May 28, 2019

Cortes Island Seniors Society (CISS)

It has been one year since we delivered to you, our *Ecological Site Investigation* of the CISS lands acquired for your proposed community housing development at 965 Beasley Road, Cortes Island; i.e. the Property.

From the outset, we registered our opinion that ***hydrology would prove to be the major driver of ecological function on the Property*** and with that in mind, we conducted an ecological investigation of the Property that provided you with initial ecological guidelines for consideration alongside the wastewater disposal sites & capacities study and the groundwater protection & water supply statement that you now have in hand. With the hydrological constraints on the Property now clarified, you have prepared a draft development plan for presentation to the community that takes all your field data into consideration.

It is our understanding that hydrology has primarily determined the siting and scale of the initial proposed development on the Property. We acknowledge that the drafted development plans, recently made public to the community, will compromise forest function in the immediate sector under development, the northernmost 5 acres of the Property. Opportunities for the restoration of forest function remain on the reminder of the Property.

We specifically adopted a landscape level precautionary approach in our ecological investigation of the Property***, to support discriminating decision making at the landscape level;*** in particular, it's important placement in the greater Hague-Gunflint watershed. As we emphasized in our *Ecological Site Investigation*, ***our recommendations are intended as guidelines for the retention of functional forest structure and are to be viewed as opportunities for the restoration of forest and hydrological function, rather than constraints to development.***

We acknowledge the CISS's good intentions and discriminating community engagement to provide due diligence in balancing ecological function on the Property, alongside the social and financial aspects of this housing development.

Respectfully,
Matt Cuscianna
Sabina Leader Mense

CORTES ISLAND SENIORS SOCIETY

PROPOSED COMMUNITY HOUSING DEVELOPMENT

ECOLOGICAL SITE INVESTIGATION

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May 28, 2018

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1 INTRODUCTION

Matt Cuscianna and Sabina Leader Mense/ we, were retained by the Cortes Island Seniors Society (CISS) on May 7, 2018 to conduct an ecological site investigation of the CISS property proposed for community housing development at 965 Beasley Road, Cortes Island. This property henceforth referred to as, the Property.

From the outset, it has been our opinion that hydrology will prove to be the major driver of ecological function on the Property and with this in mind, we have prepared an ecological assessment of the Property that provides initial guidelines to be considered alongside the wastewater disposal sites & capacities study and a groundwater protection & water supply statement, being prepared separately. Once these constraints on the Property are clarified, a more detailed look can be taken and if necessary, a re-assessment of conifer retention areas made to affect the greatest ecological integrity. We have adopted a landscape level precautionary approach in our initial assessment and have viewed the Property in the near term and 100+ years into the future.

2 PROPERTY PORTFOLIO

2.1 Legal Description

REM Easterly 78 ACRES
E ½ of the FRACTIONAL NW ¼ SECTION 7,
Sayward Land District, Cortes Island
PID #005-814-553
R – residential zoning/ SRD
51.27 acres (20.75 hectares)

2.2 Property Location

The Property is located at 965 Beasley Road, immediately adjacent the central core of the business community of Manson's Landing, including Manson's Community Hall & Post Office, Cortes Natural Food Coop and Cortes Market. The Cortes Seniors Village (6 units), Cortes Health Clinic, Cortes Island Museum & Archives, Cortes Firehall #1 and Cortes Skate Park are all located on the northern boundary of the Property. An immediately adjacent 2.6 acre commercial parcel on the northeastern flank has been recently purchased by the Cortes Island Business & Tourism Association. The Property is bounded to the west and east by residential lands and to the south by Siskin Forest Park.

Appendix I Site Investigation Map 1: Cadastral and Land Connectivity

2.3 Land Use

2.3.1 Historical

The Property occurs within the traditional lands of the Klahoose, Tla'amin and Homalco First Nations.

A Crown Grant was awarded to Fred Edgar Froud in 1915 of the 80 acres bounded by Beasley, Sutil Point & Cemetery Roads; i.e. the E1/2 of the NW ¼ of

Section 7 (L. Jordan, pers. comm., May 2018). The Property represents a 51.27 acre remainder of those original 80 acres, following successive subdivision of parcels of land from the original 80 acres, (F. Guthrie, pers. comm., May 2018) beginning in 1925 with the donation of land for the construction of St. James Church.

