2-T-1a
Metal stake	Centre of East Road at the eastern end of Main trail	Low metal stake	A2-T1b
Mallard Way Trail	From the Main Trail near “Buddy trees” feature to Mallard Way	Firm/35-40 cm-wide dirt track through ferns and high grass, log over trail	A2-T-2
Cross Trail	From Jemima Road Reserve entrance across Reserve to Graham Lake access trail on southern border	Firm/dirt, pebbles, roots, exposed sandstone, track up to 1.2 m wide, trail divides around trees near Rocky Trail	A2-T-3
Rocky Trail	From Trail 1 to Trail 3 through Reserve – Rocky Meadow Route	Firm/surface: rock, moss, vegetation, pebbles, track 30-40 cm wide	A2-T-4

Circle Loop Trail	From Trail 1 to Trail 3 through the Reserve – Forest Route	Firm/surface: dirt, pebbles, vegetation, track 30 cm wide	A2-T-5
South Beach Trail	From East Road to beach near Reserve's southeast corner; trail is partially on dedicated road access but wanders into Reserve along southeast border	Moderate steep sections, dirt, roots, duff, track 30-40 cm wide	A2-T-6
North Beach Trail	From East Road to beach near northeast corner of Reserve	Steep, eroding, dirt, track 30 cm wide	A2-T-7
East Road	Runs north-south across Reserve near Lambert Channel shoreline	Paved 2-lane road	Photo 12
Buried utility cable and barbed wire	Along the west side of East Road through the Reserve	Three metal utility access boxes, one of which is damaged, plus strands of an old barbed wire fence, buried in vegetation	Photo 14
Logging activity	Central part of the Reserve	Old narrow skidder trails, stumps cut in 2000-01	Photos 9
Old wire cable	By creek near the border with old homesite property	Cable hanging to the ground	Photo 16

Sign locations and photos are shown in Appendix 2. An identification sign at the main entrance to the Reserve at the end of Mallard Way provides basic information about the Reserve, including a small map of the property, an aerial image, and a request that visitors stay on the paths in the Reserve (Photo A2-S1). Identification signs are also present at the trail entrances at the east end of Mallard Way and the south end of Jemima Road (Photos A2-S2 and A2-S3).

East Road divides the Reserve near the coast (Figure 1, Photo 13). This section of East Road is not gazetted,⁷ and so the land surrounding the driving surface is held by the ITC. Within the Reserve, the graded road edges, roadside ditch, and interruption of the forest canopy are further anthropogenic changes. During the spring in 2019, contractors working for the BC Ministry of Transportation and Infrastructure cut four perceived hazard trees growing close to the road within the Reserve without the consent of ITC or the covenant holder (Photo 14). This incident was a reminder to ITC and DCA of the need to alert agencies periodically that, because this portion of East Road is not gazetted (dedicated), there is no highway right-of-way beyond the paved surface and any routine vegetation maintenance adjacent to the road must receive prior approval by the ITC.

⁷ One method of creating highways in BC was to publish a notice in the British Columbia Gazette and file a copy of the notice on the title to the property in question. This process, called gazetting, ended in 1987. Today, a highway is a public road if it has significant public vehicular traffic and public money has been spent on it; however, if the road has not been gazetted, only the drivable surface is public (MacGregor 2017).

Photo 13. East Road through the Reserve.



Photo 14. Trees cut long East Road by Ministry of Transportation and Infrastructure contractor, spring 2019.

The Reserve has other anthropogenic features that remain from earlier management of the land. A buried telephone utility cable with three raised metal access housings (16 cm wide and 49 cm high; Photo 15) runs along the west side of East Road, where there were also strands of an old barbed wire fence. This fence material was removed in the fall of 2019. At least one metal culvert runs under East Road in the Reserve. An old metal stake marks the end of the Main Trail (Photo A2-T-1b). In addition, near the old homesite, a long piece of old wire cable, probably from a long-ago utility line, was seen hanging from an alder tree at a height of 3 m and ending in coils on the ground (Photo 16). This cable will also be removed. Last, some very old cans and a garbage bag were noted for removal.



Photo 15. Old access housing for buried cable.

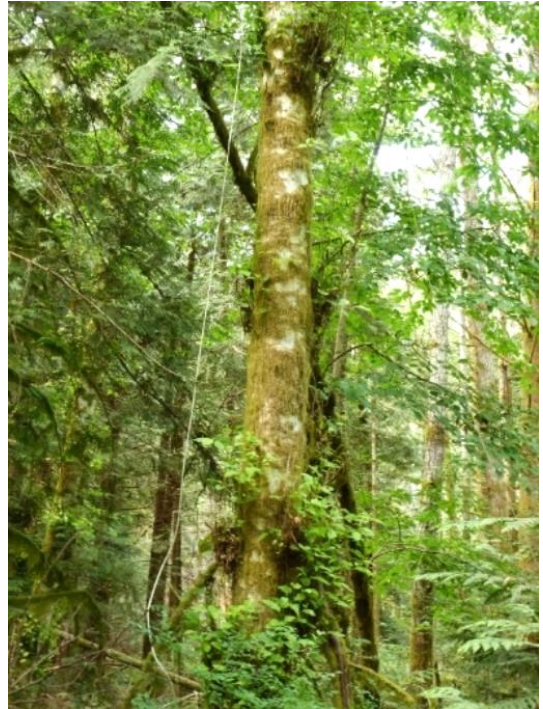


Photo 16. Hanging metal cable.

2.7 Undersurface Rights

Undersurface rights for both parcels comprising Lindsay Dickson Nature Reserve are held by the Province of British Columbia.

2.8 Notations, Charges, Liens and Interests

The land is protected in perpetuity by a Section 219 Conservation Covenant established in 2008 and held by the DCA. The covenant aims to protect, preserve, and maintain the land in a natural state. Specifically, it prohibits any use or activity that might release deleterious substances, cause erosion or loss of soil, introduce biocides, interfere with the hydrology, allow the deposit of foreign material, disturb the land, or tamper with indigenous flora. Legal understanding of the covenant is that Section 35 rights held collectively by Indigenous Peoples with traditional and treaty territories within the area are not impacted by the terms of the covenant. A Section 218 Statutory Right of Way in favour of DCA was also registered in 2008 to allow DCA periodic access to the land for the purpose of ensuring that the terms of the covenant are met on a continuing basis.

2.9 Local Planning Designations

The northeast half of the Reserve is in the Agricultural Land Reserve (Figure 3). The land use designation in the Denman Island Official Community Plan is 'Conservation/Recreation' and the sensitive areas designation is 'Connectivity Area' (Islands Trust 2017a). A Development Permit Area for Riparian Area Regulation (RAR) Streams, Lakes and Wetlands skirts the south boundary of the Reserve, engaging a small area (less than 0.2 hectares) at one point along the southern boundary of the property.

The zoning for the Reserve in the Denman Island Land Use Bylaw is 'Conservation' (CN) (Islands Trust 2017b) (Figure 3). The ocean to the east of the property is zoned 'Marine Protection' (W4) to a boundary some 400 meters offshore. Beyond this, the zoning is 'Marine Conservation' (M1).

2.10 Existing Public and Other Use

Lindsay Dickson Nature Reserve falls within the territory of multiple First Nations, and as such has been a site of cultural activity for thousands of years. There is knowledge and oral history relating to this site that may or may not be shared outside of the membership of a First Nation. As a first step toward strengthening cultural connections to the land that were negatively impacted by European settlement, ITC is exploring the potential of a Management Plan for Areas of Cultural Heritage and Sacred Significance that will support and enhance the continued use of the site by First Nations.

At present, most public use of the Reserve is for walking and quiet appreciation of nature. There are seven walking trails wholly or partially (South Beach Trail) within the Reserve (Figure 1, Table 2, Appendix 2). Two trails, outside the Reserve but along the southwest and northwest borders, lead to Graham Lake through undeveloped dedicated road allowances (DRAs). The Main Trail leads from the entrance on Mallard Way into the Reserve and down to East Road and is well-used by walkers. The Cross Trail through the west portion of the Reserve is used to walk between Mallard Way and Jemima Road. The other trails within the Reserve are mainly used for nature appreciation. In summer, the trails leading to Graham Lake along the borders of the Reserve (DRA trails) are heavily used by foot traffic and occasionally by bikes to access the lake's public swimming dock. Signage in the Reserve forbids hunting and directs the public to keep dogs on leash and refrain from horseback riding (Photos S4-1 to S4-4).

Many people visiting the Reserve or the lake park at the end of Mallard Way, where there is room for several vehicles; however, Mallard Way is narrow and ditched, so large vehicles need to pass carefully. In the summer, lake visitors also park at the end of Jemima Road. Visitors taking the trail to the beach generally park on Owl Crescent, near the southeast corner of the Reserve. Although parking on the shoulder of East Road within the Reserve occurs on occasion, space is limited and somewhat dangerous due to the regular ferry traffic.

Other public use within the Reserve includes vehicular traffic on East Rd, which is the only road along the east side of Denman Island and the main route to the Hornby Island ferry. This route experiences considerable traffic, particularly at times of ferry sailings. As this section of East Road was not gazetted, only the paved surface is actually public.

3 Ecological Inventory

Islands Trust Conservancy acknowledges that there is a wealth of Traditional Ecological Knowledge and a long history of ecosystem stewardship among the First Nations whose territory encompasses Lindsay Dickson Nature Reserve. ITC will strive to work with First Nations knowledge holders to deepen its understanding, improve its stewardship practices, and, ultimately, support the transfer of Traditional Ecological Knowledge to younger generations within First Nations communities to ensure that it is not lost. At this time, the ecological information presented in this management plan was formed using systems that are based in foundations of Western science.

3.1 Ecological Significance

The magnificence of the Reserve's forests is readily apparent. The Reserve protects Denman's tallest continuous community of living organisms from soil to tree canopy, and the property is large enough that the concentration of ecological diversity has a profound impact on the receptive visitor. Walking west in the Reserve, one travels from shoreline rock formations and sandstone bluffs, through never-logged Douglas-fir forest now several hundred years old, across swampy wetlands and creek, upslope through increasingly drier forests, past frequent and remarkable wildlife trees a metre or more in diameter, to finally look down on the sparkling waters of Graham Lake. These varied ecosystems account for the Reserve's ecological significance.

Five rare species and at least four (possibly five) rare ecological communities were identified in the Reserve during the ecological inventory undertaken for the preparation of this plan (Tables 3 and 4, Figure 5). An additional 12 rare species may be present based on previous observations, either in the Reserve or in similar habitats on Denman; these are listed in Table A4-1 in Appendix 4. Other possible rarities await further study.

Table 3. Rare species identified in Lindsay Dickson Nature Reserve in May 2019

Species Name		Status*				
Common	Scientific	Provincial	BC List	Global	COSEWIC	SARA
Northern Red-legged Frog	<i>Rana aurora</i>	S3 (2016)	Blue	G4 (2015)	SC (2015)	1-SC (2005)
Band-tailed pigeon	<i>Columba fasciata</i>	S3S4 (2015)	Blue	G4 (2016)	SC (2008)	1-SC (2011)
Autumn Meadowhawk	<i>Sympetrum vicinum</i>	S3S4 (2015)	Blue	G5 (2015)		
Common woodnymph butterfly, <i>incana</i> subspecies	<i>Cercyonis pegala incana</i>	S2 (2013)	Red	G5T4T5 (2003)		
Western Pondhawk Dragonfly	<i>Erthemus collocata</i>	S3S4 (2015)	Blue	G5 (2016)		

*Rare species status definitions are provided in Appendix 5.

Table 4. Rare ecological communities identified in the Lindsay Dickson Nature Reserve in May 2019

Ecological Community Name		Status		
Common	Scientific	Provincial	BC List	Global
Douglas-fir / dull Oregon-grape (CDFmm/01)	<i>Pseudotsuga menziesii</i> / <i>Berberis nervosa</i>	S1 (2018)	Red	G2
Possible: Western redcedar - Douglas-fir / Oregon beaked moss (CDFmm/05)	<i>Thuja plicata</i> - <i>Pseudotsuga menziesii</i> / <i>Eurhynchium oreganum</i>	S1 (2013)	Red	GNR
Grand fir / dull Oregon-grape (CDFmm/04)	<i>Abies grandis</i> / <i>Berberis nervosa</i>	S1 (2009)	Red	G1
Grand fir / three-leaved foamflower (CDFmm/06)	<i>Abies grandis</i> / <i>Tiarella trifoliata</i>	S1 (2013)	Red	G1
Western redcedar / sword fern - skunk cabbage (CDFmm/Ws53)	<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>	S3? (2012)	Blue	GNR

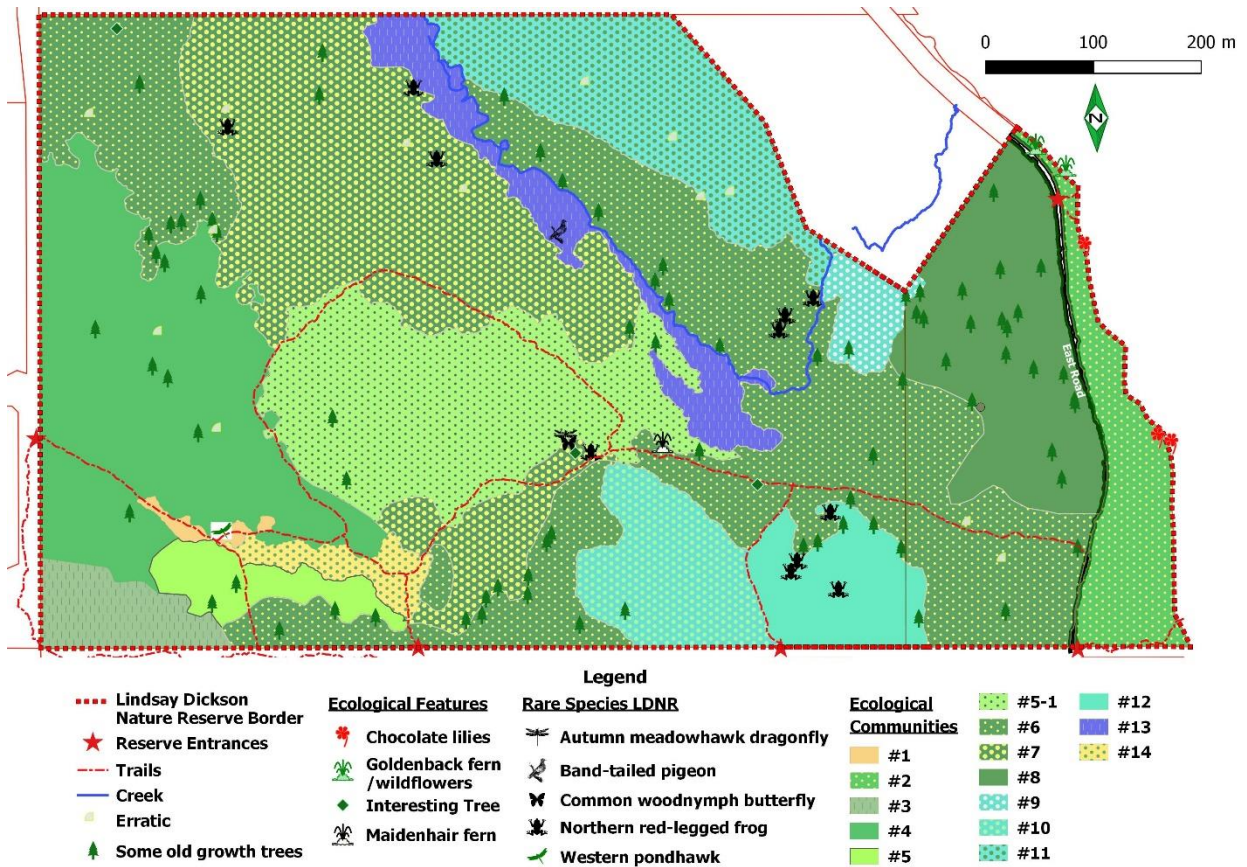


Figure 5. Ecological features of Lindsay Dickson Nature Reserve.

3.2 Climate

The climate on Denman follows a pattern of warm, dry summers and mild, wet winters. Denman is in the rainshadow of the Vancouver Island mountains and the moisture deficit is most pronounced in the summers. Temperatures are moderated by the maritime influence; consequently, the climate in the Strait of Georgia region is generally the mildest in Canada.

Data on the average climatic conditions within the Reserve were obtained from the 1981–2010 Canadian Climate Normals for the Comox weather station, which is located approximately 24 km north of the Reserve. Most precipitation falls from October through March. There is approximately 1.1 m of annual precipitation, nearly all falling as rain (Figure 6; Government of Canada 2019). The warmest period is July and August, with long-term normal maximums of less than 23°C. Long-term minimums from December through February are above 0.5°C.

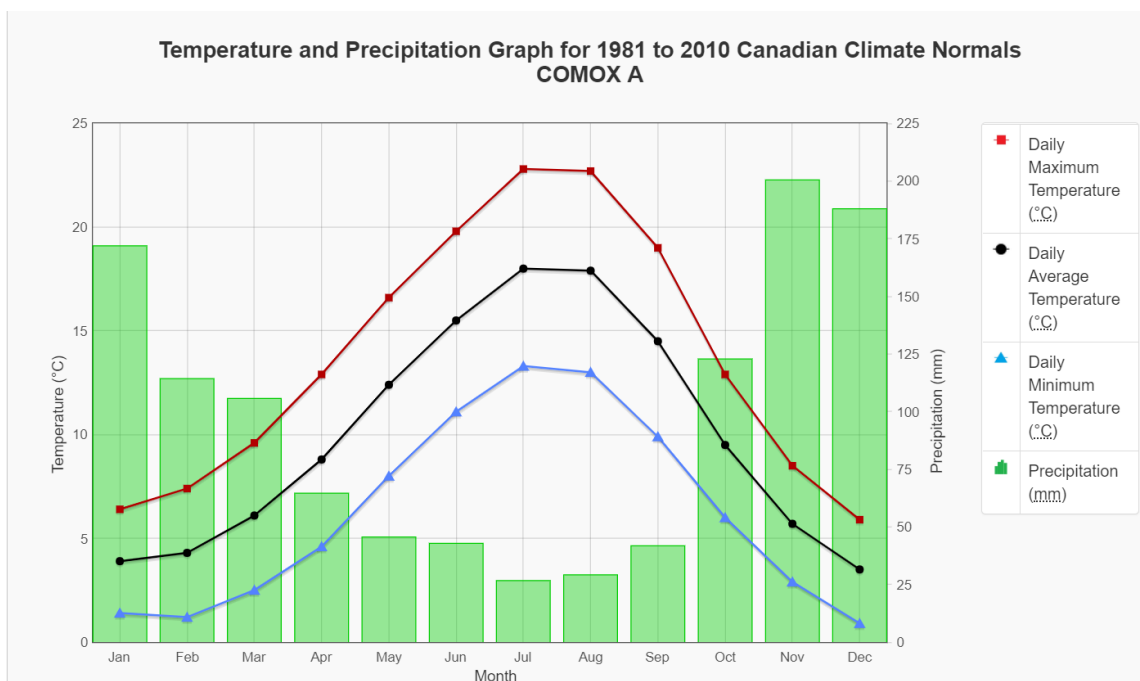


Figure 6. Temperature and precipitation averages for Comox Weather Station, located approximately 24 km north of the Reserve.

The Lindsay Dickson Nature Reserve is exposed to powerful maritime winds and weather systems coming from the southeast up the Strait of Georgia. Over time, tall trees have either adapted to these influences or succumbed to wind throw. Recent high summer temperatures and low annual moisture levels may have been stressful for some of the Reserve’s vegetation, especially western redcedar trees.

3.3 Geology and Physiography

Sediments of the Nanaimo Group underlie all of Denman Island. These are considered to have been deposited as submarine fan complexes deep in the early marine environment some 55 and 87 million years ago (Mustard et al. 1999). Underlying the Lindsay Dickson Nature Reserve are two formations in the Nanaimo Group that slope gently (3 degrees) to sea level from an elevation of 55 m. The De Courcy sediment formation consists of alternating sandstone and conglomerate layers that are relatively resistant to erosion and up to 350 m thick. Exposed at the northeast foreshore area of the property is a portion of the lower Northumberland Formation, formed mainly of shale (mudstone) with thin sandstone beds, and below those layers is the thick sandstone of the De Courcy formation. These bedrock formations are not far below the surface of the Reserve. In addition, glaciers that covered Denman as recently as 14,000 year ago (Clague 1991, Halstead and Treichel 1966) have left large rock fragments or erratics on the surface of the Reserve. Many erratics, consisting of pale granitic material and measuring 1 to 2 m across, are still obvious (Photo 17). Piles of similar rock fragments suggest that some of these erratics may have been blasted into smaller pieces during early farming activities.



Photo 17. Glacial erratic.

The terrain of the Reserve, from the Jemima Road entrance on the western border at an elevation of approximately 57 m, slopes down gradually, averaging 5% to the east, towards Lambert Channel (Figure 7). From the Jemima Road entrance to the southwest corner of the Reserve, the land climbs slightly to a ridge about 61 m above Graham Lake. From this ridge the land slopes down steeply, approximately 29%, towards Graham Lake in the south, ending at the property boundary at an elevation of 48 m. Also, from this ridge, as from Jemima Road, the land slopes more gradually to the eastern seashore. The central wetland area of the Reserve is relatively flat, dropping only 2% over a distance of 330 m. The shoreline bluff, Ecological Community 2 (Figure 6), falls fairly steeply from East Road to the sea, dropping at a slope of 42% for 8 m in the north and 18% for 98 m in the south. Along the northeastern shoreline for about 100 m, a 2-3 m high sandstone cliff drops to the sea, either as shear rock or a slightly undercut formation.

3.4 Hydrology

The Reserve is strongly influenced by water. Much of the surface water in the Reserve comes from the northwest. Extensive areas of slough sedge (*Carex obnupta*) on the adjacent property to the north reflect the impervious nature of the soils and explain the collection of water on the surface during the winter. As this drainage slope on the north side trends to the east and to the south, towards the middle of Reserve, the low north-central portion of the Reserve is water-receiving.

The major movement of surface water through the Reserve during the fall and winter (October to May) is from north to south and then back to the northeast (Figure 7). From midway along the northern border, a linear creek and wetland complex, which is within Ecological Community 13 (Photo 18, Table 5, Figures 7 and 10), conducts water to the south, across two thirds of the Reserve. Just to the north of the Main Trail, the flows widen and deepen into a shallow-water wetland (Central Wetland). This wetland then drains out as a narrow creek that flows northeast, back across the Reserve, through older mature forests. Near the Reserve's northeast

boundary, the land was damaged by the use of logging equipment in 2000–2002. Now, the water flows out of the Reserve into the former Lindsay Dickson homesite as a widened, compacted, overflow channel that has become a sedge wetland (*Carex obnupta*). Beyond the boundary of the Reserve, on the homesite, the creek runs into a pond and then flows, adjacent to the boundary, through old forest to the ocean (Lambert Channel). Surface water within the western half of the Reserve generally drains downhill, with most flowing into and pooling in the flat land in the wetland complex (Photo 18). There are at least two narrow (<5 m wide, 1-2 m deep) drainage channels down the western slope. In the south-central portion of the Reserve, surface water drains out across the Reserve’s southern boundary and contributes to the Windy Marsh/Graham Creek drainage system nearby.

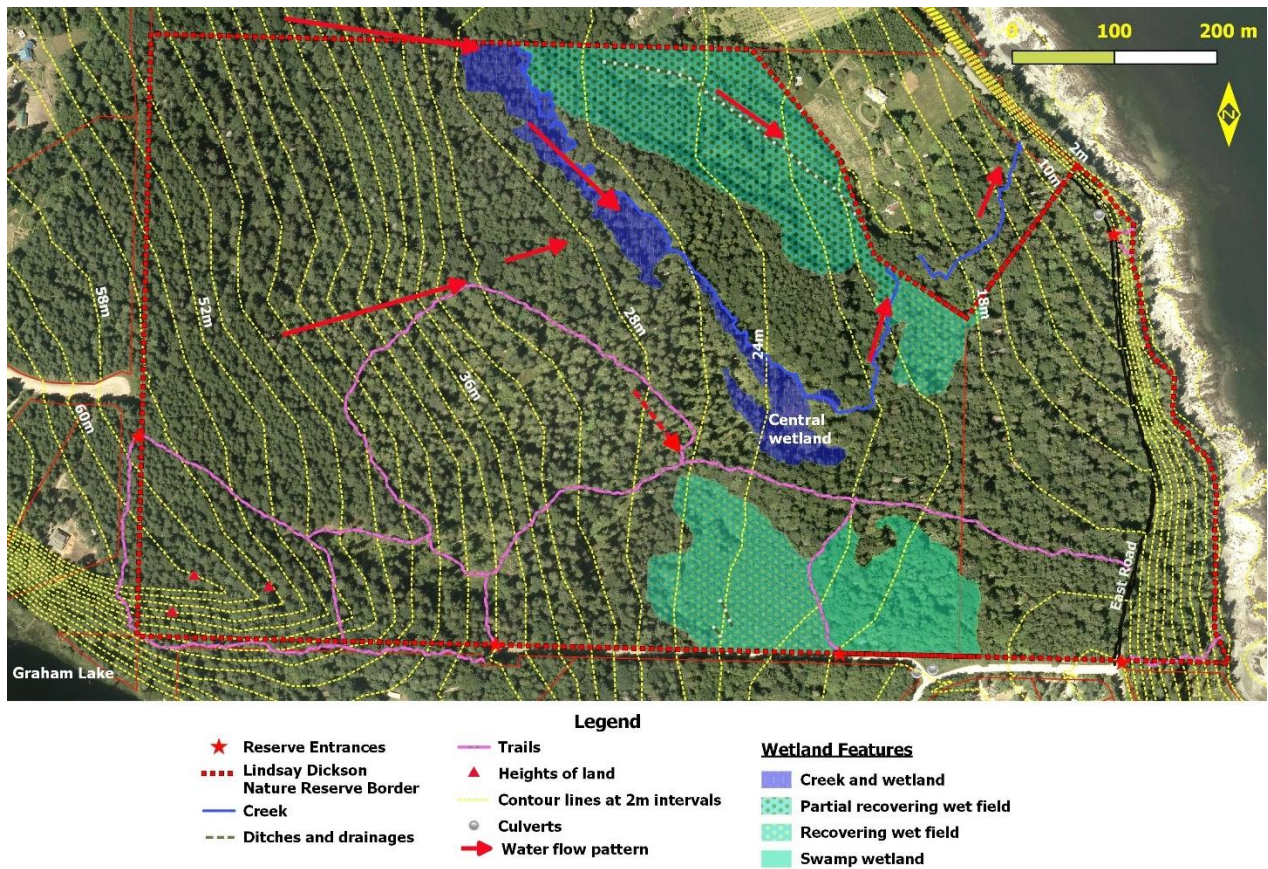


Figure 7. Terrain and hydrology of the Lindsay Dickson Nature Reserve.



Photo 18. Wetland complex in flat bench land along creek.

Ditches also drain a portion of the water flowing across the north-central boundary of the Reserve. A ditch near the northeast corner of the Reserve (Figure 7, Photo 19) was likely constructed when the old Lindsay-Dickson homesite was originally farmed. This ditch drained the farm land in that area, preventing excess water from reaching the homesite. It begins near the centre of the northern boundary, curves around inside and along the old homesite border, and then drains into the homesite pond. Recently, before they knew the location of the Reserve's northeast border, the new residents of the homesite dug a second ditch on the edge of the Reserve, adjacent to but just east of the original one (Photo 20). This new ditch also empties into the homesite pond.



Photo 19. Original drainage ditch in northeast corner of Reserve.

Photo 20. Recently constructed ditch nearby a portion of the original ditch.



The design of the surface water drainage patterns on Denman began with glaciation. Subsurface water flowing through bedrock channels contributed to the various surface water flow-patterns downslope. Over time, surface drainages were modified by major storms and thousands of years of beaver activity. More recently, human undertakings such as logging, farming, road building, and other activities causing surface disturbances have altered the drainage patterns. The creek and wetland complex and the shallow wetland in the centre of the Reserve may have been at least partly created or altered by humans. On the south side, the low-lying central area was likely part of a rich Graham Lake/Graham Creek braided drainage basin. Construction of early logging roads, and then of the Owl Crescent and Mallard Way roads and ditches, and finally the subdivision of smaller lots and associated human activities on the south side of the Reserve probably changed the original drainage patterns.

Near the southwest corner of the Reserve, Graham Lake, a 13-hectare (32-acre) body of freshwater, is separated from the Reserve by the two dedicated road allowances (DRAs), with a small triangle of private land in the centre. To the east of the Reserve, Lambert Channel borders the Reserve. Both bodies of water offer local moisture and temperature modifying effects. In addition, Graham Lake is essential as a year-round source of drinking water for animals in the Reserve. Beaver reside in the lake and some animals, such as dragonflies (Photo 21) and certain amphibians (Photo 22), may breed there, while others, such as birds, bats, mink and river otter, use the lake for foraging. The sea and shoreline are important for many animals for foraging and roosting. Overwintering Harlequin Ducks and many other sea birds (Photo 23) use the shore for sheltering and foraging, as do year-round residents such as river otters (Photo 24).



Photo 21. Common whitetail dragonfly in gap in the Reserve forest.



Photo 22. Northern red-legged frog, common in the forest areas of the Reserve.



Photo 23. Harlequin ducks on the Reserve's shoreline.

Photo 24. River otter using an otter latrine on the Reserve's shoreline.



3.5 Soils

A relatively thin veneer of colluvial deposits and some glacial-till material lies over the underlying sandstone, shale, and conglomerate rock formations in the Reserve. Solid bedrock is exposed or covered with a thin vegetative coating in the Rocky Meadow polygon. Also, cobble and large rocks are prominent on or close to the soil surface in many of the upper- and mid-slope areas (Photo 25). Sandy loam, sometimes with some pebble and smaller rock material, is seen in upturned root wads in the lower-slope areas (Photo 26). The thickness of the Reserve's generally poorly developed soil ranges from less than 10 cm to 2–3 m in the low, flat area near the creek.



Photo 25. Large sandstone slabs and other rocks near the surface.

Photo 26. Pebbles and small cobble in surface soil under up-turned root wad.



As noted previously, surface water drainage tends to flow down the gentle slopes to the centre of the Reserve from the west. Movable sediments have been eroded and carried across the land, largely by water or by earlier glacial ice. On the Reserve, sediments have accumulated in pockets on the gentle and lower slopes, and thus nutrient-richness and soil depth are greatest in the relatively flat creek-wetland basin area (Ecological Communities 5, 7 and 13).