These lands would have been logged circa 1930's (A. Ellingsen and F. Reedel, pers. comm.. May 2018) and over the winter of 1986/87, Raven Lumber initiated clear-cut logging operations (R. Gagnon, pers. comm., May 2018) that heavily impacted the land.
A single overgrown roadbed, representing the original logging road with access off Beasley Road, bisects the Property north/south for three-quarters of its length to end at a former landing. A trail accesses Cemetery Road, to the south, from the southern end of the roadbed. The roadbed is ditched on the upslope/west side and no culverts were observed. No evidence of silviculture work was observed and the Property appears to have regenerated naturally/ unassisted over the last 31 years.

Photo 2. Property roadbed

Richard Lawton purchased the land after it was logged. In 1990 & 1991, Lawton gifted the South Cortes Community Association (J. Sprungman, pers. comm., May 2018) and the Cortes Island Firefighters Association (M. Diver, pers. comm., May 2018), respectively, with land parcels accessed off Beasley Road. In 2000, Lawton further subdivided off two commercial lots, in the northeastern corner of the land, with access off Sutil Point Road. Lawton then sold the remaining 51.27 acres to CISS in 2018.

There are presently no buildings or structures present and the Property remains undeveloped. Refuse left behind by squatters who had occupied the southern area along Cemetery Road, is in the process of being removed.

2.3.2 Current

The Property was purchased by the CISS for the purpose of establishing a *"land bank"* for community housing.

2.4 Physical Features

2.4.1 Topography

The general topography of the Property is gently sloping to the east and southeast with a small depression present in the southeast corner of the Property. The highest land is located along a ridgeline on the western boundary, with elevations ranging from ~90 m to ~70 m above sea level.

2.4.2 Geology

Cortes Island's local landforms developed during the last glaciation and its aftermath; between 14,000 and 11,000 years ago. Southern Cortes Island, where the Property occurs, is underlain by Pleistocene sediments raised by rapid post-glacial rebound, ~12,000 years ago. Soil formation occurred in the upper two meters of these sediments and soils are dominated by sand, mud and gravel.
Appendix IV. Geology Cortes Island

2.4.3 Hydrology

The Property lies within the Hague-Gunflint Community Watershed, one of the largest and most important watersheds on Cortes Island, which provides drinking water for domestic use in the residential and commercially developed area of Manson's Landing. The watershed divide falls just west of the western property boundary, with water moving generally west to east and southeast, across the Property and continuing to Hague Lake (D. Shipway, pers. comm., May 2018).
Appendix V. Hague-Gunflint Community Watershed

Since 2014, Hague & Gunflint Lakes have suffered a series of significant and smaller algal blooms, indicating the lake ecosystems are stressed. Research initiated by Friends of Cortes Island under their Lake Stewardship Initiative, has been supported by the BC Ministry of Environment and Vancouver Island University. Community education, lake monitoring and proactive action taken to reduce nutrient input are addressing the issue at a watershed level. (R. Weyler, pers. comm., May 2018)

One watercourse and substantial wet ground were observed on the Property, the land being subject to large seasonal fluctuations of water at the surface and immediately below the surface. The small depression in the southeast corner of the Property, locally known as the *spruce bog,* is not a true bog but is a seasonally flooded, forested area that is characterized by wet ground several months of the year.

The 1986/87 logging and construction of the logging road disrupted the natural drainage across the land, and was/is possibly responsible for the major surface water problems on Beasley Road.

A preliminary hydrogeologic assessment of the Property was completed in 2008 for then owner, Richard Lawton; included as,
Appendix VI. EBA Preliminary Hydrogeologic Assessment
CISS has retained Ron McMurtrie & Associates for a wastewater disposal sites & capacities study and plans to engage a hydrogeologist for a groundwater protection and water supply statement (D. Rousseau, pers. comm., May 2018).

2.5 Natural Features

The Property lies within the CWHxm1, coastal western hemlock xeric maritime1 biogeoclimatic zone. The land is in the process of natural/ unassisted regeneration following clear-cut logging 31 years ago.
Over time, and with the possible restoration of forest and hydrological function, one may hope to see this land return to having strong ecological integrity.

3 OBJECTIVES of the Site Investigation

The purposes of this investigation were:

- to clearly delineate the study area based on the legal survey
- to identify any/all significant ecological values on the Property for retention, with a focus on restoring forest and hydrological function
- to view the Property in the context of the greater landscape and its potential for connectivity to surrounding protected lands, wildlife corridors and its critical location in the Hague-Gunflint Community Watershed
- to identify possible areas for development of low-impact community housing with buffering from surrounding residential areas

4 METHODS OF ASSESSMENT

Over the course of a three week period in early May 2018, we were … "*boots on the ground"* on the Property. This is the optimal time of year to conduct ecological assessments as water is moving, vegetative growth is prolific and wildlife species are active.

- The legal boundaries of the Property were identified by re-locating the IP survey markers using a Suunto MC-2DL compass.

- The roadbed, with access from Beasley Road and bisecting the Property, north/south, was GPS mapped and provided a baseline reference throughout the field work. An I-pad was used to collect all GPS data, .kml files were created and mapped using the SRD uMapIt Arc GIS web mapping application. A Nikon AW120 digital camera was used for all photographic documentation.

- The entire Property was traversed on foot on multiple dates, at multiple times and in multiple directions, to assess for:
    - above ground hydrology and any observable hydrological impacts
    - sensitive ecosystems; as defined in the Sensitive Ecosystems Inventory of the Sunshine Coast and Adjacent Islands, 2005
    - forest cover types; described by tree species, diameter at breast height (DBH) measured in centimeters and understory observed within the respective polygons, well away from edge effect
    - forest health and forest enhancement potential
    - old tree recruitment
    - wildlife presence & sign and suitable existing wildlife habitat. The BC Ministry of Environment Conservation Data Center was consulted for listings of species and ecological communities at risk in our biogeoclimatic zone.
    - wildlife corridors; assessed on the basis of local ecological knowledge of the movement of coastal wolf, cougar and Columbian black-tailed deer through the Property and the immediately surrounding land base
    - land connectivity; assessed by reviewing maps of the greater Cortes Island protected land base, i.e. provincial & municipal parks (SRD uMapIt, 2018) and privately covenanted lands (T. Archer/ TLC, pers. comm., May 2018).

- Coniferous retention areas were identified on the ground and outer perimeters mapped with GPS. Clusters of mature conifers naturally flowed together over the Property and were mapped as contiguous polygons to the west and east of the roadbed.
- In addition to the previous assessments, 2. a. - e. made Property wide, we specifically assessed coastal woody debris (CWD) and wildlife trees (WLT) in the coniferous retention areas based on Resource Inventory Committee (RIC), 2010 guidelines. The wildlife tree classification system (#1-9) in BC is standardized by the Wildlife Committee of BC and included as, Appendix VII. B.C. Wildlife Tree Classification System (conifers)
- We also assessed wildfire risk specifically in the coniferous retention areas.

- An audible and visual breeding bird survey was conducted on the Property during the peak of the nesting season on Cortes Island, while walking a transect along the roadbed traversing the Property.

- The deciduous regeneration areas, those polygons lying outside the coniferous retention areas, were assessed for:
    - housing development potential; hydrology, access, fire buffers
    - replanting
    - invasive species
    - potential harvesting of forest products, including firewood
    - residential buffers

- We collected & incorporated local historical and ecological knowledge of the Property and greater watershed from neighbouring private landowners and consulted with the Cortes Island Museum & Archives Society (CIMAS), the South Cortes Community Association (SCCA), the Cortes Island Firefighters Association (CIFA) and Friends of Cortes Island Society's (FOCI) Lake Stewardship Initiative.

5 RESULTS of the Site Investigation

5.1 Forest Cover Types

Three forest cover types were observed on the Property:
1. Coniferous Retention/ Polygons A
2. Riparian and High Water/ Polygon B
3. Deciduous Regeneration/ Polygon C
Appendix II Site Investigation Map 2: Forest Cover Types

5.1.1 Coniferous Retention; Polygons A

Overall, these polygons consist primarily of Douglas-fir (Fd) and western redcedar (Cw). Fd dominate in number (~60%) but the Cw (~40%) occur in patches and dominate in size. Approximately 80% of the Fd were 15-35 DBH where ~60% of the Cw were 35-65 DBH. Scattered western hemlock occur in the moist growing sites and red alder occur throughout, where canopy gaps exist. The understory consists of red huckleberry, salal, Oregon grape, bald hip rose, sword fern, Oregon beaked moss and twinflower.
It was within these areas of original retention that we found the greatest potential for restoring forest and hydrological function.