The value of the soils for agricultural use is shown on the Islands Trust's Denman Soil Map (Figure 8; Islands Trust 2019c). Based on field observations, the 'poor' soil area would seem to be restricted to the upper ridge area in the southwest of the Reserve.



Figure 8. Soil agricultural capacity within the Lindsay Dickson Nature Reserve. Figure is adapted from the Islands Trust Soil Map for Denman Island (Islands Trust 2019c).

The provincial government's soil classification mapping (Figure 9) suggests four soil types in three combinations: (1) Royston and Hiller, (2) Royston and Tolmie, and (3) Bowser (Province of British Columbia 2019). The shallow-soil rocky aspect of the southwest corner is a fairly limited combination of the coarse gravely loamy sand and rock fragments of the rapidly draining, acid Hiller soil type combined with the Royston soil type's medium-neutral pH, imperfectly drained, cobbly gravely loam with frequent stones. To the north and east, the slopes become a combination of the Royston soil type and the Tolmie soil type's medium-neutral pH, poorly drained sandy loam without rock fragments. The rest of the flat and gently sloping eastern half of the Reserve is considered the Bowser soil type. This type is a highly acidic variable combination of clay, silt, sand, and gravel with little or no fine gravel or cobble fragments.



Figure 9. Provincial soil classification for the Lindsay Dickson Nature Reserve. Extract covering the Reserve is taken from the provincial soil map for Denman Island (Province of British Columbia 2018).

3.6 Ecological Classifications

The Reserve is within the national Pacific Maritime Zone and the provincial Georgia Depression Ecoprovince, Georgia Puget Basin Ecoregion, and Georgia Strait Ecosection. The biogeoclimatic zone is Coastal Douglas-fir and the subzone is moist maritime (CDFmm) (University of British Columbia 2019).

3.7 Ecological Communities and Site Series

The ecological inventory for this management plan was conducted by the author over fourteen days in mid-May and July to September 2019, with some observations in March and October 2019. Repeated observations of the Reserve by the author over more than 20 years, as well as material in the first management plan (Denman Conservancy Association 2002) and baseline report (Denman Conservancy Association 2008), have contributed to this update of the major ecological communities. Fourteen ecological communities were mapped, and were classified as four or possibly five different site series, two unclassified rocky sites, and three communities of recovering fields that were considered to be at too early a developmental stage to assign a provincial status (Figure 10, Table 5, Appendix 3). Ecological Community 5 was later divided into a portion from which some trees had been removed during the logging remembered by a neighbour, as noted previously, (Ecological Community 5-1) and a portion that appeared to be mature intact second-growth forest (Community 5). Detailed descriptions of each ecological community polygon are provided in Appendix 3.

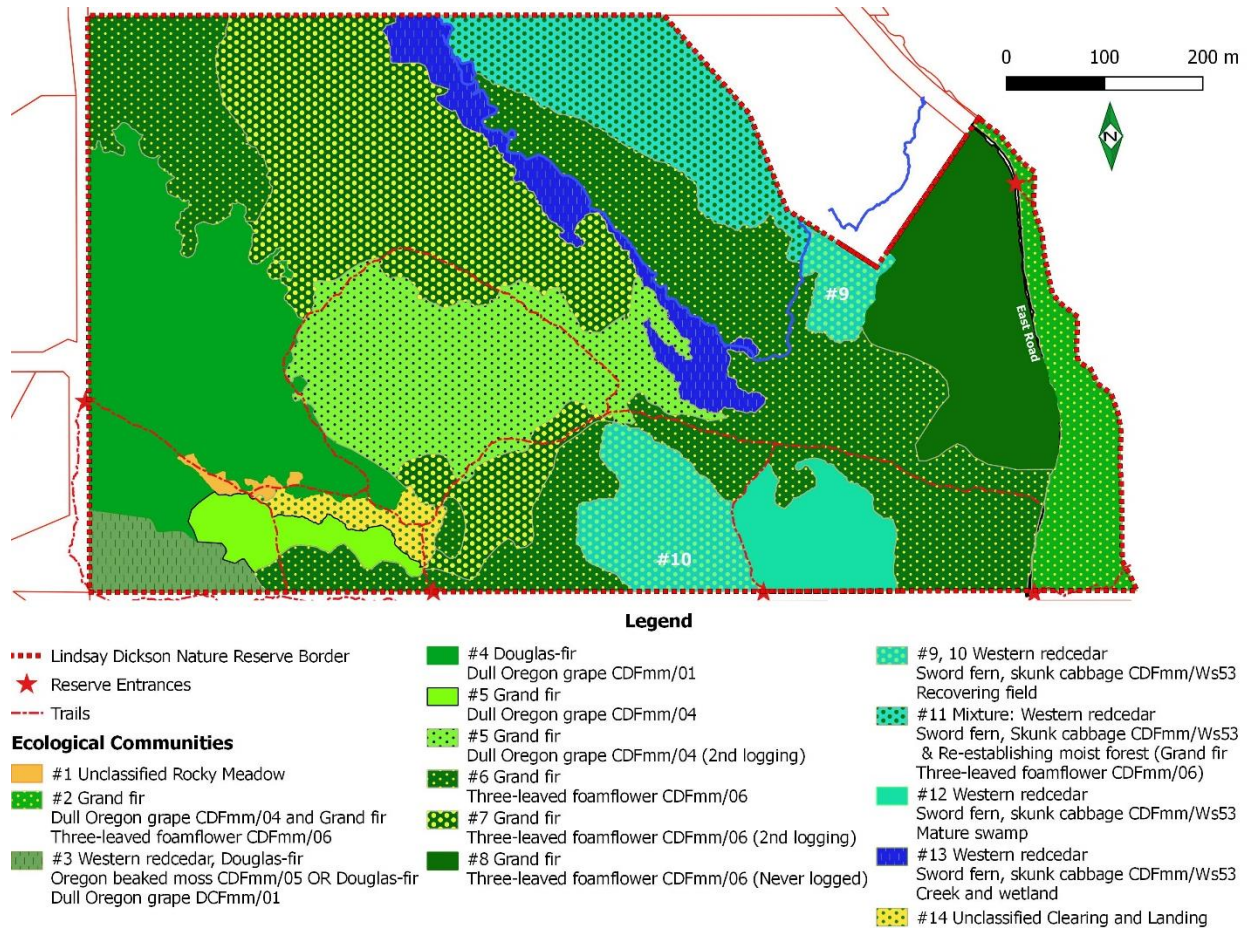


Figure 10. Ecological communities in the Lindsay Dickson Nature Reserve.

Table 5. Ecological communities in Lindsay Dickson Nature Reserve

Polygon Name	ID	Ecological Community	Classification	Structural Stage	Provincial Status
Rocky meadow	1	none	none	Herbaceous	none
Shoreline forest (includes cliff faces)	2	grand fir / dull Oregon-grape (<i>Abies grandis</i> / <i>Berberis nervosa</i>) and grand fir / three-leaved foamflower (<i>Abies grandis</i> / <i>Tiarella trifoliata</i>)	CDFmm/04 and CDFmm/06	Older mature	Red
Forest with western hemlock component	3	western redcedar - Douglas-fir / Oregon beaked moss (<i>Thuja plicata</i> - <i>Pseudotsuga menziesii</i> / <i>Eurhynchium oregonum</i>) or Douglas- fir / dull Oregon-grape (<i>Pseudotsuga</i> <i>menziesii</i> / <i>Berberis nervosa</i>)	CDFmm/05 or CDFmm/01	Older mature	Red
Moderately dry zonal forest	4	Douglas-fir / dull Oregon-grape (<i>Pseudotsuga menziesii</i> / <i>Berberis</i> <i>nervosa</i>)	CDFmm/01	Mature	Red
Dry rich Forest	5	grand fir / dull Oregon-grape (<i>Abies grandis</i> / <i>Berberis nervosa</i>)	CDFmm/04	Older mature	Red

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Moist rich forest	6	grand fir / three-leaved foamflower (<i>Abies grandis</i> / <i>Tiarella trifoliata</i>)	CDFmm/06	Older mature	Red
Logged moist rich forest [^]	7	grand fir / three-leaved foamflower (<i>Abies grandis</i> / <i>Tiarella trifoliata</i>)	CDFmm/06	Mixture of mature seral and older mature	Red
Old moist rich forest ^{^^}	8	grand fir / three-leaved foamflower (<i>Abies grandis</i> / <i>Tiarella trifoliata</i>)	CDFmm/06	Old	Red
Wet forest recovering fields [*]	9,10	western redcedar / swordfern - skunk cabbage (<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>)	Possible CDFmm/Ws53	Mature seral	Too early for status
Mixed wet forest, moist forest and open recovering fields [*]	11	Mixture: western redcedar / swordfern - skunk cabbage and re-establishing moist forest probably grand fir / three-leaved foamflower	Possible CDFmm/Ws53 and CDFmm/06	Both ecosystem types have patches of young-to-maturing seral	Too early for status
Wet swamp forest	12	western redcedar / swordfern - skunk cabbage (<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>)	CDFmm/Ws53	Older mature	Blue
Creek, Central Wetland and surrounding swamp forest ^{**}	13	western redcedar / swordfern - skunk cabbage (<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>)	CDFmm/Ws53	Mature	Blue
Landing and clearing	14	unclassified	none	Mix: shrub/pole sapling	none

[^] The reason for significant mature red alder in this part of the forest is not known but it may have resulted from early farming use.

^{*} Due to the leveling of these fields for farming, they may lack the elevated microsites needed to develop into Ws53 and may remain dominated by red alder.

^{**} Central Wetland is a small wetland partially open with sections of vegetation (willow and spirea) typical of Ws50 and Ws51 classifications.

The ecological communities within the Reserve range from those that are extremely dry in summer to those that are moist year-round. The driest site (excluding the shoreline) is Ecological Community 1, an unclassified, small, rocky meadow in the southwest corner of the Reserve, where the exposed bedrock limits vegetation to mainly herbaceous species (Photo 27). The wettest is Ecological Community 13, comprising the creek, Central Wetland and surrounding swamp wetlands, which are classified together as CDFmm/Ws53 western redcedar / sword fern - skunk cabbage swamp (Photo 18). Forest sites range from the driest Douglas-fir / dull Oregon-grape (*Pseudotsuga menziesii* / *Berberis nervosa*) CDFmm/01, Ecological Community 4, to the nutrient-rich, moist grand fir / three-leaved foamflower (*Abies grandis* / *Tiarella trifoliata*) CDFmm/06, Ecological Communities 6, 7 and 8. This rich, moist forest community is dominated by Douglas-fir but includes a sizeable component of western redcedar and grand fir. A significant old-growth, never-logged portion, Ecological Community 8, reflects development of the forest with minimal human influence (Photo 28). The history of naturally-occurring and human-caused wildfires in the Reserve is unknown, but many of the older trees and snags have major burn-scars that are suggestive of at least one hot fire in the past. Most of

the forested ecosystems have spring-board stumps (on Douglas-firs and western redcedars) from the original logging, as well as many remaining old-growth trees.



Photo 27. Death camas in bloom in the Rocky Meadow polygon, Ecological Community 1.



Photo 28. Numerous old-growth trees in un-logged Ecological Community 8.

The Reserve's drier, mature forested communities are found on the upper slopes, where the vegetation is influenced by the lower levels of moisture and nutrients. The zonal Douglas-fir / dull Oregon-grape forest community (*Pseudotsuga menziesii* / *Berberis nervosa*) is on the rocky crest and upper slope of the west side (Ecological Community 4). In this inventory, a polygon with as much as 25% western hemlock forest cover was considered a possible western redcedar - Douglas-fir / Oregon beaked moss community (*Thuja plicata* - *Pseudotsuga menziesii* / *Eurhynchium oregonum*) community, classified as CDFmm/05 site series. The reason that there are many mature western hemlock trees may relate to a possible moist microclimate effect of Graham Lake. This polygon, Ecological Community 3, comprises mature forest with veteran trees of both Douglas-fir and western hemlock. Ecological Community 5 on the mid slope of the Reserve's western side has slightly higher levels of moisture and nutrients; it supports the site series grand fir / Oregon-grape (*Abies grandis* / *Berberis nervosa*) and has a considerable component of salal (*Gaultheria shalon*), as is typical of this community.

In Ecological Communities 5 (mapped as 5-second logging) and 7, trees were removed rather haphazardly during the 2000-2002 logging. As well, as revealed through public input, in

Ecological Community 7, the large proportion of older deciduous trees (primarily red alder *Alnus rubra*) developed due to earlier patch-logging in the 1970s. Thus, the area of Ecological Communities 5 and 7, immediately west of the creek and wetland (Ecological Community 13), is a blend of older residual coniferous trees and younger mixed coniferous-deciduous species. Considerable salal (*Gaultheria shalon*) has grown in the patch-openings of Community 5-second logging; further forest growth and changes in the understory community may lead to changes in the ecological classification.

Communities in three polygons that were former farm fields are gradually becoming either wet forest ecosystems (Ecological Communities 9 and 10), or mixtures of wet forest and slightly drier forest vegetation, the latter developing on hummocks or higher sections (Ecological Community 11). The flattening and compaction of the soils in these fields may delay maturation beyond the red alder or herbaceous stages for some time.

Ecological Community 2 includes a mix of forest communities, as well as tiny, mostly vertical rock bluffs that support interesting herbaceous rock-adapted species (Photo 29), including the locally uncommon goldenback fern (*Pityrogramma triangularis*) (Photo 30). Unfortunately, a host of non-native invasive species is establishing on these bluff sites.

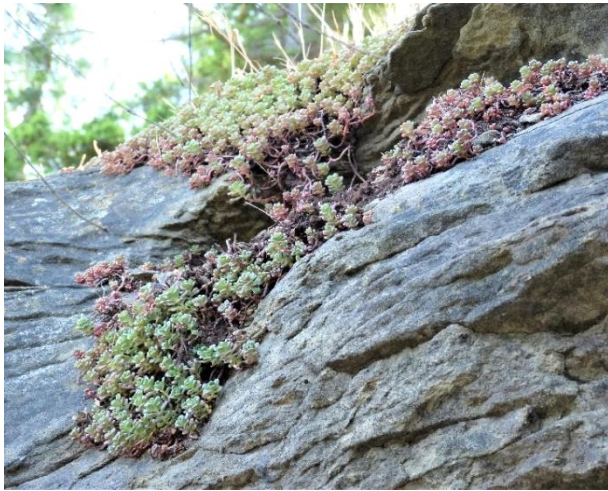
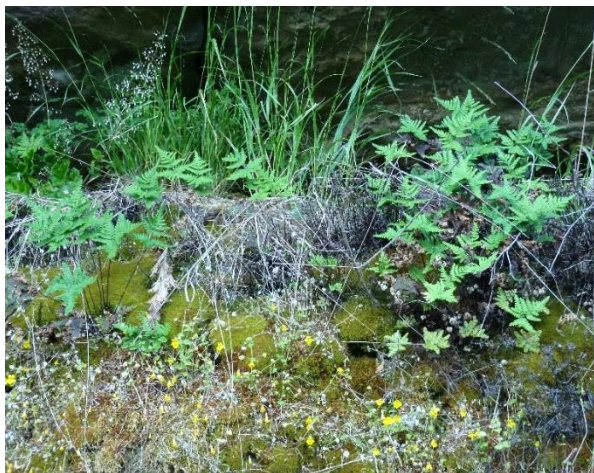


Photo 29. Sedum growing on the rocky cliff shoreline of Ecological Community 2.

Photo 30. Wildflower cliffs with goldenback fern on the shoreline.



Numerous invasive species were encountered within all of the ecological communities of the Reserve during this survey; some of the locations are shown in Figure 11. English ivy (*Hedera helix*) is likely the most critical presently, as there is at least one plant growing on a young tree, in one of the old fields. Shoreline ivy was removed successfully in previous years but requires continual monitoring as it may spread from the adjacent property. One small ivy sprout was noted and removed during this survey. The species with the most significant and widespread impact is English holly (*Ilex aquifolium*). Other invasive species such as English daisy (*Bellis perennis*) are limited to a few individuals along trails and could be removed before they become widespread, particularly in the Rocky Meadow, Ecological Community 1.

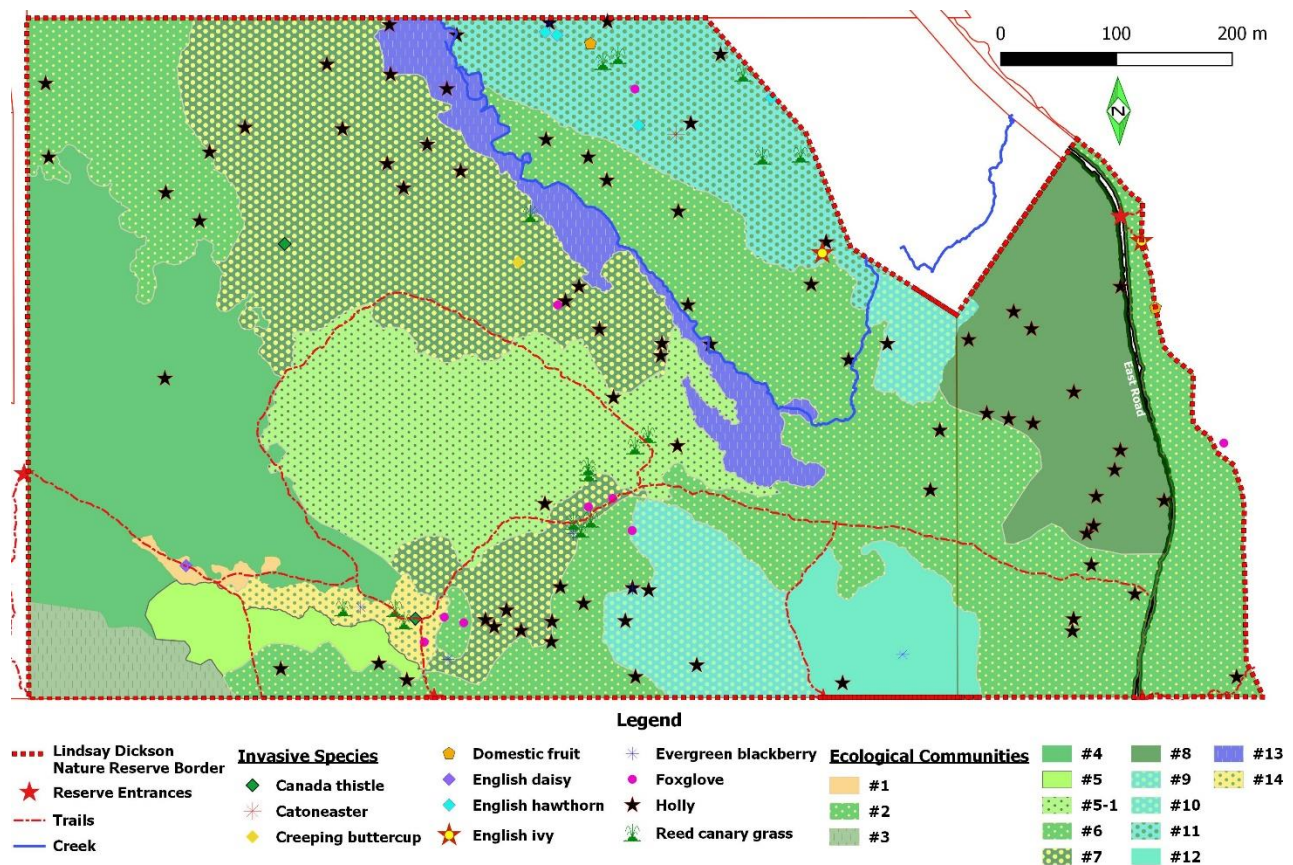


Figure 11. Some of the locations of invasive species within the Reserve.

3.8 Wildlife Species

The range of ecosystem types, including old and young forest, rocky meadow, coastal bluff, creek, and various wetlands, supports a large variety of wildlife species. Sixty-six wildlife species were identified during the recent vegetation surveys in May and August (four mammals, 39 birds, three amphibians, one reptile and 19 invertebrate species). These species are listed in Tables 6 and 7. Five of these are rare species. Calls of a northern pygmy-owl were heard during the recent inventory, but verification of this rare subspecies was not possible. Lists of additional rare species and other wildlife species that have been previously identified in the Reserve or found in similar habitats nearby are included in Appendix 3.

Many of these wildlife species take advantage of features found in the Reserve's mature forests. The plentiful decaying older trees and snags are used as foraging and nesting habitat, supporting high woodpecker abundance and diversity throughout the Reserve. The Reserve's woodpeckers are vulnerable to domestic cat predation and free-ranging dog disturbance, as they are often seen intently foraging on ground-level coarse woody debris (Photo 31). The large old-growth conifer species, including Douglas-fir, grand fir, and western redcedar, have thick, well-developed bark crevices, huge branches, and massive canopies that make them ideal wildlife trees, providing security cover and significant opportunities for foraging, perching, and nesting. The large, old bigleaf maples provide similar habitat values for the wildlife that prefer deciduous trees, thanks to their massive, moss-endowed branches and extensive leafy canopies (Photo 32).



Photo 31. Pileated woodpecker at work on a downed tree.



*Photo 32. Bigleaf maple (*Acer macrophyllum*) canopy.*

Openings in the forest, made as older trees die off, as well as the various wetlands, creeks, and meadows, create important edge habitat and provide the open, sunny spots that are particularly favoured by basking reptiles and hunting or perching invertebrates. During field reconnaissance for this plan, several species of dragonflies and damselflies were observed perched and basking on the trunks of trees in sun-dappled gaps in the forest (Photo 36). The Reserve's meadows, old fields, and other openings also support a variety of fruiting shrubs, important for many seed- and fruit-eating species.

The freshwater ecosystems that extend across the property provide habitat for aquatic-breeding amphibians and aquatic invertebrates. The proximity of Graham Lake also ensures a supply of abundant drinking water for wildlife, especially when the creek and wetland sources dry up in summer. On the eastern border of the Reserve, the shoreline and sea provide valuable travel, foraging and shelter habitats for both terrestrial and marine wildlife. Numerous seabirds perch on the shoreline's rock features, and river otter, mink, and raccoon forage and den along the shore (Photo 33). At least nine bat species have been confirmed on Denman and would be expected to occupy the various habitats within the Reserve. Bat acoustic sampling was conducted at two sites in the late summer of 2019, but the results will not be available until late 2020.



Photo 33. Mink on Reserve's shoreline.

The great abundance and diversity of wildlife in the Reserve is attributable primarily to its considerable size and the wide age range of its forests. Future wildlife observations throughout the Reserve will add to the species list and increase the understanding of the ecological interactions and processes within the Reserve.

Table 6. Mammal, reptile, amphibian, and invertebrate species identified in Lindsay Dickson Nature Reserve for the period of May-June 2019.

Common Name	Scientific Name	SAR*	Type of Record**	Main Habitat Type
Mammals				
Black-tailed deer	<i>Odocoileus hemionus columbianus</i>		Seen, scat, track	All
Raccoon	<i>Procyon lotor</i>		Track, scat	All, esp. wetland, shore
Red squirrel	<i>Tamiasciurus hudsonicus</i>		Seen, midden	All forest
River otter	<i>Lutra canadensis</i>		Seen, scat	Shore, wetland, CWD^(den)
Amphibians				
Pacific chorus frog	<i>Pseudacris regilla</i>		Seen	All
Northern red-legged frog	<i>Rana aurora</i>	*	Seen	Wetland, forest esp. CWD
Long-toed salamander	<i>Ambystoma macrodactylum</i>		Seen	Wetland, forest esp. CWD
Reptiles				
Northwestern garter snake	<i>Thamnophis ordinoides</i>		Seen	All, esp. openings
Invertebrates				
American emerald dragonfly	<i>Cordulia shurtleffi</i>		Seen	Wetland, open field, forest
Anise swallowtail butterfly	<i>Papilio zelicaon</i>		Seen	Forest opening, field
Autumn meadowhawk dragonfly	<i>Sympetrum vicinum</i>	*	Seen	Wetland, forest gaps
Banana slug	<i>Ariolimax columbianus</i>		Seen	All, forest important
Bluet species damselfly	<i>Enallagma sp.</i>		Seen	Wetland, open field, forest
Cardinal meadowhawk dragonfly	<i>Sympetrum illotum</i>		Seen	Wetland, open field, forest
Chalk-fronted skimmer	<i>Ladona julia</i>		Seen	Wetland, open field, forest
Common whitetail dragonfly	<i>Plathemis lydia</i>		Seen	Wetland, open field, forest
Common woodnymph butterfly	<i>Ceryonis pegal incana</i>	*	Seen	Woodland
Darner (eyes blue) dragonfly	<i>Aeshna sp.</i>		Seen	Wetland, open field, forest
Eight spot dragonfly	<i>Libellula forensis</i>		Seen	Wetland, forest gaps
Pacific forktail damselfly	<i>Ischnura cervula</i>		Seen	Wetland, open field, forest
Pacific sideband snail	<i>Monadenia fidelis</i>		Seen	Forest
Painted lady butterfly	<i>Vanessa carui</i>		Seen	Meadows
Pale swallowtail butterfly	<i>Papilio eurymedon</i>		Seen	Forest opening, field

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Striped meadowhawk dragonfly	<i>Sympetrum pallipes</i>		Seen	Wetland, forest gaps
Western pondhawk dragonfly	<i>Erthemus collocata</i>	*	Seen	Wetland, open field, forest
Western tiger swallowtail	<i>Papilio rutulus</i>		Seen	Forest opening, field
Woodland skipper butterfly	<i>Ochlodes sylvanoides</i>		Seen	Meadow

* SAR=Species at Risk

** Bold type indicates species expected to breed or reside within the Reserve, as shown by territorial song or other behaviour. (Birds seen were usually also heard.)

^ CWD=coarse woody debris (e.g., fallen trees or branches)

Table 7. Bird species identified in Lindsay Dickson Nature Reserve for the period of May-June 2019.

Common Name	Scientific Name (Genus species)	SAR*	Type of Record**	Main Habitat Type
American Robin	<i>Turdus migratorius</i>		Seen	All
Anna's Hummingbird	<i>Calypte anna</i>		Heard	All
Bald Eagle	<i>Haliaeetus leucocephalus</i>		Seen	Forest esp. older, shore
Band-tailed Pigeon	<i>Columba fasciata</i>	*	Heard	Forest
Barred Owl	<i>Strix varia</i>		Heard	All
Black-throated Gray Warbler	<i>Dendroica nigrescens</i>		Heard	Forest
Brown Creeper	<i>Certhia americana</i>		Seen	Forest, snags, cavities
Brown-headed Cowbird	<i>Molothrus ater</i>		Heard	Fields, farm, edge forest
Canada Goose	<i>Branta canadensis</i>		Seen	Shore, overflight
Cassin's Vireo	<i>Vireo cassinii</i>		Heard	Forest
Chestnut-backed Chickadee	<i>Parus rufescens</i>		Seen	Forest, snags, cavities
Chipping Sparrow	<i>Spizella passerina</i>		Seen	Edge, forest openings
Common Raven	<i>Corvus corax</i>		Seen	Forest, esp. older
Common Yellowthroat	<i>Geothlypis trichas</i>		Heard	Wetland shrubs
Dark-eyed Junco	<i>Junco hyemalis</i>		Seen	Fields, edge, open forest
Downy Woodpecker	<i>Picoides pubescens</i>		Seen	Forest, snags, cavities, CWD [^]
European Starling	<i>Sturnus vulgaris</i>		Egg seen	All, snag nesting
Hairy Woodpecker	<i>Picoides villosus</i>		Seen	Forest, snags, cavities, CWD
Hammond's Flycatcher	<i>Empidonax hammondii</i>		Heard	Forest
Northern Flicker	<i>Colaptes auratus</i>		Seen	Forest, snags, cavities, CWD
Northern Pygmy Owl	<i>Aegolius acadicus</i>	P*	Heard	Forest, snags, cavities
Northwestern Crow	<i>Corvus caurinus</i>		Seen	Coast, old forest
Orange-crowned Warbler	<i>Vermivora celata</i>		Heard	Openings, edge forest
Pacific Wren	<i>Troglodytes pacificus</i>		Seen	Forest

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Pacific-slope Flycatcher	<i>Empidonax difficilis</i>		Heard	Forest
Pileated Woodpecker	<i>Dryocopus pileatus</i>		Seen	Forest, snags, cavities, CWD
Pine Siskin	<i>Carduelis pinus</i>		Heard	All
Red-breasted Nuthatch	<i>Sitta canadensis</i>		Heard	Forest, snags, cavities
Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>		Seen	Forest, snags, cavities, CWD
Rufous Hummingbird	<i>Selasphorus rufus</i>		Seen	All
Song Sparrow	<i>Melospiza melodia</i>		Seen	All
Spotted Towhee	<i>Pipilo erythrophthalmus</i>		Seen	All
Swainson's Thrush	<i>Catharus ustulatus</i>		Seen	Shrub, edge forest
Townsend's Warbler	<i>Dendroica townsendi</i>		Heard	Forest
Turkey Vulture	<i>Cathartes aura</i>		Seen	Foraging in openings
Varied Thrush	<i>Ixoreus naevius</i>		Heard	Forest
Warbling Vireo	<i>Vireo gilvus</i>		Heard	Usually deciduous forest
Western Tanager	<i>Piranga ludoviciana</i>		Heard	Forest
Yellow-rumped Warbler	<i>Dendroica coronata</i>		Heard	Forest

* SAR=Species at Risk, P=possible

** Bold type indicates bird species expected to breed or reside within the Reserve, as demonstrated by territorial song or other behaviour. Also birds seen were usually also heard, either singing or calling.

^ CWD=coarse woody debris (e.g., fallen trees or branches)

3.9 Expected Change Over Time

The effects of the passage of time will vary across the Reserve. The old forests may continue much the same, with the oldest and weakest trees eventually dying. Nevertheless, although dead, many of these trees will remain standing for decades or longer, providing wildlife habitat and contributing to forest structure. When they eventually fall, these trees will serve as slowly rotting coarse woody debris habitat for many decades, during which they will contribute nutrients to the soil. These old forests are likely genetic refugia for small organisms. Over time, animals and plants with these genes will recolonize the surrounding areas and enhance the overall genetic diversity.

The mature forests will gradually develop old forest characteristics, with more snags, dead tree tops, thicker multilayered canopies, and larger trees with thick bark and larger limbs. The major understory change in both mature and older forests may well be the gradual introduction of invasive herb and shrub species, likely with the development of a major English holly shrub understory. Other future deleterious changes may be the introduction of a new or more virulent tree and root diseases or a new aggressive invertebrate, any of which could affect overall forest health. As well, strong and often unusual wind storms will continue to topple or break exposed or stressed trees, particularly along East Road and Mallard Way. The old-growth

veteran trees, particularly those in Ecological Community 8 (Photo 34), are especially vulnerable in these storms.