Of note within coniferous retention Polygon A, is the possible request by the Cortes Island Firefighters Association (CIFA) for a buffer along the northern boundary of the Property where it abuts the CIFA land (M. Diver/ Fire chief, pers. comm., May 2018). The helicopter pads located between Firehall #1 and the Property boundary require a regulatory clearance distance and as the trees grow up on the Property, this may be compromised. The Fire Chief also clarified that the helicopters utilize an east/ west approach and this was the reason for the removal of trees along the panhandle of the Property's access from Beasley Road and that continued diligence will be required there.

Photo 3. Polygon A; Coniferous Retention

5.1.2 Riparian and High Water; Polygon B

The *spruce bog*, as it is locally known, represents a small contour depression in the southeastern corner of the Property. It is characterized by year-round wet ground dominated by a strong regeneration of western hemlock, average 15-35 DBH. Scattered occurrences of Sitka spruce, western redcedar and Douglas-fir are intermixed with the western hemlock. The understory is virtually absent, given the full canopy closure under the western hemlock regeneration.

It appears that the catchment area is formed by contour ridges to the north, east, south and west of the depression. A watercourse of organic substrate flows north into the southeast corner of the property through a culvert under Cemetery Road. The resultant riparian area straddles the eastern boundary with the stream flowing north for ~350m, before infiltrating directly west of a private property. This stream is said to flow in all but the driest months of the year (R. Gagnon and A. Sanders, pers. comm., May 2018). This riparian area represents a provincially designated sensitive ecosystem.

Photo 4. Polygon B; Riparian and High Water

5.1.3 Deciduous Regeneration; Polygon C
This polygon is predominantly pioneering deciduous forest that regenerated following the logging. Single standing and small groups of conifer, within the deciduous areas, can be selected for internal retention. Red alder dominates, the majority of which fall in the small and large pole classification 25 DBH or less. Douglas-fir and white pine are naturally regenerating under the alder and occur in the shrub layer and second canopy. The understory is dominated by salal, sword fern, bracken fern and trailing blackberry.

Invasive species invade exposed soils after disruption, so it surprising to note that the Property is relatively free of the often dominant invasives: Scotch broom and Himalayan blackberry. English holly is the invasive of note along the roadbed.

Photo 5. Polygon C; Deciduous Regeneration

5.2 Forest Retention

Areas considered for retention are comprised of areas currently dominated by coniferous forest cover that also align with retention objectives. These areas vary in species composition, stocking and age class, but are all conifer dominant.
The focus of forest retention recommended for-the Property is to retain functional forest connectivity that offers near term and long term viability, as well as to restore and enhance hydrological function and habitat diversity on the recently impacted land base.
These are the forest elements considered in our site investigation:

5.2.1 Hydrological Function

Mature forests restore hydrological function to the land by slowing surface water runoff to allow tree root systems to re-infiltrate the water, by creating a moisture wicking humus layer and lowering the water table through evapo-transpiration. A large mature conifer can transpire hundreds of gallons of water in a day! Retention of mature conifers on the Property will be prioritized to restore hydrological function.

5.2.2 Riparian Management

The surface water feature locally known as the *spruce bog* requires generous forest retention to ensure the continuation of water retention, filtering and cooling that is critical to a healthy downstream aquatic ecosystem. The watercourse flowing north along the eastern boundary is slow moving and, as such, is at risk from the accumulation of contaminants due to the lack of flushing. Such contamination, especially from oil based products would pose long term detrimental effects to habitat viability for amphibians and aquatic insects.

Photo 6. Riparian sensitive ecosystem in Polygon B

5.2.3 Forest Connectivity
One of the greatest threats to the ecological integrity of a land base, is the continued subdivision of that land base into smaller and smaller fragments. As human development progresses forests become increasingly fragmented, each piece eventually losing its function as part of a greater system. Our objectives are to retain existing areas of advanced succession forest structure within a previously impacted area that is planned for development, and in accordance with existing forest structure over the greater area.

The Property represents a significant 51.27 acres of an original Crown Grant of 80 acres. Also of significance is the fact that there are neighbouring land bases of large size connected in close proximity to the Property. To the south, Siskin Forest Park is a 32 acre (13ha) park immediately north of the covenanted lands of the Siskin Strata, which boasts wildlife corridors throughout the residentially developed area, a common Forest Conservation Area 98 acres (40ha) in size and a public trail system which connects southern Cortes Island to the core of the commercial/ residential Manson's Landing. To the north, the Property is connected across Beasley Road to Manson's Lagoon via the School to Sea Trail through the Cortes Island Elementary Jr-Sec School land and Manson's Landing Provincial Park.