Photo 34. Huge old-growth Douglas-fir blown down adjacent to East Road.

Changes in forest sites with bigleaf maples can be expected to differ from changes elsewhere. These giant trees dominate large patches of the Reserve's coniferous forests and can live for 300 years. They appear to influence the understory shrub and herb communities by monopolizing the soil's moisture and nutrients, as well as sunlight. The open canopy in these sites during winter may, over time, result in different understory species than in the rest of the coniferous forest. Moisture deficit effects may also be different in areas dominated by bigleaf maple.

The seral forest stands will gradually mature and be replaced by the climax communities for these polygons. However, some of the farm fields may lack the geophysical complexity of raised soil hummocks needed to allow the roots of coniferous trees to grow above the water table. Thus, the vegetation in these sites may go through several seral stages and appear similar to that of the CDFmm/Ws52 red alder / skunk cabbage (*Alnus rubra* / *Lysichitum americanus*) ecological community for some time.

New and largely unknown changes in the Reserve are likely to occur due to climate change. Individual trees and small groups of trees are already dying, seemingly due to an unusual summer (and possibly winter) moisture deficit. Moisture deficit stress can be expected to increase as successive extreme summer droughts and declining winter precipitation fail to sufficiently recharge the soils and substrates in the Reserve. Several western redcedar trees in various locations have died, apparently as a result of moisture deficit stress, especially where trees were crowded or were growing on exposed rocky sites with thin soils (Photo 35). Other trees, particularly grand fir of various sizes and ages, have also died. This loss may be due to

moisture deficit stress or root rot, or a combination of both. Not long after the logging in 2000, a small area of mature, seemingly root rot-infected trees died to the east of the buddy trees in Ecological Community 6. This area has now expanded to involve more trees, as at least 22 dead trees were noted during the fieldwork for this plan (Photo 36). At least ten more mature trees, often Grand fir (*Abies grandis*), have died along the Main Trail, which near its midpoint passes by the root-rot patch.

Increasingly severe storms, also associated with climate change, may result in increased wind-throw effects and breakage of very tall or exposed trees, especially where individual trees or groups of trees have died and are without sufficient root holding capacity. The impacts of severe windstorms are already being observed in the Reserve. Fortunately, the large number of veteran trees and the fairly gentle slopes mean that the main canopy trees are less exposed and tend to suffer fewer detrimental wind effects; however, winds may still funnel through new or existing openings and cause damage.



Photo 35. Death of redcedars in the Reserve.



Photo 36. Tree death from apparent root rot infection.

4 Threats and Expected Change to Threats Over Time

Threats to the Reserve are outlined in Table 8. Movement through the Reserve, whether by wind, fire, water (or lack of it), humans, or other animals, can have profound effects on the Reserve's structure and species composition. Trails are the main movement route for humans, but they are also often used by other animals, and they may funnel winds or channel water. No trails in the Reserve appear to have issues with erosion but, even as early as May, dust was being raised and carried along the trail by walkers. Routine monitoring of trails could be an important way to assess the nature and severity of threats arising from trail use over time.

In contrast, threats that affect the overall health of the forests and wetlands, such as recreation off-trail, hydrological changes, wildfire, invasive species incursion, and (especially) climate change, may be more difficult to both assess and manage. In addition, the intensity of the impacts of particular threats may change over time, thus adding to the management complexity.

The greatest threats to the ecological features of the Reserve are widespread, high-intensity wildfire, non-native invasive species, and climate change. It is expected that the climate will become warmer and drier into the future, which will increase both the threat of fires and the opportunities for drought-tolerant invasive species to spread. The impacts of climate change are already becoming apparent in the Reserve. Flagging or browning of parts of western redcedar foliage is common in summer, but in recent years several young and old trees of this species have died (Photo 35). Excessive wind speeds or alteration of wind direction to powerful northerly winds are challenging tree stability and producing windthrow effects (Photo 34). Individual trees or groups of trees that are in an exposed position or weakened by drought, disease, or excessive ground moisture are most threatened by wind storms. In future years, the combination of more traffic through the Reserve along East Road, increased visitation to the Reserve, and heightened summer drought conditions will increase the risk of a summer wildfire.

Other significant threats, such as off-trail recreation, free-ranging dogs, and the reduction or alteration of flows or pollution of upstream water outside the Reserve, could also increase. Undoubtedly, mitigating these threats will depend on public education and the management of human activities within and around the Reserve.

Table 8. Current Threats to Lindsay Dickson Nature Reserve

Threats	Polygons						
	Rocky Meadow/ Coastal bluff	Old Forest	Mature Moist Forest	Moderately dry and Southwest Forests	Creek and Swamp Forests	Recovering Fields	Overall Threat Rank
Recreational Activities on Trails: Walking poses little threat of trampling or disturbance, as long as visitors stay on trails. Nevertheless, many introduced invasive species are present along current trails, probably tracked in by walkers or blown in along the trail openings. These may spread into other open areas. Compacted earthen trail surfaces are fairly robust and appropriate for the current level of traffic.	Medium	Medium	Low	Low	N/A (no trails)	Low	Low
Recreation Off Trail: To date, off-trail activities have not been a major problem in the Reserve but the trails are highly used and user numbers are growing. Potential problems with off-trail use include soil compaction (and associated impacts on root health), spread of fungal disease, enhanced dispersal of seeds of invasive species, and wildlife disturbance.	High	High	Medium	Medium	High	Low	Medium
Free Ranging Dogs: Off-leash ranging dogs are a major disturbance and threat to wildlife. Few walkers leash their dogs in the Reserve, and some cannot control their dogs from running into and around in the forest. With increased trail use, this disturbance could become significant.	High	High	High	High	High	Medium	High
Freshwater Drainage: Changes to drainage patterns on neighbouring properties or the use of chemicals on properties upstream could affect the freshwater ecosystems in the Reserve.	Low	Low	Medium	Low	High	Medium	Medium

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Fire: Fires may be caused by lightening or by human activities, such as cigarette butts tossed from passing cars on East Road. A large, high-intensity wildfire would transform the current ecosystems. Considerable fuel (dry wood) has accumulated, making high-intensity fires likely. These fires could destroy herbaceous and shrub cover as well as many young and maturing trees. Considerable fire-scarring on old Douglas-firs and interior burn scars on western redcedars suggest that these trees might survive hot fires. The light fires of the past, which may have created a different understory species structure and composition, are not considered possible in the present island environment due to a century of fire suppression and fuel loading.	High	High	High	High	Medium	Medium	High
Invasive Non-native Species: English holly, in particular, is present throughout the Reserve, as are various herbaceous species, especially on or near trails.	High	High	High	Medium	High	Medium	High
Problematic Native Species: Abundant Black-tailed Deer (<i>Odocoileus hemionus</i>) can be problematic, limiting natural regeneration, dramatically altering understory vegetation structure and composition, and adversely affecting songbird populations (Martin et al. 2011).	Medium	Medium	Medium	Medium	Low	Medium	Medium
Potential Disease Incursion: Signs of root rot but requires a pathogen diagnosis	Unknown	Medium	Medium	Medium	Unknown	Unknown	Medium
Climate Change: Increasing temperatures, drought, high winds and electrical storms are affecting the Reserve.	Medium	High	Medium	High	Medium	Low	Medium-High
Overall Threat Status for Protected Area	High	High	Medium	Medium	Medium	Medium	

5 Community Engagement

5.1 Adjacent Land holders

In preparation for the development of the Management Plan, letters were sent to all landholders and neighbours within a 100 m radius of the reserve. A total of 18 letters were mailed on August 21, 2019 (Appendix 6). The letters contained information about Lindsay

Dickson Nature Reserve, an invitation to the open house, and a management planning questionnaire (see Appendix 7).

5.2 First Nations

Letters were mailed to the following First Nations on October 24, 2019 (Appendix 8):

- Homalco First Nation
- Stz'uminus (Chemainus) First Nation
- Ts'uubaa-asatx (Lake Cowichan) First Nation
- Halalt First Nation
- Lyackson First Nation
- Penelakut Tribe
- Tla'amin (Sliammon) First Nation
- Snaw-naw-as (Nanoose) First Nation
- K'ómoks (Comox) First Nation
- We Wai Kai (Cape Mudge) First Nation
- Qualicum First Nation
- Wei Wai Kum (Campbell River) First Nation
- Cowichan Tribes

This letter provided information about the Nature Reserve and outlined the proposed management plan.

5.3 Conservation Partners and Community Members

The Lands Committee of Denman Conservancy Association reviewed and provided detailed comments on this Management Plan at various stages of its development, and led the community consultation process.

The ITC and DCA held a public meeting at the Marcus Isbister Old School Centre on September 7, 2019. People attending the meeting were asked to provide input on general management planning for the Reserve. Maps and photographs were presented, and residents were asked for their input at that time. Questionnaires were also made available to attendees.

The questionnaire was also made available online from August to November, 2019, and was completed by 18 people.

5.4 Engagement Results

A Public Open House presenting the Draft Lindsay Dickson Nature Reserve Management Plan (first revision) was held at the Marcus Isbister Old School Centre, 5901 Denman Road, on Saturday, September 7th from 11-1pm. 49 people attended this Open House and many participants provided verbal feedback to DCA and ITC personnel about the management plan draft presented. A computer was made available at the Open House for anyone wishing to fill out the online questionnaire. Refreshments were provided to attendees.

In addition to the Open House, DCA solicited further input from neighbours and others interested in the Reserve through an article in the DCA Newsletter and at our Annual General Meeting in February 2019. Interested parties were invited to contact DCA in order to obtain a copy of the draft plan for review, and answer the online questionnaire. DCA hosted a link to the ITC questionnaire on the Conservancy website, and shared a link to it on social media. The draft management plan was made available online for review to four interested neighbours and community members whose written comments were submitted via email to the DCA Land Manager, and then compiled and sent to ITC staff for incorporation into the plan.

Community members were also invited to join DCA Lands Committee members on a site visit to Lindsay Dickson Nature Reserve to discuss management issues on the ground. DCA posted a full-page advertisement in the local Grapevine publication, and placed posters around the 'downtown' area. The site visit at Lindsay Dickson Nature Reserve on a very rainy afternoon of November 16, 2019 attracted five intrepid community members. Prior to this site visit, 21 people attended a slideshow presentation by Jenny Balke at the Old School, featuring maps and images from the draft management plan.

Online questionnaire responses submitted by 18 residents of Denman (14 full-time and 4 part-time) provided useful information about Lindsay Dickson Nature Reserve, including concerns about threats to the reserve, and memories of the 'close call' surrounding the potential logging of the reserve before its securement for conservation. The importance of protecting representative Coastal Douglas-fir ecosystems was also mentioned in the comments. Most respondents use the Reserve at least a few times per year. The responses revealed that hiking/walking, wildlife viewing, and dog walking are common uses of LDNR. The values chosen as most important for LDNR by survey respondents were: Protection of habitat for at-risk species; Conservation for the sake of the intrinsic value of nature; and Ecosystem Services. Other values selected by respondents included: recreational opportunities; education/research opportunities; aesthetic appeal; tourism; photography; and increased real estate value. The responses generally validated the objectives outlined in the current management plan. A few comments suggested that the strength of ecosystem protection offered by the nature reserve and conservation covenant was not clearly understood, particularly in contrast to park designation. Further outreach to the community to clarify what protections are afforded by the land's status as a nature reserve held by ITC may be beneficial.

Respondents cited a number of activities that they feel are incompatible with the natural features of this Reserve. These included: dogs off leash; overuse by people; collecting/harvesting plants or mushrooms; motorized vehicles, atvs; drones; additional trails; commercial use; bicycles, especially on trails other than the Jemima-Mallard west trail; horses; hunting; smoking; cross-island trail being opened up along right of way next to undisturbed area. Respondents also described what they believe are the greatest threats to the Reserve: climate change and instability; rogue tree cutting and contractor tree cutting along un-gazetted portion of East Rd; invasive species; fire risk including tossed cigarette butts; and overuse of the

reserve. Some of the comments suggest that further outreach and information, perhaps in the form of additional signage, is needed to ensure users understand that bicycles and horseback riding are not permitted within the reserve.

Overall, public outreach and engagement about LDNR and this management plan revealed that while they enjoy and value the Reserve and its intrinsic natural diversity and amenities, islanders are also concerned about the impacts that encroachment on the natural values of the land from too much—or unauthorized—access of various types can cause on the Reserve. In particular, off-leash dogs, increased trail development and inappropriate use of trails, tree cutting and fire risk, especially due to smoking, were concerns mentioned by multiple respondents. It will be important going forward for DCA and ITC to solicit feedback about the ongoing use of the Reserve from community members.

6 Management Recommendations

The ecological communities of the Reserve have remained in good health since completion of the first management plan 17 years ago. The most noticeable ecological changes have been the forest regeneration and disappearance of many signs of disturbance following logging in 2000–2001. Ecosystem management has followed the original objective to “allow the natural ecological processes and functions of the site to proceed unimpeded, except in the case of wildfire or other exceptional situations where remediation is considered imperative” (Denman Conservancy Association 2002). Specific management actions over the past 15 years included the creation and maintenance of walking trails, which have been well-used by the public; numerous successful volunteer work bees for removing invasive species, such as English holly, Scotch broom (*Cytisus scoparius*), and English ivy (*Hedera helix*); and a caged tree seedling restoration project, see Section 2.6.

Key management considerations relate to monitoring, invasive species, potential wildfire, climate change impacts, and new conservation opportunities. The following discussion incorporates background information and ideas from the 2002 management plan, as well as findings from the recent inventory.

Management recommendations for the Reserve range from increased community involvement to envisioning altered ecosystems. Establishing a volunteer reserve warden to assist with reserve management and monitoring tasks is strongly recommended. Development of a monitoring program and creation of a system for accepting naturalist inventory data would yield valuable information that will assist with management. Improving community knowledge about the Reserve’s ecology and awareness of best practices to prevent wildfire can be achieved through information kiosks, signage, and involvement from the local fire department. An invasive species strategy for the trails, and for English holly throughout the Reserve, is needed. Last, approaches for adapting with climate change could include examining ecosystem composition (species, conditions and growing sites) in protected areas in southwestern BC and the northern USA, predicting and observing the adaptations of local species to new climatic

conditions, and focusing management on learning and adapting new strategies to deal with the new situations.

Continuing to pursue the additional conservation opportunities discussed in the next section will help to connect the Reserve across the landscape and with neighbouring land holders, thus lessening risks to the Reserve’s current ecological features. Improving trail signage and fire awareness within the Reserve will reduce the risks to public safety and to the ecological communities.

6.1 Management Roles

The Reserve is held by the Islands Trust Conservancy and is monitored annually by ITC, or its contractors, to determine any management concerns. Denman Conservancy Association (DCA) will help identify major management issues and carry out most of the management actions within the Reserve, in accordance with the management plan, through annually renewed service contracts with the landholder, Islands Trust Conservancy (Table 9). Annual monitoring to ensure compliance with the terms of the conservation covenant is the responsibility of the covenant holder, DCA.

Table 9. Lindsay Dickson Nature Reserve Management Partners

Partner	Role
Islands Trust Conservancy	Land Holder
Denman Conservancy Association	Management Partner
Denman Conservancy Association	Covenant Holder

6.2 Permitted and Prohibited Uses

The Nature Reserve is open to the public for walking and nature appreciation. Any uses that could reasonably pose a threat to vegetation, wildlife or wildlife habitat are not permitted. Visitors are expected to keep their pets on leash and under control while in the Reserve.

In accordance with the covenant agreement, any activity or use is prohibited that:

- causes or allows silts, leachates, fills or other deleterious substances to be released into any watercourse on the land;
- causes the erosion of land;
- causes or facilitates the loss of soil on the land;
- causes or allows pesticides, including but not limited to herbicides, insecticides, or fungicides, to be applied to or introduced onto the land;
- alters or interferes with the hydrology of the land, including by the diversion of natural drainage of flow of water in, on or through the land;
- causes or allows fill, rubbish, ashes, garbage, waste or other material foreign to the land to be deposited in or on the land;
- causes or allows any component of the land, including soil, gravel or rock, to be disturbed, explored for, moved, removed from or deposited in or on the land; or

- causes or allows any indigenous flora on the land to be cut down, removed, defoliated, or in any way tampered with.

The covenant also prohibits:

- use of the land for hunting, fishing, gathering or grazing of domestic animals;
- construction, building, affixing or placing on the land any buildings structures, fixtures or improvements of any kind; and
- lease or license of the land or any part of it, unless made subject to provisions of the conservation covenant.

In addition, the following activities by the public are prohibited in the Reserve:

- Use of motorized vehicles
- Bicycling
- Horseback riding
- Camping
- Fires
- Hunting
- Smoking
- Trail development
- Tree cutting
- Collection or harm of plants, fungi, or animals

6.3 Proposed Monitoring Program

ITC monitors annually looking for management concerns. DCA regularly visits the Reserve working as the local management partner and conducts annual compliance monitoring as covenant holder. Further possible initiatives to augment the monitoring program for the Reserve are as follows:

1. Seek out and appoint a volunteer warden or stewardship committee to report regularly (e.g., monthly) and form a 'friends of', if there is interest.
2. Invite the warden and any other interested volunteers to undertake specific monitoring tasks and participate in annual monitoring visits with all partners to discuss monitoring findings and management issues.
3. Establish specific photopoint stations to document important features that may change over time or need monitoring for protection.

Possible monitoring tasks for various ecological or other features could include:

1. Taking photos at all photopoint stations on an arranged schedule and assessing the changes.
2. Walking the trails to check their condition, use, and any impacts resulting from trail use, such as garbage dumping, damage to natural features or signage, off-trail impacts, etc.
3. Monitoring of beach-upland interface for storm damage, debris etc. Observations at extreme high tides and during storms with photographic record would be useful.

4. Visiting one or more polygons each year to document, measure and assess the condition of all old-growth/wildlife trees.
5. Assisting the work bee program by conducting an annual assessment of the presence or spread of non-native invasive species of concern.
6. Conducting specific counts or measurements of chosen species or species groups (e.g., resident birds, neotropical migrants, bird use throughout the year, growth of specific plants) or documenting such things as how species presence and abundance differs spatially and temporally within the Reserve.

Reports by the volunteer involved in these activities could be part of the DCA annual general meeting, as well as highlighted in the DCA Newsletter, in blog posts, or on its website.

6.4 Public Access

The Reserve has been, and will continue to be, available to the public for walking and quiet appreciation of nature. As stated in the previous plan and repeated in section 6.2 of this plan, “any uses that could reasonably pose a threat to vegetation, wildlife or wildlife habitat are not acceptable within the nature reserve” (Denman Conservancy Association 2002). Currently, there are seven walking trails within the Reserve.

Denman Cross-Island Trail

The Comox Valley Regional District (CVRD) is in the process of planning and constructing a multi-use trail to connect the two ferry terminals on Denman Island. They have been working with the Trails Committee of the Denman Island Residents Association to develop options for the route and have been gathering feedback from Denman residents since 2011. ITC, as the landholder of the Reserve, was consulted on the options for route choices in and around the Reserve. The route has not been determined as of the writing of this plan but the ITC Board has approved in principle two different options, 1. Constructing a portion of the Denman Cross-Island Trail in the Reserve adjacent to East Road or 2. Using the existing established trail in the southwest corner of the Reserve. If a portion of the cross-island trail does go through the Reserve that portion of the trail would allow for multi-use that is currently not allowed such as bicycles and horses. The ITC Board did not support trail construction along the undeveloped portion of Corrigal Road on the western boundary of the Nature Reserve. ITC will work with the CVRD and DCA on the location and design of the Reserve portion, if that is one of the chosen routes of the Denman Cross-island Trail, and a final decision will be made by the ITC Board and DCA.

6.5 Signage

The Reserve’s signs have changed little over the past 15 years. They remain minimal. Options for further signage include the following:

1. Create an information/education kiosk similar to other installations at protected areas on Denman. The most appropriate site for a kiosk would be at the main entrance at the west end of Mallard Way. A second kiosk could be placed at the Jemima Road entrance or, instead, near the spot where the Graham Lake trail turns downhill to the lake. This

site receives considerable use in summer from both directions and a kiosk situated near the lake might be more likely to attract the attention of summer visitors.

2. Provide suitable markers along the walking trails and at junctions to identify the trails and distinguish them from deer trails. In addition, trail maps could be provided at the information kiosk, as is done elsewhere on Denman. Trail markers help at times of peak vegetation growth at places where active deer trails meet infrequently used walking trails and the two can be confused. They also help trail maintenance volunteers identify the trail route when clearing fallen branches or trees.
3. Establish appropriate boundary signage to facilitate monitoring for trespass issues, particularly where it is difficult to know the location of the boundary and/or where the integrity of the Reserve may be threatened by activities on adjacent properties. These areas include the north boundary, along the west boundary north of Jemima Rd, along the border with the old homesite (now partially fenced by the current land holders), and perhaps along both Graham Lake access trails. For the long, linear boundaries, covenant border signs could be placed at strategic locations and the entire border could be marked by flagging tape that is renewed periodically (some is currently in place).

6.6 Trail Use, Maintenance and Development

Currently, most trails are suitable and in good repair but lack signage. There are currently two instances of downed trees over trails, where removing a section of the tree would improve trail use without significant ecological impacts (on Mallard Trail at UTM 10 U 373648 5485995 and on Circle Trail at UTM 10 U 373254 5486004) (Figure A2-1). Safety hazards for trail users include a small, very old log that lies across the Main Trail (however, it appears to have been there for a long time) and an iron stake in the centre of Main Trail at East Road (Photo A2-T-1b); if possible, the stake should be removed or cut flush with the ground.

Throughout the year, garbage consisting of plastic, glass, and metal, much of it from shellfish operations around the island (Photo 40), accumulates at and above the high tide mark on Denman's beaches, including within the Reserve; annual beach clean-ups are undertaken by the community to remove this debris and the frequency of removal could be increased within the Reserve. In the past, the DCA Land Manager helped to remove all but the keel of an abandoned sailboat that had washed up on the Reserve's shore. Thus, the use of the Reserve for boat storage, evidenced by the recent observation of a kayak stored on the beach above the high tide line within the Reserve (UTM 10 U 374018 5485967, Photo 38), and the accumulation of beach garbage are additional management concerns.



Photo 37. Garbage from shellfish industry accumulates on Reserve shoreline.

Photo 38. Kayak being stored on Reserve shoreline.



A review of the beach trails is warranted. Management considerations include:

- Whether the southern beach access trail that runs partly on the DRA and partly on the Reserve should be relocated so that it is fully on the DRA and, at the same time, whether this trail could be made less steep by creating switch backs.
- Whether it would be worthwhile to establish an alternate south beach trail across from the exit of the Main Trail onto East Road, where there is currently an old, graded road that runs to the beach. A better option, so as to avoid walkers coming out on East Road from the Main Trail, might be to route the eastern end of the Main Trail onto a well-used track running from the Main Trail to Owl Crescent (Figure 12).
- Improvements to the northern trail. For example, it appears that initial steps have been taken to create a small switchback near the top that decreases the last steep portion of the climb. Other changes could be made to reroute the trail back across the slope to make it less steep and more resistant to erosion.

Regular monitoring, maintenance, and reporting, with a focus on the trails, could be part of a reserve warden's regular tasks.

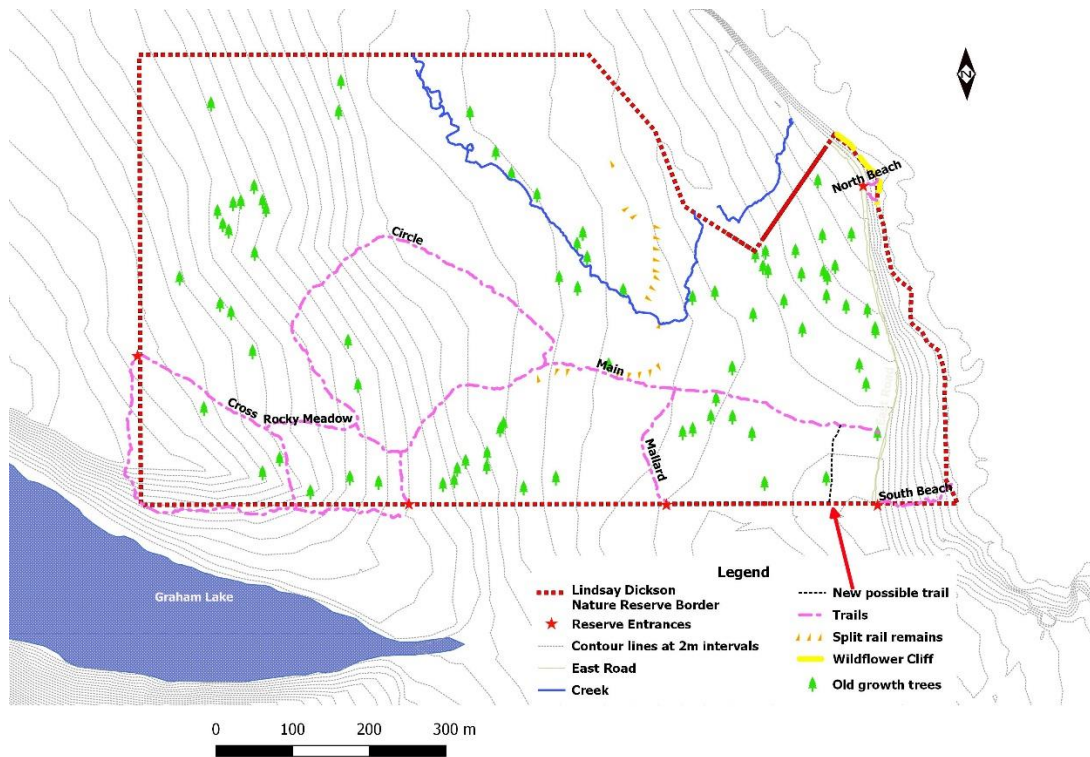


Figure 12. Potential new Trail Location.

6.7 Protection Initiatives for Sensitive Ecosystems and Species and Ecosystems at Risk

An initiative proposed in the 2002 management plan was to investigate protection of the three dedicated road allowances (DRAs) along the east and south borders of the Reserve. Protection of these DRA's would be intended to prevent further development of this land for road-development or clearing, to maintain only the existing simple trails and to conserve as undeveloped the remaining DRA portions of the significant rare ecosystems. Opening up of undeveloped DRAs would have detrimental ecological effects on the Reserve.

Protection of the old-growth portion of the Reserve, which has never been logged, continues to be a priority. This is achieved by restricting access to the area as much as possible. Still, it is apparent that some minor visitation to the area has occurred. Future use can be minimized by continuing to offer attractive trail options away from the area and by providing other opportunities to view old trees. The major negative impacts on the old forest seem to be windthrow effects and the increasing spread of English holly. Several very large trees have come down in recent years, likely due to high winds, and some of the downed trees along East Road have fallen back into the Reserve. The main protection that can be offered to these large trees is to reduce possible human-induced stress factors by minimizing soil compaction and introduction of possible disease organisms. Unfortunately, this approach could conflict with the need to manage holly in the area.

The Reserve is home to numerous northern red-legged frogs (*Rana aurora*) and Pacific banana slugs (*Ariolimax columbianus*). To protect these species within the Reserve, DCA could enhance its conservation education messaging about not introducing predatory, invasive American bullfrogs (*Lithobates catesbeianus*) to the island and about controlling non-native black slugs (*Arion ater*) and their eggs (which may come in plant pots) within the neighborhood. Black slugs have been seen crossing Mallard Way in the past, so a population may exist in the Reserve, although none were seen during this inventory.

6.8 Ecological Restoration Options

The ecological restoration method of choice has been to allow for natural regeneration of damaged ecosystems. However, one restoration project to protect young regenerating tree seedlings in the former log landing and in nearby openings, has been undertaken. Some logging debris was also removed from the rocky meadow. More of this debris could be removed from a small patch on the eastern part of the meadow. Consideration might also be given to seeding native rocky meadow species within the Rocky meadow polygon (currently, healthy populations of death camas and blue-eyed Mary thrive in the lower parts of the meadow and an onion species may also be present).

6.9 Scientific Research/Education Opportunities

In 2012, under the direction of the DCA Land Manager, 25 trees were caged with wire mesh in the old logging landing near the west end of Mallard Way. Due to the protection from browsing deer that is afforded by the cages, these trees have shown significantly hastened growth compared to un-caged trees in the ensuing years. Based on the success of the 2012 project, 40 additional cages were placed by DCA in 2016 around individual Douglas-fir, grand fir, western hemlock and western red cedar trees. Locations for caging in this second round were done in consultation with ITC during their annual monitoring visit, with most being in the previous site at the old logging landing, on the loop trail north and east of Mallard Way, and east of the rocky meadow. Ongoing monitoring is carried out through photographs which demonstrate the growth rate of caged trees versus those exposed to deer browsing. When caged trees have achieved growth to a height significantly above the level at which they are vulnerable to deer browsing, cages should be removed.

A bat acoustic call logger collected data about bat species in the late summer of 2019. Analysis of the calls will take place as part of the immediate actions of this plan and will give an indication of the species diversity. Subsequent acoustic inventories can be made at other times in future years.

The Reserve is probably Denman's largest, most significant refugia of original genetic material. As such, more information about the species present and their interactions would be valuable. At the same time, it will be important to avoid any adverse ecological impacts caused by inventory activities. The following objective, set out in section 1.4, should guide all research undertaken in the Reserve: "Support ongoing inventory, mapping and monitoring to guide

management actions within the Reserve, provided these human activities do not have a major impact on native species or the natural ecological functioning of the Reserve.”

On July 16, 2019 the ITC Board adopted a Reconciliation Declaration that states a commitment to creating opportunities for knowledge-sharing, understanding, and collaboration (Islands Trust 2019b). Relationship-building with regional First Nations, such as the K'ómoks First Nation, could lead to restored cultural and spiritual uses of the land as well as to an improved understanding of important cultural and ecological knowledge about the forests and wetlands of Denman and the Reserve itself. The first steps in relationship-building may include inviting discussion and story-telling, offering support to visiting elders, and helping with any matters identified by First Nations.

Possible inventory-related projects, in addition to the activities proposed in the monitoring program, could involve inviting naturalists, such as members from the local Comox Valley Naturalists, and other species experts to conduct low-impact studies in the reserve. DCA could act as the liaison for these visitors to the Reserve. Completing a list of the flora of the Reserve, as was done for other protected lands, is recommended as a first initiative. A comparative study of the recovering fields, although missing the changes that occurred in the early years, would provide valuable insight about the recovery of damaged moist areas. Last, support of citizen science, such as designing and providing a system for interested visitors to record species observations (e.g. identity, location, and life stage), would lead to increased understanding of the Reserve's ecology.