5.2.4 Wildlife Corridors
Corridors are critical to the maintenance of ecological processes; wildlife corridors link wildlife habitat and allow for the movement of animals and the continuation of viable populations.
We have assessed for wildlife travel corridors within the Property. By linking forested retention areas, wildlife avoid having to cross large open areas that my make them susceptible to increased predation.
We have also assessed the Property for corridors to accommodate the movement of large predators and their prey across the Property, that connect with corresponding travel corridors across surrounding lands.
It is uncommon in the islands in the Strait of Georgia, for healthy large predator-prey relationships to still exist. On Cortes Island, Columbian black-tailed deer, gray wolf and cougar are all present and are the players in these predator-prey relationships. These players frequent the Property.

5.2.5 Biodiversity; WLT and CWD
Our goal is to build on existing mature forest structure with a diversity of species, age class and vigor. A multi-layered canopy with small openings and standing and fallen wood in all stages of decay, provides the greatest level of biodiversity in our coastal forest ecosystems.
Forest management is becoming increasingly aware of the role of wildlife trees (WLT) and coarse woody debris (CWD) in maintaining biodiversity.

- **Wildlife Trees**

Wildlife trees are defined as: *"those trees, standing dead or live, with special characteristics valuable to wildlife."* Wildlife trees sustain ~80 species of vertebrates in BC and countless invertebrates: basal cavities for denning or cover, loose bark for roosting bats or cover for salamanders, food caches for squirrels, perching

sites, nest platforms, foraging for insectivorous birds, substrate for mosses and lichens.
Not all wildlife trees are equal in value when considering the needs of wildlife but significant indicators of quality are: species, height, diameter, decay stage and location. The highest quality wildlife trees observed on the Property, overall, were the mature western redcedar; WLT classes #1-2, providing essential foraging habitat for primary cavity excavators (PCE) like the pileated woodpecker. WLT classes #3-7, were predominantly alder and well utilized by the smaller woodpeckers and secondary cavity users (SCU).

There was a definite lack of WLT's observed on the Property, not unexpected on an industrially logged land base where industry regulations require these *danger trees* to be removed. Mitigation of safety hazards may be required where WLT exist in retention areas that are also in proximity to development infrastructure and/or high traffic areas, eg. trails. Removal of hazardous features by topping and/or limbing, delineating a danger zone or re-routing public trails are all mitigation options.

- **Coarse Woody Debris**

Coarse woody debris is defined as*: "fallen woody material."* An abundance of coarse woody debris leads to the development of a complex community of organisms. We observed a distinct paucity of CWD on the Property, which was expected on land logged just 31 years ago; it takes hundreds of years for a forest to build up ecologically significant CWD. The retention of CWD on the Property will be a priority.

5.2.6 Wildfire Risk

Areas of dense coniferous regeneration, especially where many outcompeted trees are dead standing, creates a high risk for intense wildfire due to the presence of low to the ground, fine ladder fuels. Thinning out the outcompeted trees removes the wildfire risk and favours the growth of dominant, healthy trees; Cw, Fd and Ss.

5.3 Wildlife

5.3.1 Mammals

Mammals observed on the Property included: Columbian black-tailed deer and Douglas squirrel.
Wildlife sign observed included: small mammal den, possible wolf scat (old & weathered), raccoon tracks, deer browse, deer day beds and prominent deer trails and scat across the Property.

5.3.2 Breeding Bird Survey

A breeding bird survey was conducted on May 18, 2018, by Sabina Leader Mense and George Sirk at the peak of the local bird nesting season.

Location: transect along the north/south roadbed bisecting the Property.
Weather: Clear skies, no wind, ~15C
On: May 18, 2018 from 0800 – 0930

Transect Field Data

Note: bird species are recorded by the first two letters of the first and second common names of the bird and the number represents the number of that species observed or heard on the transect line, eg. WAVI 18 = 18 x **WA**rbling **VI**reo

WAVI 18	PSFL 8	BHCO 6	SPTO 8	SWTH 4	RBSA 3
WETA 5	BGWA 3	AMRO 2	MAWA 1	WIWA 1	HAWO 2
PAWR 2	YRWA 3	RBNU 3	NOFL 2	CORA 1	PUFI 1
WCSP 1	CHSP 1	OCWA 1	VGSW 1		

Twenty-two species of birds were identified in their natal territory while actively displaying territorial behavior (singing). The most numerous species recorded was the warbling vireo, a species characteristic of deciduous woodlands and right at home in the Property's deciduous regeneration!