6.10 Exotic and Invasive Species Management

As already noted, many small populations of invasive herbaceous species are developing along the trails, including English daisy (*Bellis perennis*), Canada thistle (*Cirsium arvense*), Reed canary grass (*Phalaris arundinacea*), and Dandelion (*Taraxacum officinale*). There is both the opportunity to control the spread of some of these species at the trail edges in their early stages and a reasonable chance of achieving success. Trail monitoring would be the best way to assess the overall frequency and abundance of each species, followed by an assessment of whether removal actions are warranted.

An immediate recommendation is to remove the English daisies growing at the entrance to the Reserve and, particularly, along the trail by the Rocky meadow. Few individual plants are present, so their removal now would be simple. They reproduce rapidly and, once established, will out-compete and dominate the habitat. Although the meadow has other invasive species, removal of this daisy could have the greatest impact locally.

Throughout the Reserve, English holly is definitely the most significant non-native invasive species. Notably, this species can grow under the shade of the dense forest canopy. Removal of holly from the Reserve would necessitate a major management effort. Reviewing the success of the manual removal projects for holly in Morrison Marsh Nature Reserve and Fillongley Provincial Park would be useful for deciding on the most effective approach.

Scotch broom control has been quite successful in the Landing/Cleared area, and much of this site is regenerating as forest. Nevertheless, monitoring of openings in order to observe and remove new plants will be important. Reed canary grass populations are developing in many small sites, and will flourish in sunny areas. The frequency of sites with this species is likely beyond the point where cutting and covering all areas is possible, but some significant sites might be identified and action taken, resources permitting. Cutting the grass prior to seeding is a minimum-effort control option that could be undertaken by trail monitors.

The shoreline's rocky bluffs have significant native species, as well as a large number of invasive species that have spread extensively. Volunteers who had an interest in 'gardening out the weeds' at the important wildflower areas along the shore could have a major impact on the long term survival of the wildflowers. Interestingly, some native species are growing in positions on the rock undercuts where no invasive species seem able to establish.

The control of English ivy on the shore has made a considerable difference to the backshore. A small area of ivy was removed on the shoreline while this inventory was being conducted. As large amounts are present on the adjacent property, continued monitoring and removal will be necessary.

Unfortunately, on Denman the populations of uncontrolled, non-native invasive species are increasing, reproducing, and spreading through many of the private land holdings, particularly where the original vegetation and soils have been altered. Generally, the native species formerly in these sites take much longer to establish and thus are out-competed by many of the aggressive, weedy, non-native plants. Some of the new species are accidental human introductions, some come from the seashore, and others are garden plants (some of the 'deer-proof' ground covers have been called 'ecological disasters,' as they rapidly take over open areas). Thus, controlling the spread of invasive species within protected areas, particularly if the land has been disturbed, is increasingly difficult.

The relative absence of non-native herbaceous species in the Reserve's forests is notable, given that the Reserve is surrounded by long-used agricultural lands. The integrity of the original forest community has been maintained in most of the Reserve thanks to the shady conditions created by the high and complex forest canopy. Control of invasive species on forest trails should help to protect the Reserve from the spread of these species to other forest openings.

Ongoing assessment by DCA and development of a long-term plan for invasive species management are recommended. Planning will need to seriously consider both future climatic conditions and the potential for new species invasions.

6.11 Wildfire Risk Management

Wildfire risk management actions, such as removing woody debris, are limited by the overarching conservation objective of minimizing disturbance to the natural environment. Wildfire mitigation and response plans should be developed in collaboration with DCA and the

Denman Island Volunteer Fire Department. These should be updated annually as needed. Possible methods of controlling human sources of fire include posting notices of smoking bans, installing signs to notify the public of the fire-danger index, temporary trail closures during periods of extreme fire danger and adopting a cigarette butt disposal protocol.

6.12 Climate Change Impacts and Management

Climate change, with the associated warmer, drier conditions, is likely to affect species composition in the Reserve. Western redcedar trees are expected to persist only in moist sites, while the more drought-tolerant Douglas-fir will probably increase. Moisture requirements are similarly expected to drive changes in shrub and herbaceous plant composition and distribution. The timing of seasonal events also will change. This will likely disrupt the current patterns of emergence and migration of many species. On small islands with limited freshwater, changes in the location, duration, and quantities of available surface water will have profound effects on all species. Also, extreme storm events are likely to cause periodic and unpredictable changes, most probably resulting in more wind damage to trees. Added to these are the increased chance of wildfire and the increased possibility of damaging invasive plant and animal species establishing in already-stressed ecosystems. In general, for the small discrete protected land parcels on the Gulf Islands, these impacts may change the very features that contributed to their initial protection.

Managing for climate change is likely to mean preparing for new ecological scenarios that involve increased temperatures and reduced moisture conditions. Not only do managers need to plan for the protection of the existing ecosystems in the Reserve, but they also need to design realistic plans to adapt to the various scenarios that may develop over time. The natural values originally present may change considerably, and new values and opportunities may arise. Knowledge about the species found in similar protected areas on the warmer Southern Gulf Islands could be beneficial in appreciating expected ecosystem changes. In this potentially unstable future, adaptive management may be the best approach. This includes 1) observing how the natural systems seem to cope with the changes, 2) monitoring various changing features, and 3) managing 'gently,' while limiting human impacts to prevent further stress to the Reserve's ecosystems.

7 Action Items

The following action items are intended to contribute to the management, maintenance or protection of natural and cultural values in the Reserve. Additional actions are described in the monitoring program suggested in items #2 and #3 in Section 7.1.

7.1 Immediate Actions (1-2 years)

1. Support all partners, contractors and volunteers to complete cultural competency training in regard to reconciliation, knowledge and history of Coast Salish and Indigenous Peoples.

2. Seek out and appoint a volunteer warden and invite other volunteers to join a 'friends of' group if there is interest. Decide on the monitoring tasks for the warden and other volunteers.
3. Complete the following maintenance tasks to address immediate concerns:
 - Remove the garbage from the old-growth forest area (Polygon 8), the hanging cable near the creek and old homesite pond (Polygon 13), the log barriers on Mallard Way and Circle trails, and the dangerous stake in the ground at the East Road end of the Main Trail.
 - Decide on an approach to address the storage of boats on the Reserve shoreline.
 - Check for and remove any remaining Scotch broom from the landing.
4. As resources allow, plan an overall strategy for the removal of invasive species.
 - Continue the removal of English holly.
 - Continue with the work bees.
5. Engage with First Nations to ensure that the management plan is reflective of treaty, inherent rights, and the traditional territories of each Nation.
6. Work in collaboration towards a Management Plan for Areas of Cultural Heritage, gathering and harvesting, and Sacred Significance with First Nations.
7. Analyze the bat calls that have been collected with the bat acoustic call logger collected as part of the ecological inventory for this management plan to give an indication of the species diversity. Plan for subsequent acoustic inventories in future years if funding allows.
8. Evaluate the need for additional trail signage and kiosks.
9. Conduct a fire risk analysis for the Nature Reserve. Meet with the Denman Island Volunteer Fire Department to discuss approaches for mitigating the threat of wildfire in the Reserve, particularly human-source fires.
10. Continue to communicate with the BC Ministry of Transportation and Infrastructure to ensure that they respect the boundaries of the Nature Reserve when doing road maintenance.

7.2 Short term Actions (3-5 years)

1. As resources allow, continue invasive species management by implementing a comprehensive invasive species strategy (inventory, removal, reassessment), particularly for English holly.
2. If deemed necessary following evaluation of signage on the land, coordinate trail signage and/or kiosk
3. As resources allow, conduct species at risk surveys at appropriate times of year to document species of concern, collect baseline data, guide future management and restoration efforts, and to provide a better understanding of the natural values of the reserve.
4. Begin the discussion of anticipated climate change. As resources allow, design effective monitoring tasks to collect basic data on possible ecosystem changes (e.g., through brainstorming with other reserve managers). Work and liaise with First Nations associations on climate strategies and knowledge.

5. Continue to grow a vegetation list for the Reserve as funding allows.
6. Complete an inventory of all old-growth trees in the Reserve as funding allows.

7.3 Long term Actions (5+ years)

1. Review the effectiveness of invasive species management strategies and adapt as needed.
2. Review the effectiveness of climate change monitoring programs and adapt as necessary.
3. Consider where existing trails could be improved or re-routed, particularly South Beach Trail, to increase public safety as long as there are no negative impacts on sensitive ecological communities.
4. Consider preparing an educational pamphlet of significant Reserve species if funding allows.

7.4 Ongoing or Annual Action Items

1. Annual monitoring walk and discussion between Islands Trust Conservancy, covenant partners, volunteer warden and First Nations.
2. Annual review of issues identified by the warden and DCA (e.g., invasive species management, trail and incursion impacts, etc.).
3. Annual review of the wildfire risk, ideally every April to prepare for wildfire season.
4. Review of possible climate-related changes and adaptations occurring within the Reserve as required.
5. Continue to work with the Comox Valley Regional District to determine the placement of the Denman Cross-Island Trail which is in the process of being developed. Several current options involve using the Reserve as part of the trail system.

8 Conclusions

The known key features of this 53-hectare reserve, situated on the shore of Lambert Channel on east central Denman Island, include significant mature and old Coastal Douglas-fir forests, at least four rare ecological communities, and as many as 17 rare species. Visitors to the Reserve's forests or shoreline beaches can enjoy the natural world along seven different trails.

Major management considerations include routine monitoring and trail management, the spread of non-native invasive species and the threat of ecological changes due to high-intensity wildfire and climate change. Key recommendations cover appointing a volunteer warden to oversee routine monitoring and maintenance, developing both an invasive species management plan and a climate change adaptation plan, and continuing with ecological inventories.

The Lindsay Dickson Nature Reserve protects both locally and regionally significant biodiversity. While it is easy to appreciate the huge trees and vibrant forest ecosystems, the Reserve represents much more in terms of overall ecological wealth. As internationally renowned

ecologist E.C. Pielou noted, “The Lindsay-Dickson forest is one of the few surviving fragments of an ecosystem—the Coastal Douglas-fir Forest—that is one of the smallest in Canada.... This small forest is an isolated fragment of an endangered ecosystem, and undoubtedly contains some genetic diversity that exists nowhere else, most of it in local populations of tiny inconspicuous plants and animals.... The smooth functioning of the natural world depends on tiny organisms.” Thus, while management plans deal primarily with the issues and features most easily seen, the long term survival of the Reserve’s valuable genetic legacy will depend on the delicate application of management practices designed to protect the complex network of organisms and ecological processes against threats ranging from the readily apparent and straightforward to the unseen and unknown.

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10 Appendices

Appendix 1 Management Plan Photographs and Photographic Documentation

All photographs for the management plan of the Lindsay Dickson Nature Reserve are described in the five tables below.

Table A1- 1. Locations and descriptions of photographs used in the main text portion of the management plan, taken by J. Balke in Lindsay Dickson Nature Reserve

Text Section	Photo*	Location UTM Zone 10 Coordinates	Direction (°)	Date YYYY-MM-DD	Description
1	1	373912 5486065	NA	2019-10-05	Old growth forest, Douglas-fir veteran
1	2	373639 5486059	320	2019-06-29	Buddy trees along Main trail
1	3	373639 5486059	295	2019-06-29	Main Trail Colonnade
2	4	374030 5485963	360	2019-06-29	Pebble beaches
2	5	373907 5486343	130	2019-06-29	Sandstone cliff
2	6	374042 5486000	290	2019-06-29	Sandstone outcrop on shoreline (Dragon-like)
2.6	7	373892 5486172	200	2019-06-29	Possible culturally modified tree
2.6	8	373581 5486042	350	2019-08-08	Remains of split rail fences
2.6	9	EC 3**	NA	2019-05-23	Springboard stumps
2.6	10	373049 5486062	175	2019-08-14	Low cut stumps and skidder trail
2.6	11	373289 8485954	170	2019-06-29	Cage trees
2.6	12	373846 5485987	110	2019-06-29	Trail example Lower Main Trail
2.6	13	373922 5485888	20	2019-06-29	East Road
2.6	14	373922 5486294	115	2019-06-29	Trees cut along East Road
2.6	15	373886 5486357	235	2019-06-29	Utility cable housing connection
2.6	16	373712 5486238	300	2019-06-29	Hanging wire
3.3	17	373834 5486000	NA	2019-05-26	Glacial erratic
3.4	18	373311 5486476	100	2019-03-18	Creek and wetland complex
3.4	19	373584 5486391	110	2019-05-22	Old ditch
3.4	20	373613 5486424	160	2019-05-22	New ditch
3.4	21	NA	NA	2019-05-23	Dragonfly common whitetail
3.4	22	373155 5486387	NA	2019-05-24	Northern red-legged frog
3.4	23	shoreline	NA	2004--02-14	Harlequin ducks on Reserve shoreline
3.4	24	shoreline	NA	2019-03-15	River otter on Reserve shoreline
3.5	25	EC 3	NA	2019-08-08	Sandstone slabs at soil surface
3.5	26	373787 548540	60	2019-08-08	Pebbles and small rocks in soil under roots
3.7	27	EC 1	NA	2019-05-23	Rocky meadow death camas
3.7	28	373908 5486319	NA	2019-06-01	Old trees in unlogged forest
3.7	29	373949 5486309	NA	2019-05-25	Sedum on shoreline cliff
3.7	30	373903 5486354	NA	2019-05-25	Goldenback fern under shoreline cliff
3.8	31	EC 1	NA	2019-05-23	Pileated woodpecker

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3.8	32	EC 8	NA	2019-05-26	Bigleaf maple canopy
3.8	33	shoreline	NA	2012-06-23	Mink on shore
3.9	34	373903 5486243	270	2019-06-29	Fallen tree in unlogged forest at East Road
3.9	35	373158 5486192	150	2019-09-26	Dying western redcedar (<i>Thuja plicata</i>)
3.9	36	373685 5486083	NA	2019-06-29	Possible root rot area EC 6
6.6	37	373939 5486288	230	2019-06-29	Oyster baskets
6.6	38	374018 5485967	NA	2019-06-01	Kayak on shore

* Photos from the text are in a separate pdf file.

** EC = Ecological community.

Table A1- 2. Specifications and descriptions of trail photographs, taken by J. Balke in Lindsay Dickson Nature Reserve

Text Section	Photo *	Location UTM Zone 10 Coordinates	Direction (°)	Date YYYY-MM-DD	Description
2.1, 2.6	T-1a	373366 5486017	40	2019-06-29	Main Trail – upper
2.6	T-1b	3739385485970	110	2019-06-01	Metal stake at East Road end of Main Trail
2.1, 2.6	T-2a	373626 5485985	5	2019-06-29	Mallard Way Trail looking north
2.1, 2.6	T-2b	373626 5485985	170	2019-06-29	Mallard Way Trail looking south
2.1, 2.6	T-3	373158 5485937	180	2019-06-01	Cross Trail
2.6	T-4	373148 5485999	90	2019-06-01	Rocky Trail
2.6	T-5	373387 5486200	115	2019-06-01	Circle Loop Trail
2.6	T-6	373941 5485879	90	2019-06-29	South Beach Trail
2.6	T-7	373939 5486288	280	2019-06-29	North Beach Trail

* Photos are in Appendix 2.1.

Table A1- 3. Specifications and descriptions of sign photographs referred to in Table 2, taken by J. Balke in Lindsay Dickson Nature Reserve

Text Section	Photo*	Location UTM Zone 10 Coordinates	Direction (°)	Date YYYY-MM-DD	Description
2.6	S-1	373332 5485933	NA	2019-06-01	Reserve sign main entrance at west end of Mallard Way
2.6	S-2	372961 5486121	NA	2019-08-08	Jemima Road entrance
2.6	S-3	373649 5485910 373903 5485880	NA	2019-08-14	Mallard Way east entrance. Note: Another no-bicycles, no-horses sign is present at the second location indicated
2.6	S-4	373903 5485880	NA		New no-hunting sign
2.6	S-5	373952 5486026	NA	2019-08-14	Two older types of no-hunting signs, one of which is present at each location indicated.
2.6		373990 5486062	NA	2019-08-14	
2.6		373681 5485878	NA	2019-08-14	
2.6		373664 5485883	NA	2019-08-14	
2.6	S-6	373506 5485886	NA	2019-08-14	No-hunting sign – tagged

* Photos are in Appendix 2.2.

Table A1- 4. Specifications and descriptions of ecological community photographs, taken by J. Balke in Lindsay Dickson Nature Reserve

Section	Photo **	Location UTM Zone 10 Coordinates	Direction (°)	Date YYYY-MM-DD	Description
App 3*	E1-1	373133 5486008	70	2019-05-23	Rocky Meadow Rocky Trail
App 3	E1-2	373130 5485994	300	2019-08-14	Rocky Meadow Cross Trail
App 3	E1-3	EC** 1	NA	2019-05-22	Death camas
App 3	E1-4	EC 1	NA	2019-05-22	Blue-eyed Mary
App 3	E1-5	EC 1	NA	2019-05-23	Garter snake
App 3	E2-1	373971 5486103	160	2019-08-14	Shoreline valley
App 3	E2-2	373990 5486062	180	2019-08-14	Shoreline ridge
App 3	E2-3	373165 5486093	330	2019-06-29	Shoreline rocky cliff
App 3	E2-4	EC 2	180	2019-06-01	Sedum in sandstone cliff
App 3	E2-5	373832 5486332	300	2019-05-25	Shoreline rock garden
App 3	E2-6	EC 2 near above	NA	2019-05-25	Shoreline rock garden
App 3	E2-7	373903 5486354	NA	2019-05-25	Goldenback fern
App 3	E3-1	372967 5485930	260	2019-05-23	Forest with western hemlock component
App 3	E3-2	373032 5485911	70	2019-05-23	Forest with western hemlock component
App 3	E3-3	EC3	NA	2019-05-23	Springboard stump
App 3	E4-1	373115 5486108	330	2019-05-26	Moderately dry zonal forest 2019
App 3	E4-2	373115 5486108	330	2007-09-13	Moderately dry zonal forest same site 2007

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App 3	E4-3	373164 5486165	220	2019-05-24	Salal understory and older trees
App3	E4-4	373049 5486062	175	2019-08-14	Low-cut stumps along Cross Trail
App 3	E5-1	373737 5486012	240	2019-08-08	Moderately dry rich forest, redcedar and salal
App 3	E5-2	373708 5486026	005	2019-08-08	Moderately dry rich forest, tall shrubs
App 3	E6-1	373088 5486416	340	2019-08-08	Moist rich forest with sword fern understory
App 3	E6-2	373088 5486416	255	2019-08-08	Springboard stumps
App 3	E6-3	373220 5485942	280	2019-08-08	Moist rich forest on southwest
App 3	E6-4	373831 5485965	325	2019-05-26	Moist rich forest near southeast border
App 3	E6-5	373581 5486042	130	2019-08-08	Moist rich forest near Main Trail
App 3	E6-6	373727 5486053	320	2019-06-29	Moist rich forest next to never-logged community
App 3	E6-7	373717 5486065	NA	2019-08-08	Moist rich forest with vanilla leaf understory
App 3	E6-8	373556 5486255	150	2019-05-18	Moist rich forest northeast of creek
App 3	E7-1	EC 7 near creek	NA	2019-05-24	Logged moist rich forest, cut stumps
App 3	E7-2	3735504 5486108	NA	2019-08-08	Cut stumps near border with EC 5
App 3	E7-3	373381 5486185	180	2019-05-24	Salal on coarse woody debris
App 3	E7-4	373494 5486104	310	2019-08-08	Salal sword fern sedge in flat area
App 3	E7-5	373384 5485945	45	2019-08-08	Logging gap with sword fern SW
App 3	E7-6	EC 7 near Main Trail	NA	2019-08-08	Logging gap with sword fern centre
App 3	E7-7	373395 5486300	NA	2019-05-21	Old logging skid road with ruts
App 3	E7-8	373395 5486300	NA	2019-05-21	Old logging skid road with sedge
App 3	E7-9	373466 5486037	60	2019-08-08	Reed canary grass on Main Trail
App 3	E7-10	373531 5486097	NA	2019-08-08	Thistle patch
App 3	E7-11	373215 5486486	175	2007-09-11	Red alder forest
App 3	E7-12	373210 5486484	175	2019-05-26	Red alder forest
App 3	E8-1	373926 5486062	185	2019-08-14	Old moist rich forest
App 3	E8-2	373847 5486130	295	2019-08-14	Maples in old moist forest
App 3	E8-3	373848 5486135	120	2019-08-14	Fallen old growth
App 3	E8-4	373855 5486132	200	2019-08-14	Sword fern understory
App 3	E9-1	373727 5486197	65	2019-05-22	Wet forest, recovering field sword fern understory
App 3	E9-2	373734 5486210	20	2019-05-22	Wet forest, recovering field sedge understory
App 3	E10-1a	373526 5485918	30	2019-05-22	Wet forest, recovering field in May
App3	E10-1b	373553 5486998	95	2019-08-08	Wet forest, recovering field in August
App 3	E10-2a	373538 5485899	100	2019-05-22	Gap with reed canary grass in May
App3	E10-2b	373553 5486998	200	2019-08-08	Gap with reed canary grass in August
App 3	E11-1	373386 5486443	210	2019-08-14	(1) Wet forest, recovering field

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App 3	E11-2	373683 5486263	105	2019-05-22	(2) Moist forest, sedge understory
App3	E11-3	373595 5486336	140	2019-08-14	(2) Moist forest, sword fern understory
App 3	E11-4	373598 5486369	270	2019-05-22	(3) Open grass with tree patches
App 3	E11-5	373664 5486275	110	2019-09-08	Invasive English ivy
App 3	E12-1	373748 5485907	300	2019-05-23	Wet swamp forest mud flats
App 3	E12-2	EC 12	NA	2019-05-23	Wet swamp forest pools
App 3	E12-3	EC 12	NA	2019-05-23	Huge snags
App 3	E12-4	EC 12	NA	2019-05-23	Large coarse woody debris
App3	E13-1	373314 5486477	345	2019-08-08	Creek and wetland system begins at north Reserve border
App 3	E13-2	373494 5486280	140	2019-05-21	Creek and wetland channel
App 3	E13-3	373375 5486360	325	2019-05-21	Skunk cabbage habitat
App 3	E13-4	373578 5486154	160	2019-05-21	Creek widening into Central Wetland
App 3	E13-5	3736611 5486114	350	2019-08-14	Central Wetland shrub portion
App 3	E13-6	373611 5486110	345	2019-08-14	Central Wetland sedge portion
App 3	E13-7	373695 5486148	15	2019-05-22	Creek through old forest
App 3	E13-8	373695 5486148	15	2019-05-21	Creek after wetland by old growth
App 3	E13-9	373560 5486204	170	2019-03-19	Creek and wetland complex in March
App3	E13-10	373546 5486202	160	2019-05-21	Creek and wetland complex in May
App 3	E14-1	373307 5485967	10	2019-08-08	Landing, Main Trail
App 3	E14-2	373303 5485975	140	2019-05-23	Landing, Rocky Trail and tree cages
App 3	E14-3	373197 5485999	250	2019-05-23	Clearing
App 3	E14-4	373175 5485974	95	2019-08-14	Clearing

* App = Appendix

** EC = Ecological community

Table A1- 5. Specifications and descriptions of wildlife photographs, taken by J. Balke in Lindsay Dickson Nature Reserve

Text Section	Photo *	Location EC^ or UTM Zone 10 Coordinates	Direction (°)	Date YYYY-MM-DD	Description
2.6	A4-1	EC 7	NA	2019-05-26	Red squirrel (<i>Tamiascurius hudsonicus</i>)
3.8	A4-2	EC 2	NA	2019-06-29	Black-tailed deer (<i>Odocoileus hemionus</i>)
6.5	A4-3	EC 8	NA	2019-08-14	Deer trail through old forest.
3.8	A4-4	EC 11	NA	2019-06-29	Western tanager (<i>Piranga ludoviciana</i>)
3.8	A4-5	EC 12	NA	2019-05-23	Downy woodpecker (<i>Picoides pubescens</i>)
3.1, 3.8	A4-6	373155 5486387	NA	2019-05-24	Northern red-legged frog (<i>Rana aurora</i>)
3.8	A4-7	373799 5486231	NA	2019-06-01	Long-toed salamander (<i>Ambystoma macrodactylum</i>)
3.8	A4-8	EC 12	NA	2019-05-23	Pacific sideband (<i>Monadenia fidelis</i>)
3.1, 3.8	A4-9	Various	NA	Various	Various dragonflies photographed in the Reserve
3.1, 3.8	A4-10	Various	NA	Various	Various butterflies photographed in the Reserve^^

* Photos are in Appendix 4.

^ EC= Ecological community

^^ All butterflies were photographed in 2019, except pine white butterfly, which was photographed on Aug 18, 2012.

Appendix 2 Anthropogenic Features

Signs of previous logging (stumps) and ditching (known ditches) by humans are shown in Figures 4 and 7, respectively. Figure A2-1 documents the location of trails, signage, and other anthropogenic features.

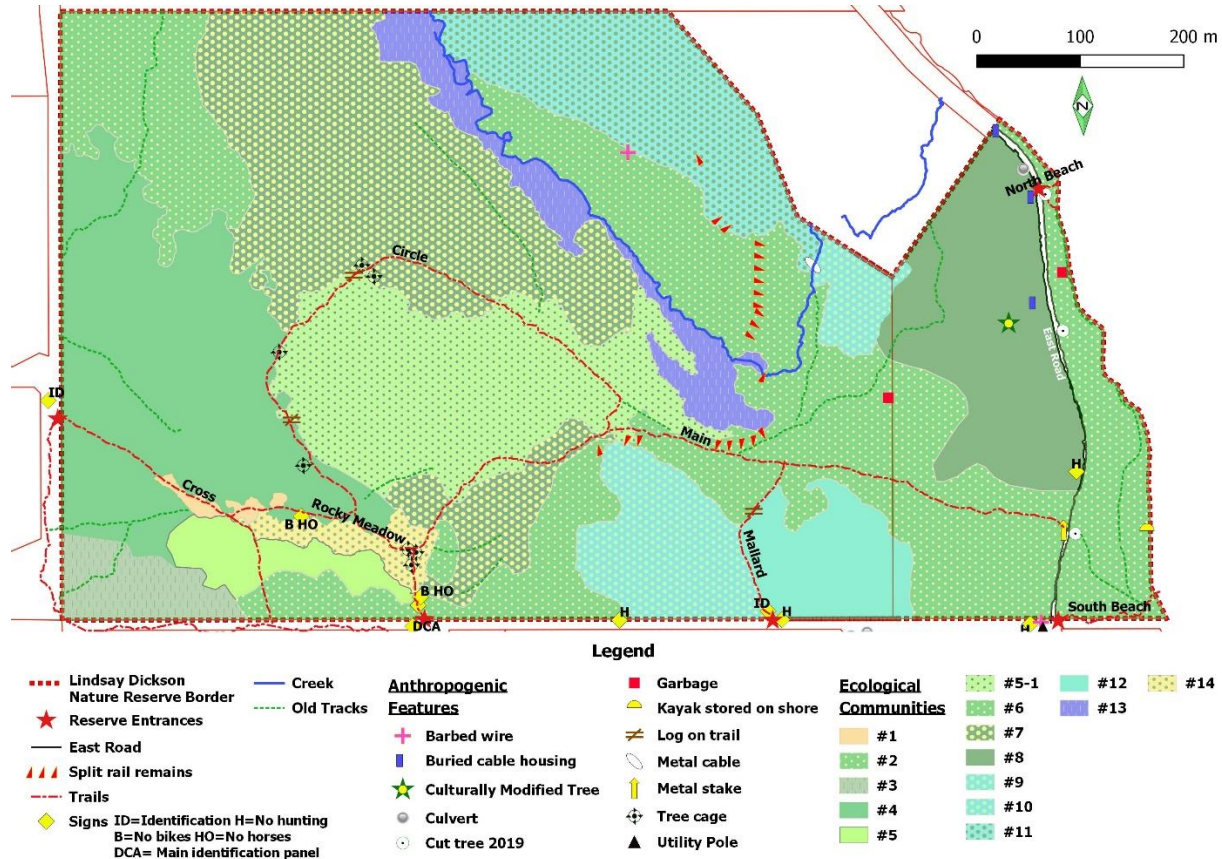


Figure A2- 1. Map of anthropogenic features in Lindsay Dickson Nature Reserve.

Appendix 2.1 Trail photographs



Photo A2-T- 1a. Main Trail.



Photo A2-T1-b. Stake in main trail.



Photo A2-T- 2a. Mallard Way Trail looking north.

Photo A2-T-2b. Mallard Way Trail looking south.





Photo A2-T- 4. Rocky Meadow Trail.



Photo A2-T- 6. South Beach Trail.



Photo A2-T- 7. North Beach Trail.

Photo A2-T- 3. Cross Trail.



Photo A2-T- 5. Circle Loop Trail.



Appendix 2.2 Sign photographs

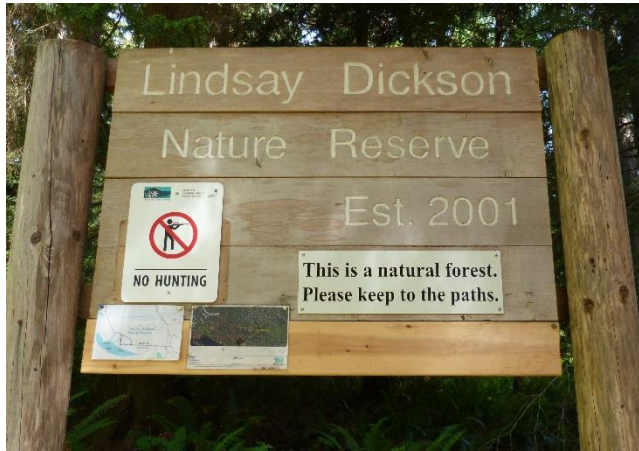


Photo A2-S- 1. Main reserve entrance at west end Mallard Way.



Photo A2-S- 2. Jemima Road entrance.



Photo A2-S- 3. Mallard Way east entrance (Identification and no bicycles, no horses).



Photo A2-S- 4. New no-hunting sign.



Photo A2-S- 5. Two older versions of no-hunting signs.



Photo A2-S- 6. Tagged old no-hunting sign.

Appendix 3 Ecological Communities

See separate attachment for Appendix 3.

Appendix 4 Wildlife Species

Common wildlife species in the Reserve that were seen regularly, or their sign was seen, in the ecological inventory conducted for the preparation of this plan included black-tailed deer (*Odocoileus hemioncus*) and red squirrels (*Tamiascurius hudsonicus*). Red squirrels were seen amongst the coarse woody debris and were heard chattering from tree trunks and canopies. Their midden sites were seen throughout the Reserve, and the large area of complex forest habitat may be a safe refugia for them, as it provides supportive habitat distant from free-ranging domestic cats (Photo A4-1). Black-tailed deer (Photo A4-2) are abundant on Denman, and deer trails were noted criss-crossing the Reserve (Photo A4-3).