Passerine birds migrating to Cortes Island in the spring of every year, get down to the business of courting, nest building and egg laying immediately upon arrival, with young fledging ~ 12-15 days later. Non-migratory, year-round birds are also generally nesting by April 1. A Swainson's thrush nest was observed on the ground in the understory below an alder canopy in Polygon C.

A significant number of species of woodpeckers, primary cavity excavators (PCE), were observed and heard on the property. They, in turn, provide secondary cavity users (SCU) such as chickadees with nesting habitat. We need to ensure the woodpeckers have sufficient habitat in which to excavate!

Bird species heard and observed on/ over the Property outside of the breeding bird survey and not repeating any of the survey species recorded, include: bald eagle, turkey vulture, red-tailed hawk, barred owl, pileated woodpecker, band-tailed pigeon, downy woodpecker, brown creeper, golden-crowned kinglet and solitary vireo.

Photo 7. Swainson's thrush nest on the ground in Polygon C

5.3.3 Rare Species and Ecosystems

No rare species or ecological communities were observed on the Property but the potential for regeneration of these ecological communities, which will provide the habitat to support rare species, exists if a long-term ecological management approach is adopted while moving forward with this community housing development.

The habitat potential exists here for several provincially listed species at risk:

- Band-tailed Pigeon/ blue-listed

Band-tailed pigeons were heard flying over the Property and good foraging habitat, with flowering and berry producing trees and shrubs is present on the Property.

- Northern Red-legged Frog/ blue-listed

Pockets of standing water and wet ground throughout the Property, during the breeding season, may provide good breeding habitat. The present lack of coarse woody debris compromises their foraging and security habitat.

- Western Screech Owl subspp. kennicottii/ blue-listed

Recent research wrt western screech owl habitat preferences is preliminarily showing that they are turning up in number, in surveys of non-optimal forested wetlands, which the Property mimics seasonally (J. Cragg, pers. comm., April 2018).

- Northern Pygmy Owl subspp. swarthi/ blue-listed

Northern pygmy owls prefer conifer forest edges and mixed woodlands and the Property offers excellent habitat for this small secondary cavity nester.

- Little Brown Myotis/ blue-listed

One of our more common bat species, the little brown bat was emergency listed in 2014 following dramatic declines due to white nose syndrome (a fungal infection). Moist forests with a concentration of insects rate high in habitat preference and could be represented on the Property.

5.4 Impacts to Hydrological Function

The natural hydrological function of this piece of land was dramatically altered by road construction and clear-cut logging that occurred in 1986/87. The original logging road that originated at Beasley Road and bisected the property from north to south created a barrier to the natural downhill flow of groundwater. The soil compaction and deep ditches cut down to the water impeding hardpan layer and essentially cut the water off and sent it over ground through ditches to the north where it enters the ditch on the south side of Beasley Road. This artificial channelization has resulted in water entering municipal drainage infrastructure and ultimately Hague Lake with increased volume and velocity, increasing risk of transporting excessive nutrients or contaminants. These effects can be mitigated by restoring the distribution and infiltration of water downstream of the roadbed.

We observed a system of curtain ditches excavated to protect private property along Sutil Point Road where the infiltration of the watercourse, traveling along the southeastern Property boundary, re-emerges. We also investigated a curtain

ditch/ drain excavated on the Property (with permission of the former landowner), in this same vicinity, by a private landowner to the east.

In the southeastern sector of the Property and immediately along Cemetery Road, two areas were occupied by squatters in recent years. Their modifications to the area, ditching and drainage to provide dry habitation, resulted in noticeable impact to the area with the loss of a former, significant sedge wetland. (A. Sanders, pers. comm., May 2018) These degraded areas now show thistle, foxglove and multiple species of invasive grasses.

6 RECOMMENDATIONS

Our recommendations are in keeping with the precautionary principle which is critical in these times of dramatic climate change where all ecologically functioning systems are, to say the least… stressed.
Our recommendations are intended as guidelines for the implementation of a functional forest retention strategy alongside an effective development strategy. Results of the wastewater disposal sites & capacities study and groundwater protection & water supply statement are factors that may involve modification of the retention strategy. The retention plan can be marked, modified or upgraded in the field at any time prior to any stage of the development to ensure ecological integrity. We would be available to provide these services.
All recommendations are referenced to,
Appendix II Site Investigation Map 2: Forest Cover Types
Appendix III Site Investigation Map 3: Prescriptive Delineation

6.1 Restoration of Hydrological Function

- *We recommend* the installation of small diameter equalization culverts during road upgrading activities at a frequent interval to redistribute the ground water on the low side of the road. Dispersing a smaller volume of water over greater area will facilitate greater infiltration into the permeable soil.
- *We recommend* the ditch be graded so as to create smaller catchment areas that slope towards each culvert and culverts be grouped in areas directly upstream of conifer retention to allow for transpiration uptake and humus layer moisture retention.

- *We recommend* forest retention in the southeastern sector of the Property, to effect protection of riparian and high water areas; Polygon B.

- *We recommend* selective thinning in areas of coniferous regeneration, within retained areas, to allow for accelerated growth of dominant trees.

- *We recommend* planting of Cw and Fd to fill areas of sparse regeneration where understory vegetation has emerged prolifically.

6.2 Restoration of Forest Function

- *We recommend* the retention of Polygons A; coniferous retention and Polygon B; riparian and high water.
- *We recommend* a minimum of 50m buffers around the *spruce bog;* which are incorporated into the delineation of Polygon B.
- *We recommend* the watercourse/ riparian sensitive ecosystem, protected within the 50m buffer within Polygon B., receive these additional restrictions: no power saws or other combustion engine tools be used within 30m of the wetted edge of the water course and hay bale filter dams to be placed at input ditches and replaced periodically during the dry season.

- *We recommend* the two forested corridors running east/ west, created where Polygons A merge across the roadbed, be retained as wildlife travel corridors; 50m minimum width.

- *We recommend* that coarse woody debris (CWD) be allowed to accumulate in all forested areas.
- *We recommend* areas of high density conifer regeneration, within the retention polygons, for thinning to remove ladder fuels that pose a high wildfire risk; these trees to remain on the ground to contribute to CWD.

- *We recommend* a dedicated retention and long-term monitoring of individual WLT in Polygons A, B and C. By way of example, we note that in the Forest Ecosystem Management Plan for Siskin Strata, immediately south of the Property, five WLT per hectare were dedicated on lands also industrially logged. For the Property, this would work out to just over 100 WLT dedications.
- *We recommend* strategic development placements, where possible, that mitigate the need to remove significant WLTs as *danger trees.*
- *We recommend* the retention of a significantly unique WLT on the Property. This Douglas-fir, DBH 81, WLT class #2 and located in the southwest sector of the Property, will require some mitigation to address safety issues if/ when community housing is located in the near vicinity.

6.3 Landscape Connectivity

- *We recommend* a north/ south wildlife corridor, minimum of 50m, be dedicated along the western boundary of the Property from Cemetery Road through to the northwest corner of the Property, where it connects with relatively undeveloped private lands to Beasley Road. This wildlife corridor would connect the Siskin Forest Conservation Area and Siskin Forest Park to the south, through the Property, with Manson's Landing Provincial Park, to the north.
- *We recommend* that NO public trails be built in this corridor to avoid human/ wildlife conflict.

6.4 Housing Development

- *We recommend* the majority of land and infrastructure developments occur within the deciduous regeneration area delineated by Polygon C. Polygon C. is further stratified into Polygons C. 1-5 for the purposes of specific development recommendations.

- *We recommend* all on site housing development involving tree removal and ground disruption be completed prior to April 1, in any year, to ensure nesting birds are not negatively impacted.

- *We recommend* trees removed during development, red alder the majority, be considered for sale as local firewood and/or to local mills.

- **We recommend* a strategy be developed to mitigate the danger from WLT in the development areas and on public trails.

- *A suggested location* for fire truck turnaround placement w/ 40m circle requirement in the center of the development area accessible by fire truck from both the north and south access points has been identified.

- *A suggested location* for new road construction commencing at Cemetery Road and heading north to connect with the end of the existing roadbed has been flagged in the field.