Resident birds in the Reserve such as red-breasted nuthatch, chestnut-backed chickadee, spotted towhee, and American robin were seen or heard regularly, whereas those that are seasonal were seen less often. Some migratory birds over-winter and are usually seen on the shoreline (various ducks, shore birds, and gulls), whereas others such as the neotropical migrants (warblers, flycatchers, vireos, etc.) breed in the Reserve in the spring and summer months, returning south in the fall. Migrant birds that are particularly attractive for the viewing public are, in winter, harlequin ducks (*Histrionicus histrionicus*) (Photo 25) and, in summer, western tanagers (*Piranga ludoviciana*) (Photo A4-4). The western tanagers breed in the open coniferous forests of the Reserve and are heard throughout the older forests; Photo A4-4 was taken at the edge of ecological communities 6 and 11. Woodpecker species were common, foraging on standing snags and downed coarse woody debris (Photo A4-5)

The Reserve includes both amphibian and reptile habitat. Many amphibian species breed in the creeks and wetlands and then move to the moist forests. The build-up of vegetative and coarse woody debris in the old forests provides protective shelter from predators and excessive climatic conditions, as well as foraging sites for invertebrate prey. Northern red-legged frogs (*Rana aurora*) breed in the aquatic sites in spring and then travel throughout the Reserve, staying near the moist forest debris (Photo A4-6). They were seen along the creek and wetland areas and near large, coarse woody debris. Young Pacific chorus frogs (*Pseudacaris regilla*) were seen in the wetland. No attempt was made to record possible salamanders, but a long-toed salamander (*Ambystoma macrodactylum*) (Photo A4-7) was observed under a large piece of fallen Douglas-fir bark. Aquatic-breeding salamander species, as well as the plethodon, or forest-breeding salamander species, would be anticipated in the Reserve. Forest-breeding, rare wandering salamanders (*Aneides vagrans*) are common on Denman. As noted already, a young northwestern garter snake was seen in the rocky meadow (Photo A3-E1-5); all three garter-snake species and northern alligator lizards are common on Denman and are probable in the Reserve.

Numerous invertebrates would be expected in the Reserve, but observation of only a few large notable species was attempted. Banana slugs (*Ariolimax columbianus*) were seen periodically and also the occasional snail (Photo A4-8). Seven dragonfly (Photo A4-9), two damselfly, and five butterfly species (Photo A4-10) were noted. The butterfly species photo includes the pine white butterfly, which was photographed in the recovering field of Ecological Community 11 in

2012 and which tends to occur in large numbers in periodic 'outbreaks.' Bee, ant, and many other invertebrate species await identification within the Reserve.

Many additional wildlife species are commonly found in similar habitats on Denman or have been seen previously in the Reserve. A list of additional rare species is provided in Table A4-1.

Table A4- 1. Additional potential rare wildlife species in Lindsay Dickson Nature Reserve

Species Name		Status*					Presence in the Reserve#
Common	Scientific	Provincial	BC List	Global	COSEWIC	SARA	
Barn Swallow	<i>Hirundo rustica</i>	S3S4B (2015)	Blue	G5 (2016)	T (2011)	1-T (2017)	L
Dun Skipper Butterfly	<i>Euphyes vestris</i>	S2 (2013)	Red	G5 (2016)	T (2013)	1-T (2003)	L
Great Blue Heron, fannini subspecies	<i>Ardea herodias fannini</i>	S2S3B,S4N (2018)	Blue	G5T4 (2016)	SC (2008)	1-SC (2010)	S
Little Brown Myotis (Bat)	<i>Myotis lucifugus</i>	S4 (2015)	Y	G3 (2016)	E (2013)	1-E (2014)	L
Marbled Murrelet	<i>Bradachyramphus marmoratus</i>	S3B,S3N (2015)	Blue	G3 (2016)	T (2012)	1-T (2003)	L
Northern Goshawk, laingi subspecies	<i>Accipter gentilis laingi</i>	S2 (2010)	Red	G5T2 (2016)	T (2013)	1-T (2003)	P
Northern Pygmy-owl, swarhi subspecies	<i>Glaucidium gnoma swarhi</i>	S3S4 (2018)	Blue	G4G5T3Q (2016)			P
Oregon Forestsnail	<i>Allogona townsendii</i>	S2 (2015)	Red	G3G4 (2010)	E (2013)	1-E (2005)	L
Peregrine Falcon, pealei subspecies	<i>Falco peregrinus pealei</i>	S3 (2010)	Blue	G4T3 (2016)	SC (2017)	1-SC (2003)	L
Townsend's Big-eared Bat	<i>Corhyorhinus townsendii</i>	S3S4 (2015)	Blue	G4 (2016)			L
Wandering Salamander	<i>Aneides vagrans</i>	S3 (2016)	Blue	G4 (2005)	SC (2014)	1-SC (2010)	L
Western Pine Elfin Butterfly	<i>Callohyrs eryphon sheltonensis</i>	S3 (2013)	Blue	G5TNR			L

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sheltonensis subspecies						
Western Pondhawk Dragonfly	<i>Erthemus collocata</i>	S3S4 (2015)	Blue	G5 (2016)		S

* Species status ranking explanations are provided in Appendix 5.

Presence in Reserve: S=seen in Reserve previously, L=likely, and P=possible



Photo A4- 1. Red squirrel (*Tamiascurius hudsonicus*).



Photo A4- 2. Black-tailed deer (*Odocoileus hemionus*).



Photo A4- 3. Deer trail through old forest.



Photo A4- 4. Western tanager (*Piranga ludoviciana*).

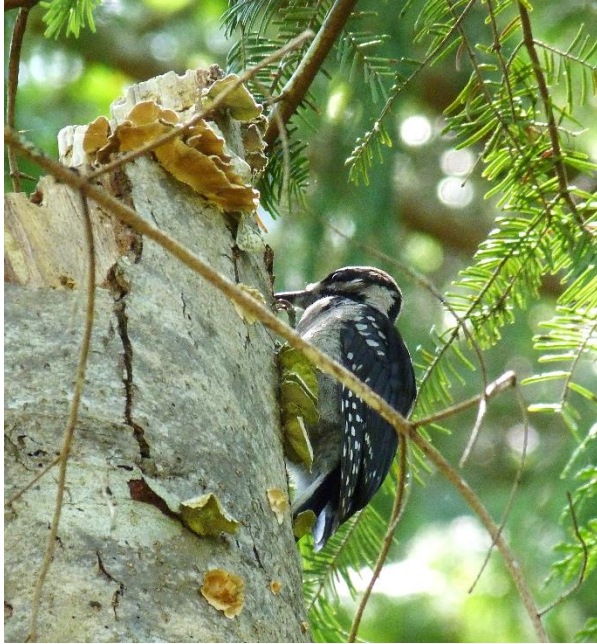


Photo A4- 5. Downy woodpecker (*Picoides pubescens*).



Photo A4- 6. Northern red-legged frog (*Rana aurora*).



Photo A4- 7. Long-toed salamander (*Ambystoma macrodactylum*).



Photo A4- 8. Pacific sideband (*Monadenia fidelis*).



Photo A4- 9. Dragonflies, from left to right, top to bottom: Eight spot (*Libellula forensis*), American emerald (*Cordulia shurtleffi*), Striped meadowhawk (*Sympetrum pallipes*), Autumn meadowhawk (*Sympetrum vicinum*), Western pondhawk (*Erthemus collocata*).



Photo A4- 10. Butterflies, from left to right: Painted lady (*Vanessa carui*), Pine white (*Neophasia menapia*), Woodland skipper (*Ochlodes sylvanoides*).

Appendix 5 Rare Species Status Definitions

Provincial Status: Applies to a species or ecological community's conservation status in British Columbia. The number in parenthesis is the year the status rank was last reviewed. 1 = critically imperiled, 3 = special concern, vulnerable to extirpation or extinction, and 4 = apparently secure.

B.C. List Status: Species are assigned to provincial lists depending on their Provincial Conservation Status. **Red** includes any native species or subspecies that have, or are candidates for, Extirpated, Endangered, or Threatened Status in British Columbia. Extirpated taxa no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed. Not all Red-listed taxa will necessarily become formally designated. Placing taxa on these lists flags them as being at risk and requiring investigation. **Blue** includes any native species or subspecies considered to be of Special Concern (formerly Vulnerable) in British Columbia. Taxa of Special Concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events. Blue-listed taxa are at risk, but are not Extirpated, Endangered or Threatened.

Global Rank: Applies to a species/ecological community across its entire range. The number in parenthesis is the year the rank was last reviewed. 1 = critically imperiled, and 4 = apparently secure.

COSEWIC (Committee On the Status of Endangered Species In Canada): Rank is followed by the date that the rank was last reviewed: SC = SPECIAL CONCERN: A species is of special concern because of characteristics that make it is particularly sensitive to human activities or natural events.

SARA (Species At Risk Act): Status consists of the SARA Schedule followed by the SARA Status code and may be followed by the date that the rank was last reviewed: SC = SPECIAL CONCERN: A species is of special concern because of characteristics that make it is particularly sensitive to human activities or natural events.

Appendix 6 Letter to Neighbours

August 21, 2019

Dear Neighbour,

The Islands Trust Conservancy is updating its management plan for Lindsay Dickson Nature Reserve and we are interested in hearing from you.

Lindsay Dickson Nature Reserve, established in 2001, is a 53-hectare forested property centrally located on the east coast of Denman Island between Graham Lake and Lambert Channel. The Reserve protects mature coastal Douglas-fir forest, including three hectares of untouched old-growth forest. More than 0.5 km of creek and wetland habitat add to the Reserve's biodiversity. Recent inventories identified five rare species and four rare ecological communities within the Reserve. The Reserve's shoreline presents a scenic vista of sandstone formations and pebble beaches, while upland trails provide pleasing walks under a multilayered forest canopy

The Islands Trust Conservancy will work in partnership with the Denman Conservancy Association to manage the property to protect its natural values, sensitive ecosystems, and threatened species. Development of any kind, including disturbance to native vegetation, soils, and water flow, is prohibited. There are restrictions on the use of the property, outlined in a conservation covenant that is held by the Denman Conservancy Association, that have been put in place to protect the native plants and animals within the Reserve. We are now updating the management plan to guide management of the Reserve for the next ten years.

Your input is requested for the development of the next Lindsay Dickson Nature Reserve Management Plan. As a neighbour of the Reserve, we would like to hear your ideas and concerns regarding the long-term management of this special place. Please complete the enclosed questionnaire, which is also available online: www.surveymonkey.com/r/ldnr2019.

The questionnaire can be completed online or returned to me by mail by September 20, 2019, or dropped off in person at the Lindsay Dickson Nature Reserve management plan open house. The open house will be held on Saturday September 7th from 11-1 pm at the Marcus Isbister Old School Centre at 5901 Denman Road. The open house will be followed by a Walk & Talk at the Reserve from 2-3 pm (meet at the top of Mallard Way).

Thank you for taking the time to share your ideas regarding management of the Lindsay Dickson Nature Reserve. For more information, please contact me at the number or address listed below.

Jemma Green
A/Property Management Specialist,
Covenant Management and Outreach Specialist Islands Trust Conservancy
250-405-5193

jgreen@islandstrust.bc.ca



Lindsay Dickson Nature Reserve on the east coast of Denman Island.

Appendix 7 Questionnaire sent to Neighbours and Made Available at Open House and Online

Lindsay Dickson Nature Reserve Questionnaire

Lindsay Dickson Nature Reserve, established in 2001, is a 53-hectare forested property centrally located on the east coast of Denman Island between Graham Lake and Lambert Channel. The Reserve protects mature coastal Douglas-fir forest, including three hectares of untouched old-growth forest. More than 0.5 km of creek and wetland habitat add to the Reserve's biodiversity. Recent inventories identified five rare species and four rare ecological communities within the Reserve. The Reserve's shoreline presents a scenic vista of sandstone formations and pebble beaches, while upland trails provide pleasing walks under a multilayered forest canopy.

The Islands Trust Conservancy's primary goal is to protect and nurture the sensitive ecosystems and natural values on this land. The information and actions required to achieve this goal and guide the management of the property are set out in a management plan that is updated every 10 years. We welcome community input on the Reserve's next management plan. Please share your thoughts on the protection and long-term management of the Lindsay Dickson Nature Reserve.

1. Are you a resident of Denman Island?

- Yes, I live on north Denman Island
- Yes, I live mid-island
- Yes, I live on south Denman Island
- No, but I own property on Denman Island
- No, I'm a visitor

2. Have you ever visited Lindsay Dickson Nature Reserve? If so, how often?

- No, never
- Once
- A few times
- A few times per year
- Once a month or more

3. If you have visited Lindsay Dickson Nature Reserve before, what did you do there?

- Hiking/walking
- Wildlife viewing
- Dog walking
- Other (please list):

4. Please list any wildlife and unique plant species you have seen in or near Lindsay Dickson Nature Reserve:

5. What do you believe to be the most important values of nature reserves? (choose three)

- Protection of habitat for at-risk species
- Ecosystem services (e.g. clean water and air, erosion control, groundwater recharge, etc.)
- Recreational opportunities
- Education and research opportunities
- Tourism
- Aesthetic appeal
- Conservation for the sake of the intrinsic value of nature
- Other (please specify):

6. What activities do you believe are incompatible with the protection of natural features, and should not be allowed within the Lindsay Dickson Nature Reserve?

7. What do you feel could be the greatest threat to the health of this nature reserve, and should be the highest management priority for the Islands Trust Conservancy?

8. Please provide any other relevant information that will help us make the best management decisions for Lindsay Dickson Nature Reserve.

9. Please share with us any history you know about this property or any knowledge you have about unique cultural or other special features on the property.

10. If you would like to receive periodic updates from the Islands Trust Conservancy on this and other conservation projects on the islands, please provide your name and email address:

Thank you for your time spent helping us plan the future of Lindsay Dickson Nature Reserve.

Appendix 8 Letter to First Nations

October 24, 2019

Dear Chief and Council,

Re: Islands Trust Conservancy Nature Reserves on Sla-dai-aich/Ihaytayich (Denman Island)

The Islands Trust Conservancy, through its work as a land trust, is drafting management plans for the new Valens Brook Nature Reserve as well as for Inner Island Nature Reserve and Lindsay Dickson Nature Reserve on Denman Island.

The Islands Trust and the Islands Trust Conservancy wish to acknowledge First Nations treaty and rights within the Islands Trust Area and ensure that the direction of the management plans is reflective of both reconciliation and conservation goals; as well as, the cultural significance and traditional use of the area so that these values can also be preserved and protected—now and into the future. We understand that the cultural significance of this land may be confidential and we would work with you to ensure that the management plan reflects this significance appropriately.

Valens Brook Nature Reserve (PID 028-931-734; Lot A, Section 6, Denman Island, Nanaimo District; Plan VIP89469 Except Parcel A (DD28585W) and PID 030-654-505; Lot 1, Section 6, Denman Island, Nanaimo District, District Plan EPP74292), Inner Island Nature Reserve (PID 018-012-256; Lot A, Section 21, Denman Island, Nanaimo; District Plan VIP55499) and Lindsay Dickson Nature Reserve (PID 009-706-071; The SE 1/4 of Sec. 14, Denman Island, Nanaimo District, Except part in plan VIP70081 and PID 009-705-911; The SW 1/4 of Sec. 14, Denman Island, Nanaimo District Except the Northerly 40 acres and part in Plan VIP70081) together make up over 68 hectares of protected forests, wetlands, and streams on Denman Island (map attached). These nature reserves are home to many sensitive and provincially red- or blue-listed ecological communities and several species at risk, and they are a protective buffer for portions of Denman's two major salmon-bearing stream systems. ITC works in partnership with the Denman Conservancy Association to conserve the unique natural and ecological values of these lands.

The Conservancy is aware that there are sites of cultural and spiritual significance in these areas, and that there are registered archeological sites on Lindsay Dickson Nature Reserve and near Valens Brook Nature Reserve. In keeping with the Islands Trust Conservancy Reconciliation Declaration (attached), we would like to work with your Nation to protect and manage cultural heritage sites in these nature reserves in a way that is reflective of treaty, inherent rights, and the traditional territories of your Nation.

You may also be interested to know that the ITC has developed a draft management plan template that includes cultural heritage. I would be pleased to provide it to you, if you would like to comment on it.

Thank you for considering our request to work together. Please contact me at the number or email listed below. Thank you for your kind consideration.

Sincerely,

Nuala Murphy
Property Management Specialist
Islands Trust Conservancy
250-405-5193 | nmurphy@islandstrust.bc.ca

Islands Trust Conservancy's Victoria office is located in Coast Salish territory and we acknowledge with respect the BOKÉĆEN, Cowichan, Halalt, Homalco, K'ómok, Klahoose, Lake Cowichan, Lekwungen, Lyackson, MÁLEXEŁ, Penelakut, Qualicum, Scia'new, selíłwitulh, SEMYOME, Shíshálh, Snaw-naw-as, Snuneymuxw, Sḵwḵwú7mesh, SḶÁUTW, Stz'uminus, SXIMEŁEŁ, T'Sou-ke, Tla'amin, Tsawwassen, We Wai Kai, Wei Wai Kum, WJOLEŁP, WSIKEM, and x^wməθk^wəyəm territories in which we live and work.

Appendix 3 Ecological Community Description

A3.1 Ecological Community 1 Rocky Meadow

The Rocky Meadow community is on a gently sloping rocky outcrop facing northeast, and consists primarily of herbaceous and moss species (Photos A3-E1-1 and 2). Various shrub species are present, mainly on the edges, although a few dwarf rose (*Rosa gymnocarpa*) occur within the meadow. The showy display of death camas (*Zygadenus venenosus*) (Photo A3-E1-3), small-flowered blue-eyed Mary (*Collinsia parviflora*) (Photo A3-E1-4), and western buttercup (*Ranunculus occidentalis*) in May reflects typical native meadow vegetation growing in moderately dry, nutrient-medium, very shallow soils on rock. An onion species (*Allium sp.*) was present in the lower slope of the meadow, but appeared to have dried before blooming.

Dicranum species and *Hylocomium splendens* are the dominant bryophytes. The lower, middle, and upper polygons of this community are different in species composition and cover. The percent cover also varies with the development of the herbaceous vegetation and is more plentiful in early spring with meadow flowers and later in the season with grass and various non-native species.

Within the community are six tree patches. Small numbers of mature second-growth Douglas-fir are growing in subsurface soil pockets or rock-fissures, but notably five of the eight Douglas-firs in the northern, highest-elevation portion of the meadow are dead.

The meadow includes both open and edge habitat. For wildlife the opening offers additional sun exposure, benefiting basking snakes such as the northwestern garter snake (*Thamnopsis ordinoides*) (Photo A3-E1-5), as well as dragonflies, damselflies and butterflies. Edges often lead to increased shrub-level vegetation that benefits ground-nesting and foraging wildlife species such as the spotted towhee (*Pipilo erythrophthalmus*) and Orange-crowned warbler (*Oreothlypis celata*). During the ecological survey conducted in preparation for this plan, a pileated woodpecker (*Dryocopus pileatus*) (Photo 41) was seen foraging in the coarse woody debris.



Photo A3-E1-1. Lower polygon of Rocky Meadow and Rocky Trail.



Photo A3-E1-2. Upper polygon of Rocky Meadow and Cross Trail.



Photo A3-E1-3. Death camas garter (*Zygadenus venenosus*).



Photo A3-E1-4. Blue-eyed Mary (*Collinsia parviflora*).



Photo A3-E1-5. Northwestern snake (*Thamnopsis ordinoides*).

Table A3.1.1. Summary description of Ecological Community 1 Rocky meadow

Name	1 Rocky meadow
Ecological Community	None
Classification	Unclassified
Structural Stage	Sparse-Herb
Status (BC List)	NA
Slope and Aspect	Slope: 7% Aspect: 60°
Photographs	A3-E1-1 to 5
Ecological Community Description	Predominantly sparse bryophyte and herbaceous community on rocky outcrop with thin soil layer. Surrounded by mature forest with occasional trees within the meadow border. Some debris from 2000-1 logging activities, wildflowers in early spring, walking trails through centre.
Disturbance Notes	Considerable coarse woody debris accumulated in meadow during logging, but most was later removed. Logging equipment probably further compacted and disrupted existing thin soils. Rocky Trail and Cross Trail traverse the polygon. Current trail users do minor trampling of vegetation at trail edges.
Anticipated Change/ Succession	Based on past climate patterns, a gradual accumulation of soil, with continued vegetative growth and death would be expected, but increasing drought periods may lead to further erosion of organic material and thinning of the soils. Growth changes are likely to be gradual but plants may die quickly. Invasive species will be an increasing problem.
Wildlife Observations	Pileated woodpeckers were seen foraging on debris on ground. Dragonflies and damselflies, both pale, as well as anise swallowtail butterflies, other flying insects, northwestern garter snake basking near log, birds such as rufous hummingbird, spotted towhee, western tanager, and Townsend warbler were heard and/or seen.

Table A3.1.2. Vegetation identified in Ecological Community 1 Rocky meadow

1 Rocky meadow unclassified		Percent Cover (%)			Notes DBH=diameter at breast height (mm)
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy	
Canopy	Canopy cover (%)		5-15		
	Canopy height estimated in m.		30+		
	Douglas-fir (<i>Pseudotsuga menziesii</i>)		5-15		M: DBH=150-550
Understory	Coarse Woody Debris (CWD) cover: 5-25%. Varies in each section				
	Shrub layer, includes trees < 10m high: Overall Percent cover = <5% Species, cover <1% unless indicated: blackberry, trailing (<i>Rubus ursinus</i>), oceanspray (<i>Holodiscus discolor</i>) fir, grand (<i>Abies grandis</i>) Oregon-grape, dull (<i>Mahonia nervosa</i>) huckleberry, evergreen (<i>Vaccinium ovatum</i>) rose, dwarf (<i>Rosa gymnocarpa</i>) 1-2% huckleberry, red (<i>Vaccinium parvifolium</i>) salal (<i>Gaultheria shallon</i>) maple, bigleaf (<i>Acer macrophyllum</i>) tiny seedlings twin flower (<i>Linnaea borealis</i>)				
	Herb layer: Overall Percent cover = 5-80%, varies with the area and seasonality Species, cover <1% unless indicated: avens, large-leaved (<i>Geum macrophyllum</i>) 2% 1-2% grass species ● 3-30% bedstraw, Cleavers (<i>Galium aparine</i>) 10-15% grass, reed canary (<i>Phalaris arundinacea</i>)● blue-eyed mary small-flowered hairy cat's ear (<i>Hypochaeris radicata</i>)●10% (<i>Collinsia parviflora</i>) 5-10% miner's lettuce, Siberian (<i>Claytonia sibirica</i>) buttercup, western (<i>Ranunculus</i> oat-grass, California (<i>Danthonia californica</i>) <i>occidentalis</i>) up to 50% onion species, (<i>Allium sp.</i>) 1-2% camas, death (<i>Zygadenus venenosus</i>) 15% plantain, English (<i>Plantago</i> <i>lanceolata</i>) ● 1-2% clover, small hop (<i>Trifolium dubium</i>) ● 5% rattlesnake plantain (<i>Goodyera oblongifolia</i>) daisy, English (<i>Bellis perennis</i>)● self-heal (<i>Prunella vulgaris</i>) 1% daisy, oxeye (<i>Leucanthemum vulgare</i>)● sorrel, sheep (<i>Rumex acetosella</i>) English plantain (<i>Plantago lanceolata</i>)● speedwell species, (<i>Veronica sp.</i>) fern, sword (<i>Polystichum munitum</i>) yarrow (<i>Achillea millefolium</i>) forget-me-not (<i>Myosotis discolor</i>)● geranium, dovefoot (<i>Geranium mole</i>)●				
Moss layer: Overall Percent cover = 75-90%, varies with the area of the polygon Species: Dominant species are <i>Dircranum sp.</i> 65% in the middle and lower sections and <i>Hylocomium splendens</i> (step moss) 60% in the upper section. Other species, cover <1% unless indicated: <i>Kindbergia oregana</i> (Oregon beaked moss) <i>Leucolepis acanthoneuron</i> (Menzies' tree moss) <i>Plagiothecium undulatum</i> (flat moss) <i>Polytrichum sp.</i> (haircap moss) 5% <i>Rhytidiadelphus loreus</i> (lanky moss) <i>Rhytidiadelphus triquetrus</i> (electrified cat's-tail moss) Other species on rocks and coarse woody debris.					

● = non-native invasive species

A3.2 Ecological Community 2 Shoreline forest

The shoreline forest is situated on a bluff overlooking Lambert channel to the east of East Road. The bluff ranges in width from 10 m to just over 100 m and drops to beaches and sandstone rock at sea level (Photos 3, 4, and 5) from an elevation of 20 m in the south and 8 m in the north. The terrain is rolling, with both ridges and valley basins perpendicular to the shoreline. The mature, high, and complex canopy forest is open and accessible in the valleys (Photo A3-E2-1) and impenetrable, with tall salal (*Gaultheria shallon*), on the ridges (Photo A3-E2-2). As already noted, two public walking trails cross the polygon from East Road to the sea.

This community also includes small sections of two-to-three metre-high rocky cliffs near the north end of the shoreline (Photos A3-E2-3 and 4). The herbaceous flora on these cliff areas is listed in Table 3.2.3 (Photos A3-E2-5 and 6). The goldenback fern (*Pityrogramma triangularis*), an uncommon species for Denman, still has healthy populations on undercut rocky ledges (Photo A3-E2-7). Many of the individual ferns were dried and withered by June. Most of these small patches of vegetation 'rock gardens' along the shoreline are being invaded and overgrown by an assortment of invasive species.



Photo A3-E2-1. Accessible valleys along shoreline.



Photo A3-E2-2. Dense salal covered ridges along shoreline.



Photo A3-E2-3. Portion of shoreline cliff near north border.



Photo A3-E2-4. Closer view of sedum growing in sandstone crevices.



Photo A3-E2-5. Wildflower rock garden on shoreline cliff.



Photo A3-E2-6. Shoreline flora, sea blush (*Plectritis congesta*) and monkey flower (*Mimulus guttatus*).



Photo A3-E2-7. Goldenback fern (*Pityrogramma triangularis*).

Table A3.2.1. Summary description of Ecological Community 2 Shoreline forest

Name	2 Shoreline forest
Ecological Community	Grand fir / dull Oregon-grape (<i>Abies grandis</i> / <i>Berberis nervosa</i>) and grand fir / three-leaved foamflower (<i>Abies grandis</i> / <i>Tiarella trifoliata</i>)
Classification	CDFmm/04 and CDFmm/06
Structural Stage	Older mature
Status (BC List)	Red
Slope and Aspect	The slope in the valleys is up to 17%, but on the steep-ridge areas the slope is 47%. The aspect turns with the shoreline from 70° to 110°.
Photographs	A3-E2-1 to 7
Ecological Community Description	East Road separates this undulating shoreline bluff from the rest of the Reserve. Slope, salt-spray, and forceful, drying winds on this east-north-east exposure affect this forest. The CDFmm/04 community on the drier upper ridges blends into the CDFmm/06 in the gently sloping basins. The understory of the former is dominated by salal, and the latter by sword fern. The forest canopy is well developed and includes a number of large veteran trees of Douglas-fir, grand fir, and western redcedar. The forest at beach level has a diversity of shrub species, including the Douglas maples that are characteristic of the east side of Denman. The shoreline, adjacent to the Reserve, consists of sand and cobble beaches located between rocky sandstone points (Photos 3, 4, and 5) and a short section of 2-3 m-high cliff faces at the northern end of the Reserve. These cliffs support wildflowers and the goldenback fern, an uncommon species for Denman. English ivy has been removed from the northern shoreline but continues to re-invade from neighbouring lands. The coast is a rich area for marine life.
Disturbance Notes	Two old, overgrown beach-access tracks are evident coming down from East Road to the beach. Early high-grade logging may have removed some timber, but many veteran trees remain. Some use of the shoreline for kayak storage is occurring at present, shellfish-related supplies often wash up onto the Reserve, and a derelict abandoned sailboat had to be removed a few years ago.
Anticipated Change/ Succession	Trees will continue to be lost due to wind-throw, particularly on the ridges and at the shoreline. Increasing heat and moisture deficits may lead to the death of sensitive species, and more invasive species will become established, particularly along the road and the beach. Overall, however, the forest will continue to mature.
Wildlife Observations	This polygon is unique in that it helps to support, and provide a habitat-buffer for, the marine and coastal species using the shore. River otter, mink, and raccoons are active along the coastline, and ducks, geese, and other birds often perch on the rocks or occupy the well-developed shrub border. Eagles, great blue herons, and likely marbled murrelets use the large trees and surrounding forest habitat along the shore.

Table A3.2.2a. Tree and shrub level vegetation of Ecological Community 2 Shoreline forest

2 Shoreline forest CDFmm/04 and /06		Percent Cover (%)			Notes DBH=diameter at breast height
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy	
Tree Canopy	Canopy height estimated in m.	40+	30-40	10-30	
	alder, red (<i>Alnus rubra</i>)			T	DBH= 305mm
	arbutus (<i>Arbutus menziesii</i>)				DBH=190mm
	Douglas-fir (<i>Pseudotsuga menziesii</i>)	1+	10-15		V: DBH=1090 M: DBH=230-300mm
	fir, grand (<i>Abies grandis</i>)	5	10	25	V: DBH=1000mm M: DBH=365-555mm S: DBH=230mm
	maple, bigleaf (<i>Acer macrophyllum</i>)			2	DBH=305mm
	redcedar, western (<i>Thuja plicata</i>)		20	20	M: DBH up to 880mm S: DBH=170-470mm
	Coarse Woody Debris (CWD) cover = 5-10%				
Understory	<p>Shrub layer: Overall Percent Cover: varies from 10 to 95% in some sections. Species, includes trees < 10m high: Salal (<i>Gaultheria shallon</i>) is dominant in the middle portion of the polygon, covering 95%, but in other areas, only 5%. The shoreline edge has a particularly well-developed and diverse shrub layer.</p> <p>Species covering 1-5%: blackberry, trailing (<i>Rubus ursinus</i>), maple, bigleaf (<i>Acer macrophyllum</i>) holly, English (<i>Ilex aquifolium</i>)● oceanspray (<i>Holodiscus discolor</i>) fir, grand (<i>Abies grandis</i>) Oregon-grape, dull (<i>Mahonia nervosa</i>) honeysuckle, western <i>Lonicera ciliosa</i> redcedar, western (<i>Thuja plicata</i>) huckleberry, red (<i>Vaccinium parvifolium</i>) thimbleberry <i>Rubus parviflorus</i></p> <p>Species covering <1%: cherry, bitter (<i>Prunus emarginata</i>), Oregon grape, tall (<i>Mahonia aquifolium</i>) cherry, domestic (<i>Prunus avium</i>), rose, dwarf (<i>Rosa gymnocarpa</i>) elderberry, red (<i>Sambucus racemosa</i>), rose, Nootka (<i>Rosa nutkana</i>) hawthorn, black (<i>Crataegus douglasii</i>), salmonberry (<i>Rubus spectabilis</i>) ivy, English (<i>Hedera helix</i>)● snowberry, common (<i>Symphoricarpos albus</i>) maple, Douglas (<i>Acer glabrum</i>) twin flower (<i>Linnaea borealis</i>)</p>				
	<p>T = trace (less than 1%) ● = non-native invasive species</p>				

Table A3.2.2b. Herb and moss level vegetation of Ecological Community 2 Shoreline forest

Understory	<p>Herb layer: Overall Percent cover: up to 40%</p> <p>Species: Sword fern (<i>Polystichum munitum</i>) covers up to 30% in areas where salal is not dominant.</p> <p>Species covering < 1%:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">avens, large-leaved (<i>Geum macrophyllum</i>)</td> <td style="width: 50%;">pathfinder plant (<i>Adenocaulon bicolor</i>)</td> </tr> <tr> <td>anemone, Lyall's (<i>Anemone lyalli</i>)</td> <td>rattlesnake plantain (<i>Goodyera oblongifolia</i>)</td> </tr> <tr> <td>bedstraw species (<i>Galium spp</i>)</td> <td></td> </tr> <tr> <td>buttercup species (<i>Ranunculus sp.</i>)</td> <td>sedge, slough (<i>Carex obnupta</i>)</td> </tr> <tr> <td>fern, bracken (<i>Pteridium aquilinum</i>)</td> <td>starflower (<i>Trientalis latifolia</i>)</td> </tr> <tr> <td>foam flower (<i>Tiarella trifoliata</i>)</td> <td>sweet-cicely (<i>Osmorhiza chilensis</i>)</td> </tr> <tr> <td>grass species●</td> <td>vanilla leaf (<i>Achlys triphylla</i>)</td> </tr> <tr> <td>herb-robert (<i>Geranium robertianum</i>)●</td> <td>wall lettuce (<i>Lactuca muralis</i>)</td> </tr> <tr> <td>miner's lettuce, Siberian (<i>Claytonia sibirica</i>)</td> <td></td> </tr> </table>	avens, large-leaved (<i>Geum macrophyllum</i>)	pathfinder plant (<i>Adenocaulon bicolor</i>)	anemone, Lyall's (<i>Anemone lyalli</i>)	rattlesnake plantain (<i>Goodyera oblongifolia</i>)	bedstraw species (<i>Galium spp</i>)		buttercup species (<i>Ranunculus sp.</i>)	sedge, slough (<i>Carex obnupta</i>)	fern, bracken (<i>Pteridium aquilinum</i>)	starflower (<i>Trientalis latifolia</i>)	foam flower (<i>Tiarella trifoliata</i>)	sweet-cicely (<i>Osmorhiza chilensis</i>)	grass species●	vanilla leaf (<i>Achlys triphylla</i>)	herb-robert (<i>Geranium robertianum</i>)●	wall lettuce (<i>Lactuca muralis</i>)	miner's lettuce, Siberian (<i>Claytonia sibirica</i>)	
	avens, large-leaved (<i>Geum macrophyllum</i>)	pathfinder plant (<i>Adenocaulon bicolor</i>)																	
anemone, Lyall's (<i>Anemone lyalli</i>)	rattlesnake plantain (<i>Goodyera oblongifolia</i>)																		
bedstraw species (<i>Galium spp</i>)																			
buttercup species (<i>Ranunculus sp.</i>)	sedge, slough (<i>Carex obnupta</i>)																		
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foam flower (<i>Tiarella trifoliata</i>)	sweet-cicely (<i>Osmorhiza chilensis</i>)																		
grass species●	vanilla leaf (<i>Achlys triphylla</i>)																		
herb-robert (<i>Geranium robertianum</i>)●	wall lettuce (<i>Lactuca muralis</i>)																		
miner's lettuce, Siberian (<i>Claytonia sibirica</i>)																			
<p>Moss layer: Overall Percent cover: 5-10%</p> <p>Species: Moss was present on CWD and in some ground patches. Common species include:</p> <p><i>Kindbergia praelonga</i> (slender beaked moss) <i>Rhytidiadelphus loreus</i> (lanky moss)</p> <p><i>Leucolepis acanthoneuron</i> (Menzies' tree moss)</p> <p>Other species were present on tree bases and CWD.</p>																			

● = non-native invasive species

The following table lists species noted in the rocky shoreline areas that are not entered in the tables describing forest species. The list is preliminary, as there are also many invasive species, and likely other native species.

Table 3.2.3. Preliminary list of vegetation on rocky cliffs in Shoreline forest

Rocky cliff species	
alumroot ,species (<i>Heuchera sp</i>)	hairy cat's ear (<i>Hypochaeris radicata</i>)
chocolate lily (<i>Fritillaria affinis</i> or <i>lanceolata</i>)	hawkweed species (<i>Hieracium sp.</i>)●
clover, small hop (<i>Trifolium dubium</i>)●	monkey-flower, yellow (<i>Mimulus guttatus</i>)
Dandelion (<i>Taraxacum officinale</i>)●	saxifrage species (<i>Saxifraga sp.</i>)
fern, goldenback (<i>Pityrogramma triangularis</i>)	sea blush (<i>Plectritis congesta</i>)
fern, licorice (<i>Polypodium glycyrrhiza</i>)	sedum species (<i>Sedum sp.</i>)
fringecup (<i>Tellima grandiflora</i>)	strawberry, woodland (<i>Fragaria vesca</i>)
geranium, dovefoot (<i>Geranium molle</i>)●	thistle, Canada (<i>Cirsium arvense</i>)●
grass species●	vetch, species (<i>Vicia sp.</i>)
grass, California oat-grass (<i>Danthonia californica</i>)	yarrow (<i>Achillea millefolium</i>)

● = non-native species

Also, plantain, maritime or sea or seaside *Plantago maritima juncooides* is prominent on the foreshore of the Reserve.

A3.3 Ecological Community 3 Southwest forest with western hemlock component

The southwest corner of the Reserve slopes steeply, at 27%, from a ridge at 61 m above sea level towards the Reserve's southern border, at 48 m, with Graham Lake below at 36 m. The southern end of this polygon slopes east, at 12%, towards the sea. Due to the 25% canopy cover of western hemlock, the polygon can be considered as western redcedar - Douglas-fir / Oregon beaked moss (*Thuja plicata* - *Pseudotsuga menziesii* / *Eurhynchium oreganum*) CDFmm/05 or it can be classified with the rest of the moderately dry forest as Douglas-fir / dull Oregon-grape (*Pseudotsuga menziesii* / *Berberis nervosa*) CDFmm/01.

The terrain surface is raised hummocks, with about 25% cover of coarse woody debris. Overall tree cover is about 75%, with a limited shrub and herbaceous cover and about 40% moss cover. The forest is maturing climax, probably ranging from 50 to well over 100 years old, and is dominated by Douglas-fir but contains considerable western redcedar and western hemlock, plus an occasional grand fir (Photos A3-E3-1 and 2). There are a few springboard stumps with burn marks (Photo A3-E3-3) and an occasional low-cut stump. Western hemlocks may be present due to the polygon area enjoying more moisture than the rest of the upper slope, as it catches precipitation coming over the lake, from Vancouver Island, and from the moist microclimate of the lake itself.



Photo A3-E3-1. Southwest forest, large western hemlock (*Tsuga heterophylla*) evident.

Photo A3-E3-2. Southwest forest



Photo A3-E3-3. Burnt springboard stump.

Table A3.3.1. Description of Ecological Community 3 Southwest forest with western hemlock component

Name	3 Southwest forest with western hemlock component
Ecological Community	Western redcedar - Douglas-fir / Oregon beaked moss (<i>Thuja plicata</i> - <i>Pseudotsuga menziesii</i> / <i>Eurhynchium oregonum</i>) or Douglas-fir / dull Oregon-grape (<i>Pseudotsuga menziesii</i> / <i>Berberis nervosa</i>)
Classification	CDFmm/05 or CDFmm/01
Structural Stage	6 Mature forest
Status (BC List)	Red
Slope and Aspect	Down towards the Lake: Slope 27%, Aspect 200°. Along the ridge: Slope 12% Aspect 125°
Photographs	A3-E3-1 to 3
Ecological Community Description	Mature coniferous forest, dominated by Douglas-fir, on a moderately dry, nutrient-medium-to-poor, water-shedding site, with shallow soils over rocks. Both western redcedar and western hemlock are significant forest components. The site is at the crest and upper slope, at the highest elevation of the Reserve, situated above Graham Lake. Coarse woody debris and burn-scarred springboard stumps and tree-bases are prominent. Standing dead snags are also present. The understory is fairly open, the shrub layer is mainly salal, and the numerous hummocks have abundant areas of both mosses and exposed duff.
Disturbance Notes	The site's historic logging past is evidenced by the springboard stumps. Low-cut stumps are also present, suggesting either further logging or removal of some springboard stumps for firewood. The major burn scars are evidence of an extensive fire in the past.
Anticipated Change/ Succession	The exposed position of the trees, perched high on shallow rocky soils, predisposes them to wind-throw, as evidenced by the fallen trees. Trees on this site will also suffer from a future moisture deficit. Already western hemlocks appear stressed, and some are weeping sap. As more openings develop, the salal understory may increase.
Wildlife Observations	Numerous birds were heard. The conifer canopies, large woody debris, thick bark, and large limbs would provide valuable foraging, nesting, and sheltering habitat. Western hemlocks are noted for shedding seeds through most seasons, thus a good food source. The open understory makes the area an ideal travel corridor to freshwater in the lake, and the trail is available when not in use by humans.

Table A3.3.2. Vegetation identified in Ecological Community 3 Southwest forest with western hemlock component

3 Southwest forest with western hemlock CDFmm/04 or /05		Percent Cover (%)			Notes All heights are estimates DBH=diameter at breast height
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy	
Tree Canopy	Douglas-fir (<i>Pseudotsuga menziesii</i>)		35	5	M: 30-40+m, DBH=425-935mm S: 25m, DBH=280mm
	fir, grand (<i>Abies grandis</i>)		1		30+m high, DBH 440mm
	hemlock, western (<i>Tsuga heterophylla</i>)	<1	25	10-15	V: At least one veteran tree DBH=920mm M: 30-40m high, DBH=365-600mm S: 25m, DBH=150mm
	redcedar, western (<i>Thuja plicata</i>)		25		M: 30-40m, DBH=up to 965mm
Coarse Woody Debris (CWD) cover = 25%. Also rocks on surface.					
Understory	Shrub layer: Overall Percent Cover: 25%, variable Species, includes trees < 10m high: salal (<i>Gaultheria shallon</i>) is dominant at 15% Other Species: hemlock, western (<i>Tsuga heterophylla</i>) 5-10% huckleberry, red (<i>Vaccinium parvifolium</i>) Oregon-grape, dull (<i>Mahonia nervosa</i>) redcedar, western (<i>Thuja plicata</i>) 2%				
	Herb layer: Poorly developed, coverage <5%. Species covering <1%: fern, bracken (<i>Pteridium aquilinum</i>) fern, sword (<i>Polystichum munitum</i>) starflower (<i>Trientalis latifolia</i>)				
	Moss layer: Overall Percent Cover: 40% Species: varied, on trees, CWD, and rocks <i>Hylocomium splendens</i> (step moss) <i>Kindbergia oregana</i> (Oregon beaked moss) <i>Isoetecium myosuroides</i> (cattail moss) <i>Kindbergia praelonga</i> (slender beaked moss) Other species are present.				

A3.4 Ecological Community 4 Dry zonal forest

The dry Douglas-fir (*Pseudotsuga menziesii*) CDFmm/01 forest occupies the top of the slope from the southwest corner to the middle of the west side of the Reserve. Here, the terrain is relatively flat to gently sloping. The shallow soils are marginally deeper and the sandstone/conglomerate perhaps more fractured than in the rocky meadow, so that trees are able to grow. The dominant Douglas-fir trees (*Pseudotsuga heterophylla*) are smaller in diameter than others in neighbouring polygons, but have increased in size since 2007 (Photos A3-E4-1 and 2). Misshapen old-growth trees and the occasional western hemlock (*Thuja plicata*) are present (Photo A3-E4-3), and there are low-cut stumps along the Cross Trail, indicating that some trees were probably removed here during the 2000-2002 logging (Photo A3-E4-4).



Photo A3-E4-1. Douglas-firs in dry zonal forest 2019.



Photo A3-E4-2. Douglas-firs in dry zonal forest 2007.



Photo A3-E4-3. Older trees in young forest. Cross Trail.



Photo A3-E4-4. Cut stumps along Cross Trail.

Table A3.4.1. Description of Ecological Community 4 Dry zonal forest

Name	4 Dry zonal forest
Ecological Community	Douglas-fir / dull Oregon-grape (<i>Pseudotsuga menziesii</i> / <i>Berberis nervosa</i>)
Classification	CDFmm/01
Structural Stage	6 Mature
Status (BC List)	Red
Slope and Aspect	Slope: 7-10% Aspect: 45-50°
Photographs	A3-E4-1 to 4
Ecological Community Description	The canopy of the dominant, relatively-small-diameter Douglas-firs (<i>Pseudotsuga menziesii</i>) is patchy. Old growth veteran trees are present, as well as an occasional large western redcedar (<i>Thuja plicata</i>) and grand fir (<i>Abies grandis</i>). The shrub layer is dominated by dense salal (<i>Gaultheria shallon</i>), interspersed with a few ocean spray (<i>Holodiscus discolor</i>) and other shrubs. Moss occurs around tree bases and in occasional patches. Blown down trees are frequent.
Disturbance Notes	The historic logging history is uncertain. Remaining older veteran trees tend to be misshapen and are relatively small and springboard stumps are present. Gaps in the canopy that arise from blown down trees fill up with dense salal and other shrubs. The recent logging only accessed the perimeter of this polygon and along the Cross Trail, probably because the younger trees were of small diameter and considered of less value.
Anticipated Change/ Succession	The community will likely struggle with increasing water deficit and heat stress, and more trees will die, become diseased, or be blown down. The trees that dominate will mature, the shrub layer will continue to fill gaps where the soil is sufficient, and moss will grow where rock is near the surface.
Wildlife Observations	A few deer trails were present, but the thick salal tends to limit access for larger animals. Small rodents and shrub- or ground-nesting birds may well take advantage of this dense shrub layer. The canopy would be valuable for a variety of coniferous-forest bird species.

A3.5 Ecological Community 5 Dry rich forest

The dry rich forest, site series CDFmm/04, is located mid-slope on the west side of the Reserve and is down-slope from the moderately dry zonal forest, site series CDFmm/01 of polygon 4. Portions of this polygon were high-grade-logged in 2000–2002, but the effects are hidden by the salal understory. Here, the soil receives slightly more moisture, than the communities at the top of the slope, but the rocks in the soil surface still reflect the nature of the substrate. While Douglas-firs (*Pseudotsuga menziesii*) make up the dominant tree cover in some areas, western redcedars (*Thuja plicata*) are more numerous in others, likely because the firs were cut during the recent logging.

The most prominent feature of the dry rich forest is the dominant understory of salal (*Gaultheria shallon*), one-to two-metres high (Photo A3-E5-1). This community begins at an elevation of 57 m at the western border of the Reserve, spans the upper slope, which has a ridge and at least two small draws, and blends into Ecological Community 7 as the terrain flattens. Because the canopy was opened up by removal of the large Douglas-firs in the recent logging, followed by additional tree-loss from wind-throw effects, salal and other shrubs, such as oceanspray (*Holodiscus discolor*), have flourished in the sunny gaps (Photo A3-E5-2). The abundant salal growth in the openings on the relatively nutrient-rich, flat, moisture-receiving, central portion of the Reserve is unusual and has made the border between the communities 5 and 7, site series CDFmm/04 and CDFmm/06, unclear.



Photo A3-E5-1. Tall salal (*Gaultheria shallon*) understory.



Photo A3-E5-2. Oceanspray (*Holodiscus discolor*) in understory.

Table A3.5.1. Description of Ecological Community 5 Dry rich forest

Name	Polygon 5 Dry rich forest
Ecological Community	grand fir / dull Oregon-grape (<i>Abies grandis</i> / <i>Berberis nervosa</i>)
Classification	CDFmm/04
Structural Stage	Older mature, with sites of high-grade logging and removal of a portion of the canopy
Status (BC List)	Red
Slope and Aspect	Slope 6-14% Aspect 50-90°
Photographs	A3-E5-1 and 2
Ecological Community Description	This mature coniferous-forest community features the effects of partial high-grade logging and an understory dominated by salal (<i>Gaultheria shallon</i>). Grand-fir (<i>Abies grandis</i>) and western redcedar (<i>Thuja plicata</i>) are the dominant conifers in some areas, and there is at least one patch of mature western hemlock (<i>Tsuga heterophylla</i>). In other areas, Douglas-fir (<i>Pseudotsuga menziesii</i>) is dominant. Occasional veteran old-growths are present. The herb and moss layers are sparse.
Disturbance Notes	Historic logging and fire are likely part of the disturbance history, although the events are not recorded. The recent logging in 2000–2002 removed some trees, although the extent is difficult to determine due to the overgrowth of salal.
Anticipated Change/ Succession	The dense shrub cover will likely delay tree growth in the gaps initially, but firs that get started will be somewhat protected from browsing damage as they grow. The mature trees will continue to develop, although warming and drying effects of climate changes may increasingly affect the redcedars. As already noted, the death of redcedars in areas of stress is already occurring (Photo A3-E5-3).
Wildlife Observations	The large coniferous canopy, mature trees, and numerous gaps with extensive shrub growth support forest and ground-nesting birds, invertebrates, and small mammals. The dense salal makes travel for larger mammals such as black-tailed deer (<i>Odocoileus hemionus</i>) difficult.

Table A3.4.2. Vegetation identified in Ecological Community 5 Dry rich forest

5 Dry rich forest CDFmm/04		Percent Cover (%)			Notes DBH=diameter at breast height (mm)
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy	
Tree Canopy	Canopy cover (%)	to 10	50-60	10-15	
	Canopy height estimated in m.	>35	25-35	10-25	
	Douglas-fir (<i>Pseudotsuga menziesii</i>)	to 10	to 30	3-5	V: DBH=940-1020 M: DBH=360-590 S: DBH=120
	fir, grand (<i>Abies grandis</i>)		to 20		M: DBH=215-400
	redcedar, western (<i>Thuja plicata</i>)		to 50	5-10	M: DBH=905 S: DBH=300-705
	hemlock, western (<i>Tsuga heterophylla</i>)		<5	5	M: DBH=370-470 S: DBH=235
Understory	Coarse Woody Debris (CWD) cover = 5-35%				
	Shrub layer species, includes trees < 10m high: Overall percent cover = 30-95% Dominant species: salal (<i>Gaultheria shallon</i>) 25-95% Other species, cover <1% unless indicated: hemlock, western (<i>Tsuga heterophylla</i>) Oregon-grape, dull (<i>Mahonia nervosa</i>) 2-5% huckleberry, red (<i>Vaccinium parvifolium</i>) rose, dwarf (<i>Rosa gymnocarpa</i>) oceanspray (<i>Holodiscus discolor</i>) to 5% twin flower (<i>Linnaea borealis</i>)				
	Herb layer species: Overall Percent cover = <5% Other species, cover <1% unless indicated: bedstraw species (<i>Galium sp.</i>) groundcone (<i>Boschniakia hookeri</i>) fern, sword (<i>Polystichum munitum</i>) sedge, Dewey's (<i>Carex deweyana</i>) grass species vanilla leaf (<i>Achlys triphylla</i>)				
	Moss layer: Overall Percent cover: is sparse and varies with the amount of shrub cover. Species: <i>Hylocomium splendens</i> (step moss) <i>Rhytidiadelphus loreus</i> (lanky moss) <i>Isoetes myosuroides</i> (cattail moss) <i>Rhytidiadelphus triquetrus</i> (electrified cat's-tail moss) <i>Kindbergia praelonga</i> (slender beaked moss) Other species are present.				

A3.6 Ecological Community 6 Moist rich forest

NOTE: Ecological Communities 3, 4, 5, 6, 7, and 8

The CDFmm/01, 04, and 06 site series of the Douglas-fir (*Pseudotsuga menziesii*) forest-communities blend into one another as the terrain changes across the Reserve. In this plan, the CDFmm/01 and CDFmm/04 have been considered as distinct ‘ecological communities.’ The CDFmm/01, possibly CDFmm/05, site series was placed in a separate ecological community due to the large western hemlock (*Tsuga heterophylla*) component. The site series CDFmm/06 is also a distinct community ecologically, but in this plan has been divided into three ecological communities based on different logging histories. In general, the CDFmm/06 site series is supported on the lower slope and flatter terrain that has richer soils and more moisture. In this site series, sword fern (*Polystichum munitum*) replaces the salal as the dominant understory vegetation.

Thus, moist rich forest, site series CDFmm/06 grand fir / three-leaved foam flower (*Abies grandis* / *Tiarella trifoliata*), is divided into three polygons:

- EC 6, Moist rich forest (without the logging incursion in 2000–2002)
- EC 7, Logged Moist rich forest (with the logging incursion in 2000–2002)
- EC 8, Old Moist rich forest (never logged).



EC3 site series CDFmm/01 (/05) EC4 site series CDFmm/01. EC5 site series CDFmm/04. with western hemlock.



EC6 site series CDFmm/06 not logged in 2000-2002. EC7 site series CDFmm/06 logged in 2000-2002. EC8 site series CDFmm/06 never logged.

Ecological Community 6 is the portion of the moist rich forest, site series CDFmm/06, that was not logged in 2000–2002, but had been logged historically, as shown by the presence of springboard stumps. This community occurs on the edge of the logged

forest; the largest portion is on the east side of the Reserve. As a log-skidder was driven to many areas with an occasional tree removed in some sites, the division between logged and un-logged is not always clear. The community includes polygons in the northwest corner (Photos A3-E6-1 and 2) and on the southwest border (Photo A3-E6-3), as well as a connected polygon, beginning near the southeast border (Photo A3-E6-4), continuing around the main trail near Central wetland (Photo A3-E6-5) and then around the old, never-logged Ecological Community 8 (Photos A3-E6-6 and 7), and ending northeast of the creek (Photo A3-E6-8). The elevation range is 48 m to 22 m, and the slope and aspect vary from 15% 235° east of Ecological Community 12, to 8% 100° in the northwest, to roughly flat around Central wetland and the creek.

The species composition of the coniferous forest is varied. Douglas-fir trees (*Pseudotsuga menziesii*) dominate in most sites, although some have a large component of western redcedar (*Thuja plicata*), plus other species such as mature grand fir (*Abies grandis*) and bigleaf maples (*Acer macrophyllum*). Occasional veteran trees occur, as seen near the edge of Ecological Community 12. Many of these old trees, particularly on slopes in the northwest, are smaller and show evidence of fungal conk. The forest canopy is tall and multilayered with trees over 40 m in height. In stands where the canopy is open, sword ferns (*Polystichum munitum*) dominate, but under the more-closed canopies, particularly those with the large redcedar component, the understory is sparse.



Photo A3-E6-1. Sword fern (*Polystichum munitum*) understory in northwest of Reserve.



Photo A3-E6-2. Springboard stumps from historic logging.

Table A3-6-1. Description of Ecological Community 6 Moist rich forest

Name	6 Moist rich forest
Ecological Community	Grand fir / three-leaved foamflower (<i>Abies grandis</i> / <i>Tiarella trifoliata</i>)
Classification	CDFmm/06
Structural Stage	Older mature forest
Status (BC List)	Red
Slope and Aspect	Slope and aspect vary with the terrain: 15% 235° east of Polygon 12, 8% 100° in the northwest, 8% and 60° in the southeast and nearly flat around Central wetland.
Photographs	A3-E6-1 to 8
Ecological Community Description	This community is an older mature coniferous forest, dominated by Douglas-fir (<i>Pseudotsuga menziesii</i>) with grand fir (<i>Abies grandis</i>) and western redcedar (<i>Thuja plicata</i>). The forest has a well-developed canopy layer and a sparse shrub layer. Sword fern (<i>Polystichum munitum</i>) is the dominate herbaceous species with patches of vanilla leaf (<i>Achlys triphyla</i>). Most areas have numerous springboard stumps and the occasional veteran old growth.
Disturbance Notes	The forest was logged historically but not in 2000–2002. In the past, fire has left marked burn-scars on many of the older trees and snags. The Main Trail crosses this Polygon, so walkers and their pets are common at least in the vicinity of the trail.
Anticipated Change/ Succession	The forest will continue to mature and young trees, and understory plants will develop in gaps where older trees have died, fallen, and opened up the canopy. Browsing deer and the well-developed canopy will likely keep the rest of the understory open. Warming and water deficits associated with climate changes may reduce the western redcedar and sword fern components, but they will likely be retained in the flat terrain near the wetlands for longer than in other areas.
Wildlife Observations	The open understory provides a clear travel corridor for larger species, which is well used, judging by the number of deer trails. Similarly, the large coarse woody debris provides routes for small mammals, as shown by the number of squirrel middens on the fallen logs. Amphibians, reptiles, and small mammals also use the large downed trees as protective cover and as sites to forage for invertebrate prey. The well-developed maple and coniferous tree canopies and the tall snags afford habitat for many aerial species, both birds and bats.



Photo A3-E6-3. Ecological Community 6 on southwest side of Reserve.



Photo A3-E6-4. Ecological Community 6 near southeast border.



Photo A3-E6-5. Ecological Community 6 near Main Trail.



Photo A3-E6-6. Ecological Community 6 next to never-logged community.



Photo A3-E6-7. Vanilla leaf (*Achlys triphylla*) understory next to never logged community.



Photo A3-E6-8. Ecological Community 6 northeast of creek.

A3.7 Ecological Community 7 Logged moist rich forest

Community 7 is also part of the moist rich forest, site series CDFmm/06, but here, the forest was high-grade-logged in 2000–2002 (Photo A3-E-7-1) as well as logged historically, and some of the forest may have been cleared in the past for other human uses. The community covers much of the lower slope in the centre of the Reserve, west of the creek and wetlands, from the northern border to the southern border. The slope varies from nearly flat to 10%, and the aspect varies with the ridges along the western slope of the Reserve, although it is roughly towards the east.

As already noted, where logging occurred in the flat central area of the Reserve, the border between this community and community 5 is difficult to discern (Photo A3-E7-2). Salal (*Gaultheria shallon*), the dominant understory plant of community 5, favours water-shedding, relatively nutrient-poor sites (Klinka et al. 1989). Sword fern (*Polystichum munitum*), the dominant understory in community 7, grows in nutrient-rich, water-receiving sites. Yet, where the logging occurred, thick salal patches are growing in the rich, wet, flat central terrain of the Reserve, often raised onto downed-coarse woody debris. Salal thrives in the sun and here is growing on coarse woody debris (Photo A3-E7-3) and is mixed with moist-site vegetation such as sword ferns and slough sedge (*Carex obnupta*) (Photo A3-E7-4).

The tree canopy varies in species and coverage across the entire community, due to the removal of individual trees and patches of trees during the recent logging. The log-skidder appears to have been driven randomly around the Reserve and, as a result, some areas of this climax forest are largely intact with the occasional cut-stump, whereas others have the small, open, gaps described earlier in this section. Near the southern border, along Mallard Way, and in the centre of the Reserve, exposed trees blew down after the logging, leaving conspicuous openings of sword ferns among the old trees (Photos A3-E-7-5 and 6). In low-lying areas, the log-skidder caused soil compaction; thus, mini-slough sedge (*Carex obnupta*) wetlands have formed along old skidder tracks (Photos A3-E-7-7 and 8). Another change likely resulting from the recent logging is the introduction of invasive species, particularly in the open gaps. A patch of reed canary grass (*Phalaris arundinacea*) has grown up adjacent to Main Trail (Photo A3-E7-9), and thistles (*Cirsium sp.*) and other species are noticeable in openings (Photo A3-E7-10). Some of these species will likely be shaded out as the surrounding forest re-grows, but in the meantime, they may spread to other open areas.

An area at the northern border of this community, may have been subjected to other uses that have not been recorded. Recent logging tracks lead into this area, and a few conifers have been cut. Nevertheless, among the patches of older coniferous trees, there are red alder (*Alnus rubra*) trees that were 25 or more in height in 2007 (Photo A3-E-7-11) and are still present in 2019 (Photo A3-E7-12). The presence of these trees suggests that this is another area may have been previously cleared for farm uses. The clearing, soil compaction, high water table, and lack of raised microsites may have delayed the coniferous forest re-growth in the alder patches. Tables A3-7-2 and A3-7-3, describe typical coniferous and red alder-dominated areas with logging incursion. The

actual coverage varies widely, and invasive species, as previously noted, are most common in the non-forested openings, particularly near the trails.



Photo A3-E7-1. Low cut stump near creek.



Photo A3-E7-2. Logging near the border of ecological communities 5 and 7.



Photo A3-E7-3. Salal (*Gaultheria shallon*) on coarse woody debris



Photo A3-E7-4. Salal, slough sedge (*Carex obnupta*) and sword fern (*Polystichum munitum*).



Photo A3-E7-5. Logging and wind-throw create forest gap in the southwest.



Photo A3-E7-6. Similar gap in the centre of Reserve.



Photo A3-E7-7. Use of log-skidder trail left ruts.



Photo A3-E7-8. In other direction, slough sedge (*Carex obnupta*) filled the ruts.



Photo A3-E7-9. Main Trail and Invasive reed canary grass (*Phalaris arundinacea*).



Photo A3-E7-10. Patch of thistles (*Cirsium* sp.) in logging gap.



Photo A3-E7-11. Red alder (*Alnus rubra*) patches west of creek at north border in 2007.



Photo A3-E7-12. Same site in 2019.

Table A3-7-1. Vegetation identified in Ecological Community 7 Logged moist rich forest

Name	7 Logged moist rich forest
Ecological Community	Grand fir / three-leaved foamflower (<i>Abies grandis</i> / <i>Tiarella trifoliata</i>)
Classification	CDFmm/06
Structural Stage	Mixture of mature seral and older mature
Status (BC List)	Red
Slope and Aspect	Slope varies from flat to 10%. Aspect varies with the ridges but is approximately northeast 60-70
Photographs	A3-E-7-1 to 7
Ecological Community Description	The varied forest vegetation is due to logging incursion 17-19 years ago. Remains of low-cut stumps and log-skidder tracks are evident, as well as spring board stumps and an occasional veteran old tree. The mature climax coniferous forest is a mixture of Douglas-fir (<i>Pseudotsuga menziesii</i>), grand fir (<i>Abies grandis</i>), and western redcedar (<i>Thuja plicata</i>), with individual trees and gaps of trees removed. Large bigleaf maples (<i>Acer macrophyllum</i>) are also present. The shrub layer is sparse but varied, with patches of oceanspray (<i>Holodiscus discolor</i>) and small growths of salal (<i>Gaultheria shallon</i>), particularly where there is coarse woody debris. The herb layer is dominated by sword fern (<i>Polystichum munitum</i>). Deciduous areas of young and up to 30-40+ year-old red alder (<i>Alnus rubra</i>) are present along skid trails and in patches near the northern border.
Disturbance Notes	The area was high-grade logged historically and more moderately in 2000–2002. History of fires is unknown, but at least one hot fire has left marked burn scars on older trees. Main Trail and Circle Trail cross the polygon.
Anticipated Change/ Succession	The logged coniferous-dominated openings are expected to gradually fill in, as the young trees mature. The closing canopy will shade out the understory plants for a couple of decades but will finally resemble that of the remaining forest of this community. This process may take some time, leaving small gaps in the tall forests. Climate changes may decrease the component of redcedar and may also dry the red alder area, allowing more coniferous growth, including redcedar in these patches.
Wildlife Observations	Woodland wildlife species have benefitted from the gaps, edges, and seed and berry-bearing shrubs. The component of deciduous forest adds to the diversity of foraging and nesting opportunities.

Table A3-7.2a. Tree and shrub herb level vegetation in Ecological Community 7 Logged moist rich forest

Polygon Site:		Percent Cover (%)			Notes DBH=diameter at breast height (mm)											
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy												
Tree Canopy	Canopy cover (%)		20-50	10-40												
	Canopy height estimated in m.	40+	30-40	10-30												
	alder, red (<i>Alnus rubra</i>) – where present		10	35-40	M: DBH=300-530 S: DBH=270											
	Douglas-fir (<i>Pseudotsuga menziesii</i>)	1-2	up to 20	up to 5	V: DBH=1010-1540+ M: DBH=775 S: DBH=270-325											
	fir, grand (<i>Abies grandis</i>)	1-2	1-20	5	V: DBH=770-950 M: DBH=510-630 S: DBH=180-455											
	hemlock, western (<i>Tsuga heterophylla</i>)		0-2		M: DBH=720											
	maple, bigleaf (<i>Acer macrophyllum</i>)		5-10	2-3	M: DBH=500-930 S: DBH=255											
	redcedar, western (<i>Thuja plicata</i>)	2-5	20-30	5-20	V: DBH=1110-1380 M: DBH=545-780 S: DBH=250-430											
Understory	Coarse Woody Debris (CWD) cover = 10-20%															
	<p>Shrub layer species (incl trees < 10m). Overall percent cover = 2-5% Oceanspray (<i>Holodiscus bicolor</i>) is occasionally present in the border gaps with Polygon 5 at 2-15%, but in general shrub layer is sparse. Other species with coverage <1% unless indicated:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">blackberry, trailing (<i>Rubus ursinus</i>)</td> <td style="width: 50%;">huckleberry, red (<i>Vaccinium parvifolium</i>)</td> </tr> <tr> <td>Douglas-fir (<i>Pseudotsuga menziesii</i>)</td> <td>1-2%</td> </tr> <tr> <td>fir, grand (<i>Abies grandis</i>) 1-2%</td> <td>Oregon-grape, dull (<i>Mahonia nervosa</i>)</td> </tr> <tr> <td>redcedar, western (<i>Thuja plicata</i>) 1-2%</td> <td>rose, dwarf (<i>Rosa gymnocarpa</i>)</td> </tr> <tr> <td>hemlock, western (<i>Tsuga heterophylla</i>) 5%</td> <td>salal (<i>Gaultheria shallon</i>)</td> </tr> <tr> <td>holly, English (<i>Ilex aquifolium</i>) 1-2%</td> <td></td> </tr> </table>					blackberry, trailing (<i>Rubus ursinus</i>)	huckleberry, red (<i>Vaccinium parvifolium</i>)	Douglas-fir (<i>Pseudotsuga menziesii</i>)	1-2%	fir, grand (<i>Abies grandis</i>) 1-2%	Oregon-grape, dull (<i>Mahonia nervosa</i>)	redcedar, western (<i>Thuja plicata</i>) 1-2%	rose, dwarf (<i>Rosa gymnocarpa</i>)	hemlock, western (<i>Tsuga heterophylla</i>) 5%	salal (<i>Gaultheria shallon</i>)	holly, English (<i>Ilex aquifolium</i>) 1-2%
blackberry, trailing (<i>Rubus ursinus</i>)	huckleberry, red (<i>Vaccinium parvifolium</i>)															
Douglas-fir (<i>Pseudotsuga menziesii</i>)	1-2%															
fir, grand (<i>Abies grandis</i>) 1-2%	Oregon-grape, dull (<i>Mahonia nervosa</i>)															
redcedar, western (<i>Thuja plicata</i>) 1-2%	rose, dwarf (<i>Rosa gymnocarpa</i>)															
hemlock, western (<i>Tsuga heterophylla</i>) 5%	salal (<i>Gaultheria shallon</i>)															
holly, English (<i>Ilex aquifolium</i>) 1-2%																

A3.8 Ecological Community 8 Old moist rich forest

This community, site series CDFmm/06, was never logged and encompasses the most impressive forest stand on Denman Island. The forest represents a rare example of a rich, biodiverse genetic legacy. The terrain is a relatively flat bench between the flat, creek and wetland basin and East Road. The soil nutrient regime is rich, and thus the old trees have matured over several centuries to encompass vast complex canopies, thick bark, massive limbs, and diameters often over two metres (Photo A3-E8-1). Veteran Douglas-firs (*Pseudotsuga menziesii*), grand firs, (*Abies grandis*), and western redcedars (*Thuja plicata*), over 40 m tall, tower above younger coniferous trees. Mature bigleaf maples occupy gaps in the firs (Photo A3-E8-2), and large openings are being created as the old trees gradually fall (Photo A3-E8-3). The understory is open, with a few shrub species, and is dominated by sword fern (*Polystichum munitum*), with patches of vanilla leaf (*Achlys triphylla*) and a sparse assortment of other species (Photo A3-E8-4).



Photo A3-E8-1. Old growth Douglas-fir (*Pseudotsuga menziesii*).



Photo A3-E8-2. Big leaf maples (*Acer macrophyllum*).



Photo A3-E8-3. Fallen old-growth.



Photo A3-E8-4. Old forest and sword fern (*Polystichum munitum*) understory.

Table A3.8.1. Description of Ecological Community 8 Old moist rich forest

Name	8 Old moist rich forest
Ecological Community	Grand fir / three-leaved foamflower (<i>Abies grandis</i> / <i>Tiarella trifoliata</i>)
Classification	CDFmm/06
Structural Stage	Old forest
Status (BC List)	Red
Slope and Aspect	Slope ~4% Aspect 60°
Photographs	A3-E8-1 to 4
Ecological Community Description	Widely-spaced, veteran old growth trees form the top of the multi-layered canopy of Douglas firs (<i>Pseudo tsuga menziesii</i>), grand firs (<i>Abies grandis</i>), and western redcedars (<i>Thuja plicata</i>). Huge bigleaf maples (<i>Acer macrophyllum</i>) occupy openings, with the occasional red alder (<i>Alnus rubra</i>). Large coarse woody debris on the forest floor is obvious in the open understory, where sword fern is the dominant species. A few shrubs, together with invasive non-native English holly (<i>Ilex aquifolium</i>), are present, with occasional patches of vanilla leaf (<i>Achlys triphylla</i>) and an assortment of other herbaceous species.
Disturbance Notes	The huge trees, open understory, and lack of the almost-ubiquitous spring-board stumps indicate that historic logging did not take place in this polygon. Burn scars on the bark of mature trees indicate that hot fires occurred in the past. Violent storms, with winds from unusual directions, continue to bring down individual old trees, and some old veterans have died and are standing snags. A tree with a bark-scar may be a culturally modified tree. Remains of a barbed wire fence separates the forest from East Road. Currently, there is little disturbance besides wildlife and the occasional human. Wildlife trails are noticeable in the open forest.
Anticipated Change/ Succession	Hopefully the forest will persist, much as it has done. Invasive English holly is present and is likely to become more prevalent, and other invasive species may gradually establish in openings as trees die. Although damage due to excessive wind storms is a threat, climate drying and warming may have less effect here than in other communities due to the lower slope position and the species age and composition. One effect may be that fewer young redcedars are recruited in the future.
Wildlife Observations	The open understory and large coarse woody debris make travel easy for both black-tailed deer (<i>Odocoileus hemionus</i>) and red squirrels (<i>Tamiasciurus hudsonicus</i>). Bats also travel and forage through this forest. The current acoustic analysis, discussed in Appendix 4, will reveal the identity of the bat species. The large tree-limbs encourage roosting and nesting by large raptors, marbled murrelets (<i>Brachyramphus marmoratus</i>), and great blue herons (<i>Ardea herodias</i>). Neotropical migrant species, as well as resident bird species, were heard in the large canopies, and woodpeckers were busy foraging on the snags. A long-toed salamander (<i>Ambystoma macrodactylum</i>) was found under a large piece of coarse woody debris on the forest floor.

Table A3.8.2. Vegetation identified in Ecological Community 8 Old moist rich forest

8 Old moist rich forest CDFmm/06		Percent Cover (%)			Notes DBH=diameter at breast height (mm)
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy	
Tree Canopy	Canopy cover (%)	10	80	10-15	
	Canopy height estimated in m.	40+	30-40	10-30	
	alder, red (<i>Alnus rubra</i>)		<1%		Older dying
	Douglas-fir (<i>Pseudotsuga menziesii</i>)	10	65	5-10	V: DBH=2120 M: DBH=415-865
	fir, grand (<i>Abies grandis</i>)	2	2-5	1	V: DBH=990 M: DBH=580 S: DBH=205-330
	hemlock, western (<i>Tsuga heterophylla</i>)			1	S: DBH=230
	maple, bigleaf (<i>Acer macrophyllum</i>)		5-10	1-2	M: DBH=420-670 S: DBH=275
	redcedar, western (<i>Thuja plicata</i>)	3-5	10	10	V: DBH=1165-1740 M: DBH=685 S: DBH=225-330
Understory	Coarse Woody Debris (CWD) cover = 10%.				
	Shrub layer, includes trees < 10m high: Overall Percent cover: 5-10% Dominant but sparse species: Oregon-grape, dull (<i>Mahonia nervosa</i>) 5% Other species, cover < 1% unless indicated: hemlock, western (<i>Tsuga heterophylla</i>) salal (<i>Gaultheria shallon</i>) huckleberry, red (<i>Vaccinium parvifolium</i>) 2%				
	Herb layer: Overall Percent cover: 40-50% Dominant species: fern, sword (<i>Polystichum munitum</i>) 30-40% Other species, cover < 1% unless indicated: bedstraw species (<i>Galium spp</i>) pathfinder plant (<i>Adenocaulon bicolor</i>) bedstraw, Cleavers (<i>Galium aparine</i>) rattlesnake plantain (<i>Goodyera oblongifolia</i>) chickweed, common (<i>Stellaria media</i>) starflower (<i>Trientalis latifolia</i>) 1-2% grass species vanilla leaf (<i>Achlys triphylla</i>) 5-10% with grove-lover (<i>Nemophila parviflora</i>) some large patches miner's lettuce, Siberian (<i>Claytonia sibirica</i>) wall lettuce (<i>Lactuca muralis</i>)				
	Moss layer: Overall Percent cover: 5-10% Species: <i>Hylocomium splendens</i> (step moss) <i>Leucolepis acanthoneuron</i> (Menzies' tree moss) <i>Plagiomnium insigne</i> (coastal leafy moss) <i>Rhytidiadelphus loreus</i> (lanky moss) Other species on tree trunks and coarse woody debris.				

A3.9 Ecological Community 9 Wet forest recovering field northeast

This community is a nearly rectangular polygon, located in the northeast portion of the Reserve, east of the creek and near the neighbouring old homesite. A few remnants of a split-rail fence are present, and alive and dead *Prunus* shrubs can be seen along the northern border. An adjacent portion of an old road to the south is now indistinguishable and is included in the polygon. The polygon is in a relatively flat plain, at an elevation of 19 m; as it is situated next to the creek and wetlands, the area has a high water table and thus has damp soil conditions. These various characteristics suggest that the area was once cleared and used as a paddock or pasture, which probably added to the soil compaction and subsequent soil impermeability. Ageing red alder (*Alnus rubra*), greater than 40 years old, is the dominant canopy, and the understory is a mixture of sword fern (*Polystichum munitum*) and slough sedge (*Carex obnupta*) (Photos A3-E9-1 and 2).



Photo A3-E9-1. Ecological Community 9 with red alder (*Alnus rubra*) canopy and sword fern (*Polystichum munitum*) understory.



Photo A3-E9-2. Ecological Community 9 with red alder (Alnus rubra) canopy and slough sedge (Carex obnupta) understory.

Table A3.9.1. Description of Ecological Community 9 Wet forest recovering field northeast

Name	9 Wet forest recovering field NE
Ecological Community	Western redcedar / swordfern - skunk cabbage (<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>)
Classification	CDFmm/Ws53
Structural Stage	Mature seral
Status (BC List)	Blue
Slope and Aspect	Relatively flat. up to 2% slope. Aspect 20°
Photographs	A3-E9-1 and 2
Ecological Community Description	The vegetation is likely recovering from the land being cleared and used as a pasture or paddock. The area has a relatively impermeable soil surface and is adjacent to the creek and wetland polygon. Remains of a bordering split-rail fence and cherry trees are evident, and an old road to the south is almost indistinguishable and is now included in the polygon. The canopy is mainly red alder (<i>Alnus rubra</i>), and the understory is dominated by sword fern (<i>Polystichum munitum</i>) and slough sedge (<i>Carex obnupta</i>). English holly (<i>Ilex aquifolium</i>) is also present.
Disturbance Notes	As already noted, the land was likely cleared and used by the homesteaders for either pasturing animals or for growing hay. There has been no disturbance for over 30 years.
Anticipated Change/ Succession	A few conifers are becoming established, likely on raised hummocks, and the surrounding trees, including a number of veteran old growth trees, have extended their canopies over the polygon edges. Recovery of the conifer-forest is obviously slow, but warming, drying conditions may assist in this conversion. Otherwise, the area is likely to develop characteristics of an alder wetland, Ws52, or, if there are sufficient raised sites, to develop into a western redcedar wetland, Ws53. The fact that this area is a bench, not a depression, and is situated above the creek and slope draining east to the sea suggests that drainage may allow conifer-forest to develop over time.
Wildlife Observations	The understory supports moisture-loving species such as salamanders and frogs and provides cover for ground-nesting birds. The adjacent large trees supply perches for large raptors, and the deciduous forest supports a host of nesting and foraging birds. A long-toed salamander (<i>Ambystoma macrodactylum</i>) (Photo A4-5) was found under coarse woody debris, beside an adjacent old-growth tree.

Table A3.9.2. Vegetation identified in Ecological Community 9 Wet forest recovering field northeast

9 Wet forest recovering field NE CDFmm/53		Percent Cover (%)			Notes DBH=diameter at breast height (mm)
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy	
Tree Canopy	Canopy cover (%)		70		
	Canopy height estimated in m.	40-45	25-30		
	alder, red (<i>Alnus rubra</i>)		65		M: DBH=240-365
	Douglas-fir (<i>Pseudotsuga menziesii</i>)	3-5	1		M: DBH=290
	fir, grand (<i>Abies grandis</i>)	1-2			
	hemlock, western (<i>Tsuga heterophylla</i>)				
	redcedar, western (<i>Thuja plicata</i>)	3-5+	5-10		M: Split trunks
Understory	Coarse Woody Debris (CWD) cover = 5%.				
	Shrub layer, includes trees < 10m high: Overall Percent cover = <5% Species: The most abundant shrub is holly, English (<i>Ilex aquifolium</i>) 3-5%. Young trees form the bulk of this sparse layer, each with about 1% coverage: alder, red (<i>Alnus rubra</i>) redcedar, western (<i>Thuja plicata</i>) fir, grand (<i>Abies grandis</i>)				
	Other species, cover <1% unless indicated: blackberry, trailing (<i>Rubus ursinus</i>) 1% huckleberry, red (<i>Vaccinium parvifolium</i>) cherry, bitter (<i>Prunus emarginata</i>) salal (<i>Gaultheria shallon</i>) Douglas-fir (<i>Pseudotsuga menziesii</i>)				
	Herb layer: Overall Percent cover = ~100% Species: Dominated by fern, sword (<i>Polystichum munitum</i>) 60% and sedge, slough (<i>Carex obnupta</i>) 40%. Other species, cover is <1% unless indicated: bedstraw species (<i>Galium spp</i>) miner's lettuce, Siberian (<i>Claytonia sibirica</i>) buttercup, species (<i>Ranunculus sp.</i>) sedge species (<i>Carex sp.</i>) fringe cup (<i>Tellima grandiflora</i>) vanilla leaf (<i>Achlys triphylla</i>) grass, reed canary (<i>Phalaris arundinacea</i>) ● 1% wall lettuce (<i>Lactuca muralis</i>) grass species				
Moss layer: Overall Percent cover: <5% Species: Moss is present mostly on trees and on coarse woody debris. <i>Dicranum sp</i> <i>Hylocomium splendens</i> (step moss), trace (<1%), on ground <i>Leucolepis acanthoneuron</i> (Menzies' tree moss) <i>Plagiothecium undulatum</i> (flat moss) <i>Rhytidiadelphus loreus</i> (lanky moss) <i>Rhytidiadelphus triquetrus</i> (electrified cat's-tail moss) Other species on tree trunks and coarse woody debris.					

● = non-native invasive species

A3.10 Ecological Community 10 Wet forest recovering field south central

This community is located on the south-central side of the Reserve. The land may have been part of a braided wetland-drainage system from Graham Lake, associated with the adjacent Windy Marsh, prior to the creation of Owl Crescent and Mallard Way and the subdivision that they service. The land is a relatively flat, in a slight depression, at an elevation of about 28 m. At least two minor drainage channels flow across the area. Remnants of a split rail fence surround this community, indicating that the area was likely cleared and used as a pasture or hay field in the past. During the recent logging in 2000–2002, at least one logging-equipment track was made through the polygon, and other openings in the canopy may be areas that were used as log-landings. Red alder (*Alnus rubra*) is the dominant canopy tree, English holly (*Ilex aquifolium*) is more abundant in the very sparse shrub layer than other shrub species, and slough sedge (*Carex obnupta*) is the primary herb species (Photos A3-E10-1a and b). Invasive reed canary grass (*Phalaris arundinacea*) is growing in the larger gaps in the canopy (Photos A3-E10-2a and b).



Photo A3-E10-1a. Ecological Community 10 with red alder (*Alnus rubra*) canopy and slough sedge (*Carex obnupta*) understory, photographed in May.



Photo A3-E10-1b. Same community photographed in August.



Photo A3-E10-2a. Ecological Community 10 with reed canary grass (*Phalaris arundinacea*) growing in canopy opening, photographed in May.



Photo A3-E10-2b. Same invasive species photographed in August.

Table A3.10.1. Description of Ecological Community 10 Wet forest recovering field south central

Name	10 Wet forest recovering field south central
Ecological Community	Western redcedar / swordfern - skunk cabbage (<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>)
Classification	CDFmm/Ws53
Structural Stage	Mature seral
Status (BC List)	Blue
Slope and Aspect	Relatively flat
Photographs	A3-E10-1a and b, A3-E10-2a and b
Ecological Community Description	The land in this polygon was likely cleared for former use as a pasture or hayfield; the edge has remnants of a split-rail fence. The vegetation is in a young-to-maturing seral stage, with red alder (<i>Alnus rubra</i>) as the dominant canopy species. Coniferous forests surround the polygon on three sides, and young Douglas-firs (<i>Pseudotsuga menziesii</i>) and a few grand firs (<i>Abies grandis</i>) are growing along the edges and on raised microsites. Two aggressive invasive species, English holly (<i>Ilex aquifolium</i>) and reed canary grass (<i>Phalaris arundinacea</i>), are becoming established. The reed canary grass is in open patches that were likely compacted by logging equipment.
Disturbance Notes	As already noted, this area was likely cleared and used to pasture animals or as a hay field. In 2000–2002, logging equipment crossed the polygon, creating at least one compacted track, and other openings may have been log-landings. Since that time, the area has been recovering.
Anticipated Change/ Succession	Although the area drains into ditches along Mallard Way, the land is slightly depressed so that drainage is slow and surface water accumulates. Thus, together with the compacted soil, paucity of raised hummocks, and abundant surface-water flows across the land, the polygon is likely to remain a wetland for some time. Eventually, as the alders die and are replaced and as surface debris accumulates, more coniferous species will grow, resulting in a 'fluctuating water table' site or a swamp-forest.
Wildlife Observations	This area also supports moisture-loving species, particularly in the dry season, as indicated by the predominance of sedge, which reflects year-round surface moisture. Salamander species will increase as the coarse woody debris accumulates. The deciduous canopy hosts foraging and nesting bird species, the openings create edge habitat, and the sunny openings attract invertebrates, basking snakes, and other species.

A3.11 Ecological Community 11 Mixed wet forest, moist forest and open recovering fields

Community 11 groups together formerly farmed and ditched fields in the northeast corner of the Reserve. The terrain is flat to gently sloping (4%) downwards for roughly 300m, with an elevation ranging from about 26 m on the west to around 20 m at the eastern Reserve border and with an aspect of 80°. The surface-water drainage on lands north of the Reserve tends to flow overland from the west, down to the middle of the Reserve's northern border. Then, the flows spread across the flat land that lies to the east, which is partly on the Reserve and partly on the neighbouring land to the north. As already noted, early farmers, living on the homesite to the north, created a ditch (Photo 24) to deflect the surface-water around the house and lower fields, and a more recent ditch (Photo 25) reinforced the earlier one.

The young forest vegetation in the recovering fields varies with the moisture gradient and is divided into three polygons : (1) a partially-treed, wet swamp dominated by slough-sedge (*Carex obnupta*) (Photo A3-E11-1); (2) a young mixed moist forest on raised hummocks with alternating slough sedge and sword fern (*Polystichum munitum*) understory (Photos A3-E11-2 and 3); and (3) grassy openings with patches of trees (Photo A3-E11-4) on slightly elevated, drier land, with a few low-lying patches of sedges, especially around the old ditch (Photos A3-E11-4 and 5). Over the last 30 years, these former agricultural fields are being slowly replaced by forests, and only a small fraction of the completely open land remains.



Photo A3-E11-1. (1) Partially-treed, wet, slough edge (*Carex obnupta*) understory.



Photo A3-E11-2a. (2) Moist forest, slough sedge (*Carex obnupta*) patches.



Photo A3-E11-2b. (2) Moist forest, dry understory patches.



Photo A3-E11-4. (3) Grassy open area with patches of trees.



Photo A3-E11-5. English ivy (*Ilex arundinacea*) on a tree in (3).

Table A3.11.1. Description of Ecological Community 11 Mixed wet forest, moist forest and open recovering field

Name	11 Mixed wet forest, moist forest and open recovering field
Ecological Community	Mixture: western redcedar / swordfern - skunk cabbage and re-establishing moist forest probably grand fir / three-leaved foamflower
Classification	CDFmm/Ws53 & CDFmm/06
Structural Stage	Both ecosystem types have patches of young to maturing seral
Status (BC List)	Possibly Blue & Red – when climax
Slope and Aspect	Slope: Almost flat, 4% Aspect: 80°
Photographs	A3-E11-1 to 5
Ecological Community Description	Former fields consist of (1) a partly-forested, slough sedge-dominated (<i>Carex obnupta</i>) wet area, (2) a young forest on hummocky terrain with a mixed sword-fern (<i>Polystichum munitum</i>) and slough-sedge understory and (3) a grass-dominated open area with young forest patches. The polygon contains a varied mixture of species at different developmental stages, with many non-native species, decaying split rails, and two ditches, all of which are the result of the former use as pasture or a hayfield.
Disturbance Notes	As already noted, the land in this community was farmed and ditched. It has remained without disturbance for over 30 years, except for a second ditch that was dug on the east side of the original ditch near the old homesite house.
Anticipated Change/ Succession	The open dry areas of the community will continue to fill in with young seral and climax forest species. The young climax moist-forest areas, with the abundant sword-ferns in the understory, may mature into CDFmm/06 forests in the future. If climate change doesn't dry out the wettest sections, they will likely remain as red alder (<i>Alnus rubra</i>) wetlands for some time. The paucity of raised hummocks and the large amount of surface water may lead to cycles of alder growth. The surface-water flow-areas on neighbouring land to the northwest of the Reserve border also have older alder stands.
Wildlife Observations	The open sunny areas, the moisture, and the edges created by the many shrubs and young trees have made this an attractive habitat for a wide diversity of open-land birds and invertebrate species, particularly butterflies and dragonflies. The wealth of berries and seeds attracts other foraging species such as the forest-dwelling western tanager (<i>Piranga ludoviciana</i>) (Photo A4-3), one of the many species that benefits from edges and openings. A variety of species have been identified in this area over the years.

Table A3.11.2a. Tree and shrub level vegetation identified in Ecological Community 11 Mixed wet forest, moist forest and open recovering field

Vegetation within each of the polygons of this community is identified in this table as follows:

- (1) = wet forest recovering field, red alder dominated
- (2) = moist forest recovering field, hummocky, Douglas-fir and red alder dominated
- (3) = open recovering field, grassy field with groups of trees and a few sedge-dominated patches

11 Mixed wet forest, moist forest and open recovering fields vegetation CDFmm/Ws53 and CDFmm/06		Percent Cover (%)		Notes DBH=diameter at breast height (mm)
		(M) Main Canopy	Secondary Canopy (S)	
Tree Canopy	Canopy cover (%)	Varied	Varied	
	Canopy height estimated in m.	20-40	10-20	
	alder, red (<i>Alnus rubra</i>)	(1) 15-20	(2) 15	(1) M: DBH=270 (2) S: DBH=100-280
	Douglas-fir (<i>Pseudotsuga menziesii</i>)	(1) 0-40 (2) 70	(1) 0-5 (3) 15-20	(1) M: DBH=395-505 S: DBH=195-250 (2) M: DBH=305-590 (3) S: DBH=285-585 often 'wolfy' (open-grown, or in groups)
	fir, grand (<i>Abies grandis</i>)	(3) 2	(2,3) <1%	(3) M: DBH=435-690 S: DBH=145 many browsed
	redcedar, western (<i>Thuja plicata</i>)	(1) 5 (3) 2-3	(2) 1	(1) M: DBH=240 (2) 1 tree S: DBH=340 (3) 1 multi-trunk tree
Understory	<p>Coarse Woody Debris (CWD) cover =5-10%</p> <p>Shrub layer species, includes trees < 10m high: Overall percent cover = 2-10% Species vary with area but the layer is generally sparse.</p> <p>Dominant species: In (2) is English holly (<i>Ilex aquifolium</i>)● 2+%. In (3) are cherry and plum species, as well as domestic (<i>Prunus sp.</i>) 5+%.</p> <p>Other species (with coverage <1% unless indicated): apple, Pacific crab (<i>Malus fusca</i>) (3) 3+% ivy, English (<i>Hedera helix</i>)● (Photo A3-E11-5) blackberry, trailing (<i>Rubus ursinus</i>) (2,3) 1-2% Oregon-grape, dull (<i>Mahonia nervosa</i>) (2) blackberry, evergreen (<i>Rubus laciniatus</i>)● (3) red cedar, western (<i>Thuja plicata</i>) (2) 1-2% cotoneaster <i>Cotoneaster sp.</i>● (3) rose, dwarf (<i>Rosa gymnocarpa</i>) (3) fir, grand (<i>Abies grandis</i>) (2,3) rose, Nootka (<i>Rosa nutkana</i>) (3) 1-2% hawthorn, black (<i>Crataegus douglasii</i>) (3) 1% rowan (<i>Sorbus sp.</i>)● (3) hawthorn, non-native <i>Crataegus sp.</i>● (3) 1% salal (<i>Gaultheria shallon</i>) (2) (3) patches on the edges 3% huckleberry, red (<i>Vaccinium parvifolium</i>) (2)</p>			

● = non-native invasive species

Table A3-11-2b. Herb and moss level vegetation for (1) wet forest recovering field

Herb layer for wet forest recovering field species (1): Overall Percent cover = 20-50%	
Dominant species: sedge, slough (<i>Carex obnupta</i>) 90%.	
Other species, cover <1% unless indicated:	
bedstraw species (<i>Galium spp</i>) 1%	fern, sword (<i>Polystichum munitum</i>) <5%
buttercup, creeping (<i>Ranunculus repens</i>) ● 1%	nettle, hedge (<i>Stachys cooleyae</i>) 1-2%
Moss layer: Overall Percent cover = <2% primarily on tree bases	

● = non-native invasive species

Table A3-11-2c. Herb and moss level vegetation for (2) moist forest recovering field

Herb layer for moist forest recovering field species (2). Overall Percent cover = 65-75%	
Dominant species: sedge, slough (<i>Carex obnupta</i>) 30% and fern, sword (<i>Polystichum munitum</i>) 15-20%.	
Other species, cover <1% unless indicated:	
bedstraw species (<i>Galium spp</i>) 1=%	herb-robert (<i>Geranium robertianum</i>) ●
bedstraw, Cleavers (<i>Galium aparine</i>) 3-5%	miner's lettuce, Siberian (<i>Claytonia sibirica</i>)
buttercup, creeping (<i>Ranunculus repens</i>) ●	pathfinder plant (<i>Adenocaulon bicolour</i>) 2-5%
buttercup, western (<i>Ranunculus occidentalis</i>)	sedge species (<i>Carex</i> sp.)
fern, bracken (<i>Pteridium aquilinum</i>)	self-heal (<i>Prunella vulgaris</i>)
fern, lady (<i>Athyrium filix-femina</i>)	speedwell, thyme-leaved (<i>Veronica serpyllifolia</i>)
grass, reed canary (<i>Phalaris arundinacea</i>) ●	sweet-cicely (<i>Osmorhiza chilensis</i>)
hairy cat's ear (<i>Hypochaeris radicata</i>) ●	vanilla leaf (<i>Achlys triphylla</i>) 1-2%
Moss layer for moist forest recovering field species (2): Overall Percent cover = 5-10%	
Species:	
<i>Leucolepis acanthoneuron</i> (Menzies' tree moss)	<i>Plagiomnium insigne</i> (coastal leafy moss)
<i>Plagiothecium undulatum</i> (flat moss)	<i>Rhytidiadelphus loreus</i> (lanky moss)
Other species present especially on tree trunks and coarse woody debris	

● = non-native invasive species

Table A3-11-2d. Herb and moss level vegetation for (3) open recovering field

Herb layer for open-land recovering field species (3): Overall Percent cover = 95%	
Dominant species: grass species 70-80% and thistle, Canada (<i>Cirsium arvense</i>) 30%	
Other species, cover <1% unless indicated:	
bedstraw species (<i>Galium spp</i>) 1=%	hairy cat's ear (<i>Hypochaeris radicata</i>) ●
buttercup, creeping (<i>Ranunculus repens</i>) ●	herb-robert (<i>Geranium robertianum</i>) ●
buttercup, western (<i>Ranunculus occidentalis</i>)	plantain, English (<i>Plantago lanceolata</i>) ●
daisy, oxeye (<i>Leucanthemum vulgare</i>) ●	rush species (<i>Juncus</i> sp.)
dandelion (<i>Taraxacum officinale</i>) ●	sedge species (<i>Carex</i> sp.)
fern, bracken (<i>Pteridium aquilinum</i>) 10%	self-heal (<i>Prunella vulgaris</i>) (2)
grass, reed canary (<i>Phalaris arundinacea</i>) ●	patches thistle, bull (<i>Cirsium vulgare</i>) ●
Moss layer for open-land recovering field species (3): Overall Percent cover = 10-15 %	
Species: <i>Kindbergia oregana</i> (Oregon beaked moss), <i>Kindbergia praelonga</i> (slender beaked moss) and complex mix, on trees bases, coarse woody debris, many similar to (2), as described in Table A3-11-2c.	

● = non-native invasive species

A3.12 Ecological Community 12 Wet swamp forest

The wet swamp forest community is situated on the southern border, adjacent to the junction of Owl Crescent and Mallard Way. The community is in a depression that adjoins the slightly higher recovering wet field south central (Ecological community 10) on the other side of Mallard Way Trail. The swamp was probably part of the Graham Lake - Windy Marsh drainage system, prior to the road construction for the adjacent subdivision. The reason the area was never cleared for agriculture may stem from the fact that the water levels were higher and, perhaps, because it is a depression, and thus the land was less amenable to being drained and leveled.

The swamp is a complex of wet pockets, with skunk cabbage mud flats, standing water pools (Photos A3-E12-1 and 2), huge snags (Photos A3-E12-3 a, b, and c), large fallen trees (Photo A3-E12-4), and an even mix of deciduous and coniferous tree species that are growing on raised microsites throughout the polygon. Many of the trees have dead or broken tops. Around the rim of the depression are many veteran Douglas-firs (*Pseudotsuga menziesii*). Shrubs are varied and relatively sparse, but invasive English holly (*Ilex aquifolium*) is the most abundant of the shrub species. Sword fern (*Polystichum munitum*) dominates the herb layer.



Photo A3-E12-1. Wet mud flats with skunk cabbage (*Lysichiton americanus*).



Photo A3-E12-2. Standing water pools.



Photos A3-E12-3 a, b, and c. Huge standing snags.



Photo A3-E12-4. Large fallen logs, contributing long-lasting, moist coarse woody debris to forest floor.

Table A3.12.1. Description of Ecological Community 12 Wet swamp forest

Name	12 Wet swamp forest
Ecological Community	Western redcedar / swordfern - skunk cabbage (<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>)
Classification	CDFmm/Ws53
Structural Stage	Older mature climax swamp forest
Status (BC List)	Blue
Slope and Aspect	Slope: flat bottomland, depression
Photographs	A3-E12-1 to 4
Ecological Community Description	A rich swamp wetland in a depression that was not cleared for agricultural uses. The surrounding raised rim of land has numerous old growth Douglas-firs (<i>Pseudotsuga menziesii</i>). The bottomland is a complex of interlacing wet pockets and standing water pools (Photo A3-E-12-2), surrounding raised microsites that support huge old-growth snags (Photo A3-E-12-3) and tall trees. The trees have multi-layered canopies, and many have dead or broken tops. The swamp forest is a mix of deciduous and coniferous species. The sparse but varied shrub layer has been invaded by English holly (<i>Ilex aquifolium</i>), which was plentiful along the Reserve's southern border. Sword fern (<i>Polystichum munitum</i>) is the dominant herb, and pockets of skunk cabbage (<i>Lysichiton americanus</i>) are common.
Disturbance Notes	Burn scars, on tree bark and even through the interior of a very old redcedar snag, reflect the history of one or more hot fires. Any previous uses of the land are unknown.
Anticipated Change/ Succession	The polygon has remained largely unchanged for 30 years, but the mature red alders are ageing and falling; this will continue as young alder replace them. Because the water table is high, many of the trees have shallow roots and so continuing wind-throw can be expected as the trees grow. The openings may be increasingly invaded by invasive species such as English holly, and a small patch of reed canary grass (<i>Phalaris arundinacea</i>) has now established. Climate change effects may lead to earlier seasonal drying or even shrinkage of the wetland.
Wildlife Observations	A host of bird, amphibian, and invertebrate species were identified in early spring. The available water and large coarse woody debris (Photo A3-E-12-6) provides excellent shelter and foraging habitat. The relatively open canopy, and variety of shrub species provide sun, edges, and an ample food source. Numerous woodpeckers were seen foraging (Photo A4-5).

Table A3.12.2. Vegetation identified in Ecological Community 12 Wet swamp forest

12 Wet swamp forest CDFmm/Ws53		Percent Cover (%)			Notes DBH=diameter at breast height (mm)
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy	
Tree Canopy	Canopy cover (%)		20-25	5	
	Canopy height estimated in m.		20-30+	10-20	
	alder, red (<i>Alnus rubra</i>)		5		DBH=450-550, many 30m+ and broken or dead tops
	fir, grand (<i>Abies grandis</i>)		2-3	1-2	M: DBH=350, 25m S: DBH=260m 13m
	maple, Douglas (<i>Acer glabrum</i>)		5		DBH=220-305, 20m, many broken or dead tops
	redcedar, western (<i>Thuja plicata</i>)		5-10	5-10	M: DBH=590 S: DBH=320-375
Understory	Coarse woody debris (CWD) cover = 20-25 %.				
	Shrub layer species, includes trees < 10m high: Overall percent cover = 10% Generally sparse, dominant species throughout: English holly (<i>Ilex aquifolium</i>) 5%. Other species, cover <1% unless indicated: blackberry, evergreen (<i>Rubus laciniatus</i>) ● 1% elderberry, red (<i>Sambucus racemosa</i>) 1% blackberry, trailing (<i>Rubus ursinus</i>) huckleberry, red (<i>Vaccinium parvifolium</i>) 1-2% currant, stink (<i>Ribes bracteosum</i>) 1% salmonberry (<i>Rubus spectabilisabilis</i>) 2%				
	Herb layer species. Overall Percent cover = 60-70% Dominant species fern, sword (<i>Polystichum munitum</i>) 30-40% Other species (coverage <1% unless indicated): anemone, Lyall's (<i>Anemone lyalli</i>) grass, reed canary (<i>Phalaris arundinacea</i>) ● bedstraw species (<i>Galium spp</i>) miner's lettuce, Siberian (<i>Claytonia sibirica</i>) 1% bittercress, beautiful (<i>Cardamine pulcherrima</i>) nettle, hedge (<i>Stachys cooleyae</i>) 1-2% buttercup, species (<i>Ranunculus sp.</i>) rush species (<i>Juncus sp.</i>) fern, deer (<i>Blechnum spicant</i>) rush, common (<i>Juncus effusus</i>) fern, lady (<i>Athyrium filix-femina</i>) 1-2% sedge species (<i>Carex sp.</i>) fern, licorace (<i>Polypodium glycyrrhiza</i>) sedge, slough (<i>Carex obnupta</i>) fern, spiny wood (<i>Dryopteris expansa</i>) 1-2% skunk cabbage (<i>Lysichiton americanus</i>) 5+% grass species starwort species (<i>Stellaria sp.</i>) patches				
	Moss layer species: Overall percent cover = 5-10% <i>Leucolepis acanthoneuron</i> (Menzies' tree moss) <i>Plagiomnium insigne</i> (coastal leafy moss) <i>Mnium sp.</i> (other similar species) <i>Rhytidiadelphus loreus</i> (lanky moss) <i>Plagiothecium undulatum</i> (flat moss) Other species present especially on tree trunks and coarse woody debris				
	● = non-native invasive species				

A3.13 Ecological Community 13 Creek, Central Wetland and surrounding swamp forest

This community consists of the creek, the surrounding swamp wetland and a small shrub-sedge open wetland. This complex drainage system begins at the centre of the north border of the Reserve, at an elevation of about 26 m (Photo A3-E13-1). The water flows slowly through a fairly flat area that extends across the centre of the Reserve and forms channels (Photo A3-E13-2) and pools, with pockets of slough sedge (*Carex obnupta*) and skunk cabbage (*Lysichiton americanus*) (Photo A3-E13-3) and with a partial canopy of western redcedar (*Thuja plicata*). Two thirds of the way across the Reserve, the drainage widens (Photo A3-E13-4) and becomes Central wetland, which is described in the next paragraph. The creek then turns back to the northeast, flowing across the flat plain, through older forest (Photo A3-E13-5), and out of the Reserve as a slough sedge-dominated wetland at the boundary with the old homesite, on the Reserve's eastern border (Photo A3-E-13-6). A defined creek-course is distinguishable periodically, but is surrounded by braided channels of old flows and water pockets. Overall, the creek system is classified as a western red-cedar (*Thuja plicata*) swamp-forest habitat CDFmm/Ws53. In winter much of the land appears as a wet mudflat (Photo A3-E13-7), but it is covered with skunk cabbage and other vegetation in the growing season (Photo A3-E13-8).

Central wetland is an enlarged and depressed bend in this creek system, as it turns back north. The wetland is a mix of open water (from October through May-June) and shrub and herbaceous habitat-types. As the creek enters the wetland, the swamp habitat widens and, for a short section, the wetland has a red alder (*Alnus rubra*) canopy. This opens into a dense mix of shrubs such as spirea (*Spirea douglasii* spp. *Douglasii*), Pacific willow (*Salix lucida* ssp. *lasiandra*), and Pacific crab apple (*Malus fusca*) (Photo A3-E13-9) for about one third of the wetland. Then, another one third of the open area is dominated by sedge (Photo A3-E13-10). As the flow alters course, the surrounding forest overhangs the edges of a section of open water in winter that becomes mud flat and herbaceous vegetation by early summer. Overall, trees from the surrounding forest shelter the wetland and add approximately 3-5% cover. A large Sitka spruce (*Picea sitchensis*), a species not noted elsewhere on the Reserve, is growing on the west side of the wetland. The wetland itself has hummocky terrain with many raised microsites growing shrub-level tree species. Finally, the creek flows out of Central Wetland as a channel with a pebbled-substrate.



Photo A3-E13-1. Creek / wetland system begins at northern Reserve border. **Photo A3-E13-2. The creek flows partially in channels.**



Photo A3-E13-3. Skunk cabbage (*Lysichiton americanus*) habitat.



Photo A3-E13-4. Swamp widens into wetland.



Photo A3-E13-5. Shrub portion of wetland.



Photo A3-E13-6. Sedge portion of wetland.



Photo A3-E13-7. Creek flows in channel older mature forest.



Photo A3-E13-8. Creek flows out of Reserve in slough sedge (*Carex obnupta*) wetland.

Table A3.13.1. Description of Ecological Community 13 Creek, Central Wetland and surrounding swamp forest

Name	13 Creek, central wetland and surrounding swamp forest
Ecological Community	Western redcedar / swordfern - skunk cabbage (<i>Thuja plicata</i> / <i>Polystichum munitum</i> - <i>Lysichiton americanus</i>)
Classification	CDFmm/Ws53
Structural Stage	Mature
Status (BC List)	Blue
Slope and Aspect	Slope: very slight slope, lots of flat areas with standing water, <5%.
Photographs	A3-E-13-1 to 10
Ecological Community Description	Complex wetland and flowing water community. The forest surrounding the creek is older mature climax. The nearly 0.5-ha wetland is partly open water, with tall overhanging conifers, partly sedge-dominated and partly dominated by willow (<i>Salix sp.</i>), spirea (<i>Spirea douglasii</i>) and other shrubs. The surrounding wetlands are similar to those described in Polygon13, but are mainly western redcedar (<i>Thuja plicata</i>) growing on raised microsites with sword fern (<i>Polystichum munitum</i>). These are surrounded by a network of wet channels and water pockets that contain slough sedge (<i>Carex obnupta</i>), skunk cabbage (<i>Lysichiton americanus</i>), , and salmonberry (<i>Rubus spectabilis</i>).
Disturbance Notes	The historic disturbance is unknown but water flows may have been directed or controlled by humans in the distant past. Logging equipment crossed the creek in 2000–2002 near the northern border of the property. The damage to the creek is no longer discernible, but trees immediately adjacent to this polygon were cut at that time. Because the land is very flat, the flow has created braided channels over time, as heavy flows changed the main creek course, most likely when obstructions such as fallen trees blocked the drainage.
Anticipated Change/ Succession	Siltation will continue to raise the substrate level, but heavy flows will carve new channels in the flat terrain, retaining the water pockets. Siltation will bring both substrate and nutrients (and possibly pollutants), allowing for increased vegetative growth. Over time, the trees without raised sites that are sufficiently large to allow further growth will die and fall, creating openings and understory growth, and other trees will continue to mature. As already noted, climate changes may shrink the wet sites and change the species composition.
Wildlife Observations	Like the wet, mixed-vegetation sites in other polygons, this polygon supports a rich diversity of wildlife species. In particular, in the spring months, the polygon attracts amphibians and invertebrates requiring water, both flowing and standing, for part of their life cycle. This area is a drinking water source for many species, until the standing pools of water dry up in summer.

Table A3.13.2a. Vegetation identified in Ecological Community 13 Creek, Central Wetland and surrounding swamp forest: Tree coverage.

13 Creek and surrounding swamp forest CDFmm/Ws53		Percent Cover (%)			Notes DBH=diameter at breast height (mm)
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy	
Tree Canopy	Canopy cover (%)		5-60		
	Canopy height estimated in m.		30-40	10-30	
	alder, red (<i>Alnus rubra</i>)			1	Only in Central Wetland and with broken multi-trunks
	Douglas-fir (<i>Pseudotsuga menziesii</i>)		1-2	<1	M:DBH=490 S: DBH=250
	hemlock, western (<i>Tsuga heterophylla</i>)		<1		M: DBH=670-750 next to wetland
	redcedar, western (<i>Thuja plicata</i>)		to 50	10-15	M: DBH=380-680 S: DBH=240
	spruce, Sitka (<i>Picea sitchensis</i>)		<1		M: DBH=940 1 tree next to Central Wetland
Understory	Coarse Woody Debris (CWD) cover = 10-20 %.				
	Shrub layer species, includes trees < 10m high): Overall percent cover = 20-30 % Dominant species: salmonberry (<i>Rubus spectabilisabilis</i>) 20% Other species, cover <1% unless indicated: apple, Pacific crab (<i>Malus fusca</i>) 1% huckleberry, red (<i>Vaccinium parvifolium</i>) blackberry, trailing (<i>Rubus ursinus</i>) 2-5% rose, dwarf (<i>Rosa gymnocarpa</i>) elderberry, red (<i>Sambucus racemosa</i>) salal (<i>Gaultheria shallon</i>) 1%on CWD and edges holly, English (<i>Ilex aquifolium</i>)● 1+%				
	Herb layer species: Overall Percent cover = 50-80% Dominant species: depends on patch examined but, overall, sedge, slough (<i>Carex obnupta</i>) and skunk cabbage (<i>Lysichiton americanus</i>) 30-75%, Other species, cover <1% unless indicated: bedstraw species (<i>Galium spp</i>) monkey-flower (<i>Mimulus moschatus</i>) fern, deer (<i>Blechnum spicant</i>) nettle, hedge (<i>Stachys cooleyae</i>) 1-3% fern, lady (<i>Athyrium filix-femina</i>) 2-5% rush, common (<i>Juncus effusus</i>) fern, sword (<i>Polystichum munitum</i>) 2-10% sandwort species (<i>Stellaria sp.</i>) foam flower (<i>Tiarella trifoliata</i>) skullcap, blue (<i>Scutellaria laterifolia</i>) 2-10% mint, Canada (<i>Mentha arvensis</i>) water-parsely, Pacific (<i>Oenanthe sarmentosa</i>) 1-2%				
	Moss layer: Mosses in this swamp community are found on tree bases and on coarse woody debris and coverage varies with the amount of debris. Species: <i>Isoetecium myosuroide</i> (cattail moss) Mnium species <i>Kindbergia praelonga</i> (slender beaked moss) <i>Plagiothecium undulatum</i> (flat moss) Other species are present.				

● = Non-native invasive species.

Table A3.13.2b. Vegetation identified in Ecological Community 13 Creek, Central Wetland and surrounding swamp forest: Central Wetland vegetation

Understory	<p>Coarse Woody Debris (CWD) cover = 15-20 %.</p> <p>Shrub layer, includes trees < 10m high: a mix of species and is mainly on the north side and around the edges</p> <p>Overall Percent cover: 35-40%</p> <p>Other species (< 1% unless indicated):</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">alder, red (<i>Alnus rubra</i>) 10-20%</td> <td style="width: 50%;">salal (<i>Gaultheria shallon</i>) on the edges and CWD^ 5+%</td> </tr> <tr> <td>apple, Pacific crab (<i>Malus fusca</i>) 5-10%</td> <td>spirea (<i>Spirea douglasii</i> spp. <i>Douglasii</i>) 20-25%</td> </tr> <tr> <td>holly, English (<i>Ilex aquifolium</i>)</td> <td>willow, Pacific (<i>Salix lucida</i> ssp. <i>lasiandra</i>) 15%</td> </tr> <tr> <td>huckleberry, red (<i>Vaccinium parvifolium</i>) 1-2% at edges</td> <td></td> </tr> </table> <p>redcedar, western (<i>Thuja plicata</i>) on hummocks 5-10%</p>	alder, red (<i>Alnus rubra</i>) 10-20%	salal (<i>Gaultheria shallon</i>) on the edges and CWD^ 5+%	apple, Pacific crab (<i>Malus fusca</i>) 5-10%	spirea (<i>Spirea douglasii</i> spp. <i>Douglasii</i>) 20-25%	holly, English (<i>Ilex aquifolium</i>)	willow, Pacific (<i>Salix lucida</i> ssp. <i>lasiandra</i>) 15%	huckleberry, red (<i>Vaccinium parvifolium</i>) 1-2% at edges		
	alder, red (<i>Alnus rubra</i>) 10-20%	salal (<i>Gaultheria shallon</i>) on the edges and CWD^ 5+%								
	apple, Pacific crab (<i>Malus fusca</i>) 5-10%	spirea (<i>Spirea douglasii</i> spp. <i>Douglasii</i>) 20-25%								
	holly, English (<i>Ilex aquifolium</i>)	willow, Pacific (<i>Salix lucida</i> ssp. <i>lasiandra</i>) 15%								
huckleberry, red (<i>Vaccinium parvifolium</i>) 1-2% at edges										
<p>Herb layer: primarily sedges with slough sedge (<i>Carex obnupta</i>) dominant at 40%.</p> <p>Overall Percent cover: 70-80%</p> <p>Other species, cover < 1% unless indicated:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">bedstraw species (<i>Galium</i> spp)</td> <td style="width: 50%;">sedge species (<i>Carex</i> sp.) 15-20%</td> </tr> <tr> <td>fern, lady (<i>Athyrium filix-femina</i>) 2-5%</td> <td>skullcap, blue (<i>Scutellaria lateriflora</i>) 10-15%</td> </tr> <tr> <td>fern, licorace (<i>Polypodium glycyrrhiza</i>)</td> <td>skunk cabbage (<i>Lysichiton americanus</i>) 15-20%</td> </tr> <tr> <td>mint, Canada (<i>Mentha arvensis</i>) 5-10%</td> <td>water-parsley, Pacific (<i>Oenanthe sarmentosa</i>)</td> </tr> <tr> <td>monkey-flower (<i>Mimulus moschatus</i>)</td> <td style="text-align: center;">10%</td> </tr> </table>	bedstraw species (<i>Galium</i> spp)	sedge species (<i>Carex</i> sp.) 15-20%	fern, lady (<i>Athyrium filix-femina</i>) 2-5%	skullcap, blue (<i>Scutellaria lateriflora</i>) 10-15%	fern, licorace (<i>Polypodium glycyrrhiza</i>)	skunk cabbage (<i>Lysichiton americanus</i>) 15-20%	mint, Canada (<i>Mentha arvensis</i>) 5-10%	water-parsley, Pacific (<i>Oenanthe sarmentosa</i>)	monkey-flower (<i>Mimulus moschatus</i>)	10%
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fern, licorace (<i>Polypodium glycyrrhiza</i>)	skunk cabbage (<i>Lysichiton americanus</i>) 15-20%									
mint, Canada (<i>Mentha arvensis</i>) 5-10%	water-parsley, Pacific (<i>Oenanthe sarmentosa</i>)									
monkey-flower (<i>Mimulus moschatus</i>)	10%									
<p>Moss layer: only moss is on the tree trunks and on the coarse woody debris, species are similar to the rest of the wetland</p>										



Photo A3-E13-9. Swamp habitat in March.



Photo A3-E13-10. Same swamp site in May.

A3.14 Ecological Community 14 Landing and clearing

This community is situated next to the main entrance into the Reserve and consists of two polygons. The first was the site of a major log-landing and is referred to as the landing (Photos A3-E14-1 and 2). The rocky-substrate habitat in the second polygon adjacent to the landing was almost totally cleared and is referred to as the clearing (Photo A3-E14-3 and 4). The terrain in the clearing slopes down gradually from an elevation of about 48 m towards the main entrance, at 38 m. The community is a mix of shrub- and pole-sapling-stage vegetation, with a few residual coniferous trees. Shrub habitat is dominant in the landing, possibly due to the compacted soil. Both polygons comprise recovering forests, probably destined to blend from CDFmm/01 to CDFmm 04, or even to CDFmm/06 at the lower edge.



Photo A3-E14-1. Landing on Main Trail.



Photo A3-E14-2. Landing on Rocky Trail.



Photo A3-E14-3. Clearing, west of Landing.



Photo A3-E14-4. Clearing shrubs and young trees.

Table A3.14.1. Description of Ecological Community 14 Landing and clearing

Name	14 Landing and clearing
Ecological Community	Unclassified
Classification	None
Structural Stage	Mix: shrub/pole sapling
Status (BC List)	None
Slope and Aspect	Slope: 8.5% Aspect: 70°
Photographs	10, A3-E-14-1 to 4
Ecological Community Description	A young forest community at the shrub-to-pole-sapling developmental stage, growing on soil compressed by logging equipment at the lower elevation (Photo A3-E14-1 and 2) and on thin rocky soil in the upper cleared portion (Photo A3-E14-3 and 4). A few residual mature trees remain, and the young coniferous trees are a mix of species. The shrub community is varied but predominantly salal (<i>Gaultheria shallon</i>), and is more developed in the clearing. The herb species are varied, although sparse in the clearing and more abundant in the landing, where many invasive species have grown, even small patches of reed canary grass (<i>Phalaris arundinacea</i>).
Disturbance Notes	As already noted, the area was logged in 2002–2002, and the lower half used as a log-landing. Main Trail and Rocky Meadow Trail run through the polygon. A cage-tree study is in progress, wherein young seedlings are surrounded by wire to deter browsing by black-tailed deer (<i>Odocoileus hemionus</i>) (Photos 10 and A3-E14-2).
Anticipated Change/ Succession	The forest will continue to develop. Canopy closure in the maturing pole-sapling areas will shade out the understory species. The understory species will likely remain around the older trees and re-establish in the young to maturing forest. Climate changes may hasten the death of the young in-filling western hemlocks (<i>Tsuga heterophylla</i>) and stress many of the dense, less drought-tolerant species. As the polygon is situated in a relatively narrow gap between tall forests, recovery of the forest will be slow.
Wildlife Observations	Species using edges and sunny gaps are supported. Many dragonflies, damselflies, and butterflies were seen in the spring, as well as other flying insects. The flowering shrubs attract nectaring species. Ground-foraging and nesting bird species also benefit by the relatively dense shrub cover.

Table A3.14.2a. Vegetation identified in the landing polygon of Ecological Community 14 Landing and clearing

14 Landing unclassified		Percent Cover (%)			Notes DBH=diameter at breast height (mm)
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy	
Tree Canopy	Canopy cover (%)		10-15	5-10	
	Canopy height estimated in m.		30+	20-30	
	alder, red (<i>Alnus rubra</i>)			<1	On edges, to 15m
	Douglas-fir (<i>Pseudotsuga menziesii</i>)		2-5	1	Veteran DBH=1010 40m
	fir, grand (<i>Abies grandis</i>)		5-1-		DBH=560-730
	redcedar, western (<i>Thuja plicata</i>)			2	DBH=320-550
	hemlock, western (<i>Tsuga heterophylla</i>)			2-3	Split trunk DBH=430
Understory	Coarse Woody Debris (CWD) cover: is difficult to see in salal, approximately 10%				
	Shrub layer species, includes trees < 10m high: Overall percent cover = 15-20%. The dominant shrub species is hemlock, western (<i>Tsuga heterophylla</i>) at 10%.				
	Other species, cover <1% unless indicated: blackberry, evergreen (<i>Rubus laciniatus</i>)● 1% - at least one plant broom, Scotch (<i>Cytisus scoparius</i>) 2-3% Oregon-grape, dull (<i>Mahonia nervosa</i>) Douglas-fir (<i>Pseudotsuga menziesii</i>) 2% redcedar, western (<i>Thuja plicata</i>) fir, grand (<i>Abies grandis</i>) 3% salal (<i>Gaultheria shallon</i>) 5% honeysuckle, western <i>Lonicera ciliosa</i> twin flower (<i>Linnaea borealis</i>) 1%				
	Herb layer species. Overall Percent cover = 25-35%. Dominant species are fern, sword (<i>Polystichum munitum</i>) 10-15% and vanilla leaf (<i>Achlys triphylla</i>) 10-15%. Other species, cover <1% unless indicated: bedstraw, Cleavers (<i>Galium aparine</i>) 2-3% pearly everlasting (<i>Anaphalis margaritacea</i>) bittercress, little western (<i>Cardamine oligosperma</i>) sedge, slough (<i>Carex obnupta</i>) fern, bracken (<i>Pteridium aquilinum</i>) sedge species (<i>Carex sp.</i>) 5-10% fern, lady (<i>Athyrium filix-femina</i>) self-heal (<i>Prunella vulgaris</i>) foxglove (<i>Digitalis purpurea</i>)● starflower (<i>Trientalis latifolia</i>) grass, reed canary (<i>Phalaris arundinacea</i>)● 1-2% thistle, bull (<i>Cirsium vulgare</i>)● 1% grass species 5% thistle, Canada (<i>Cirsium arvense</i>)● 2-3% grove-lover (<i>Nemophila parviflora</i>) thistle, species (<i>Cirsium sp.</i>) hairy cat's ear (<i>Hypochaeris radicata</i>)● 1% vetch species (<i>Vicia sp.</i>) herb-robert (<i>Geranium robertianum</i>)● wall lettuce (<i>Lactuca muralis</i>) miner's lettuce, Siberian (<i>Claytonia sibirica</i>) yerba Buena (<i>Satureja douglasii</i>)				
Moss layer: Overall Percent cover = 5-10%. Moss is present under some of the vegetation, in small openings, and on coarse woody debris. Species: <i>Kindbergia praelonga</i> (slender beaked moss) Plagiomnium insigne (coastal leafy moss) Other species are present.					

● = non-native invasive species

Table A3.14.2b. Vegetation identified in the clearing polygon of Ecological Community 14 Landing and clearing

14 Clearing unclassified		Percent Cover (%)			Notes DBH=diameter at breast height (mm)
		(V) Veteran Tree Canopy	(M) Main Canopy	(S) Secondary Canopy	
Tree Canopy	Canopy cover (%)		5-10	10	
	Douglas-fir (<i>Pseudotsuga menziesii</i>)		<5		25m DBH=385-385
	fir, grand (<i>Abies grandis</i>)		5		40+m DBH=415-555
	redcedar, western (<i>Thuja plicata</i>)		5	10	M: 30m DBH=550-870 S: 15m DBH=310
Understory	Coarse Woody Debris (CWD) cover: is difficult to see in salal, approximately 10%				
	Shrub layer, includes trees < 10m high: Overall Percent cover = 60-75%. Shrub layer dominated by salal (<i>Gaultheria shallon</i>) 50-60%, most on the west end				
	Other species, cover <1% unless indicated: blackberry, trailing (<i>Rubus ursinus</i>) 1% Oregon-grape, dull (<i>Mahonia nervosa</i>) 1% Douglas-fir (<i>Pseudotsuga menziesii</i>) 7% redcedar, western (<i>Thuja plicata</i>) 1-2% fir, grand (<i>Abies grandis</i>) 2-3% rose, dwarf (<i>Rosa gymnocarpa</i>) 3-5% hemlock, western (<i>Tsuga heterophylla</i>) 5% snowberry, common (<i>Symphoricarpos albus</i>) huckleberry, red (<i>Vaccinium parvifolium</i>) 2-3% twin flower (<i>Linnaea borealis</i>) 1-2% oceanspray (<i>Holodiscus discolor</i>) 5-7%				
	Herb layer species: Overall Percent cover = < 10% layer is sparse. Other species, cover <1% unless indicated: bedstraw species (<i>Galium spp</i>) miner's lettuce, Siberian (<i>Claytonia sibirica</i>) fern, bracken (<i>Pteridium aquilinum</i>) pearly everlasting (<i>Anaphalis margaritacea</i>) fern, sword (<i>Polystichum munitum</i>) 1% sedge, slough (<i>Carex obnupta</i>) Small patch grass species sedge species (<i>Carex sp.</i>) hairy cat's ear (<i>Hypochaeris radicata</i>) starflower (<i>Trientalis latifolia</i>) herb-robert (<i>Geranium robertianum</i>)• vanilla leaf (<i>Achlys triphylla</i>) 5%				
Moss layer species. Overall Percent cover = 5%, very little moss under shrubs. The usual forest species found at edges of tree patches, in a few small openings and on coarse woody debris. <i>Dicranum sp</i> <i>Kindbergia oregana</i> (Oregon beaked moss) <i>Hylocomium splendens</i> (step moss) Other species are present.					

● = non-native invasive species