- *We recommend* permeable surfaces for all trails, driveways and roads.

- *We recommend* a minimum of 50m treed buffers along the eastern and western boundaries of the Property for residential privacy and forest connectivity.

- *We recommend* a 15m treed buffer on the southern boundary along Cemetery Road, for residential privacy and forest connectivity.

- *We recommend* no application of herbicide, pesticide, insecticide on the Property.

7 CONCLUSION

"A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise." Aldo Leopold

The ecological strategy to land development, is always to first identify what to leave. Our recommendations are intended as guidelines for the retention of functional forest structure for the near term and 100+ years into the future. We hope our recommendations will be viewed as opportunities for the restoration of forest and hydrological function, rather than constraints to

development. A healthy functioning forest, in the immediate vicinity of community housing, provides more positive benefits to residents than human designed development features can ever begin to.

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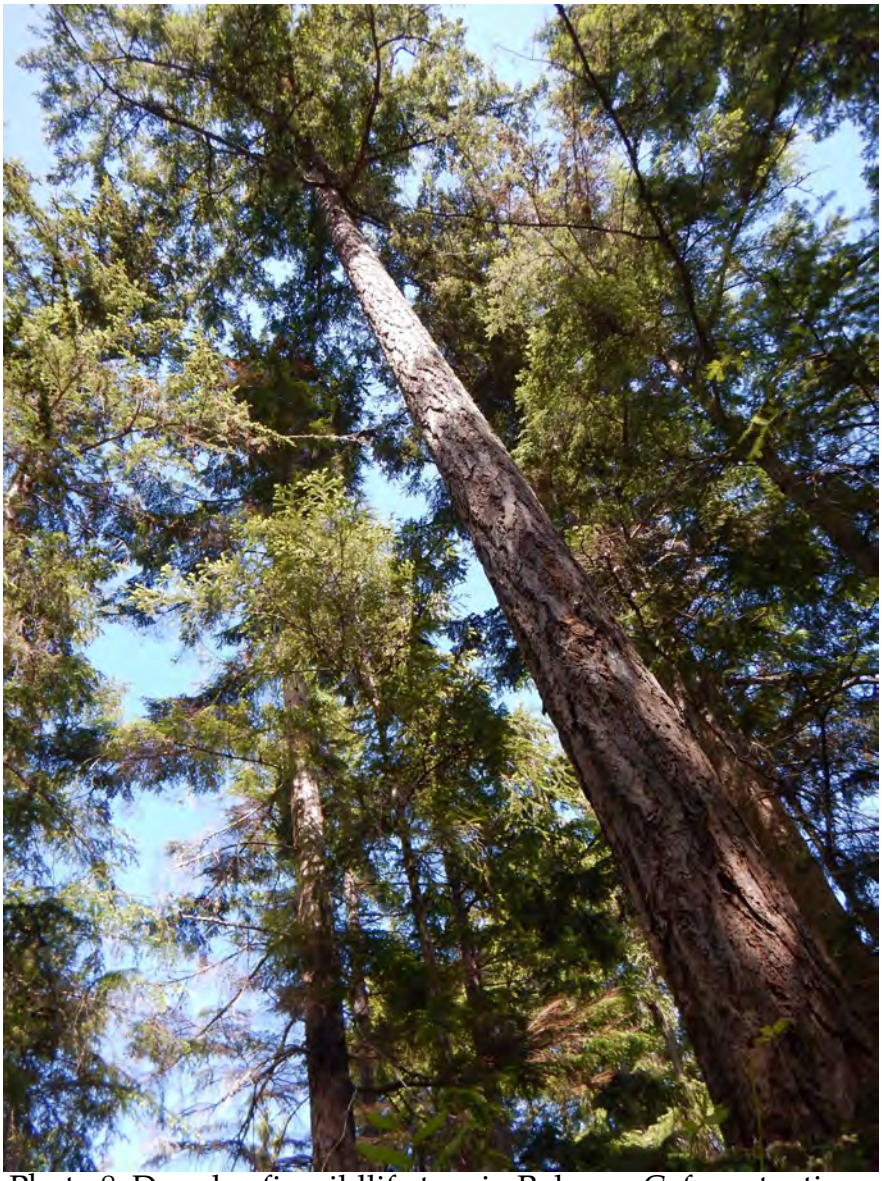
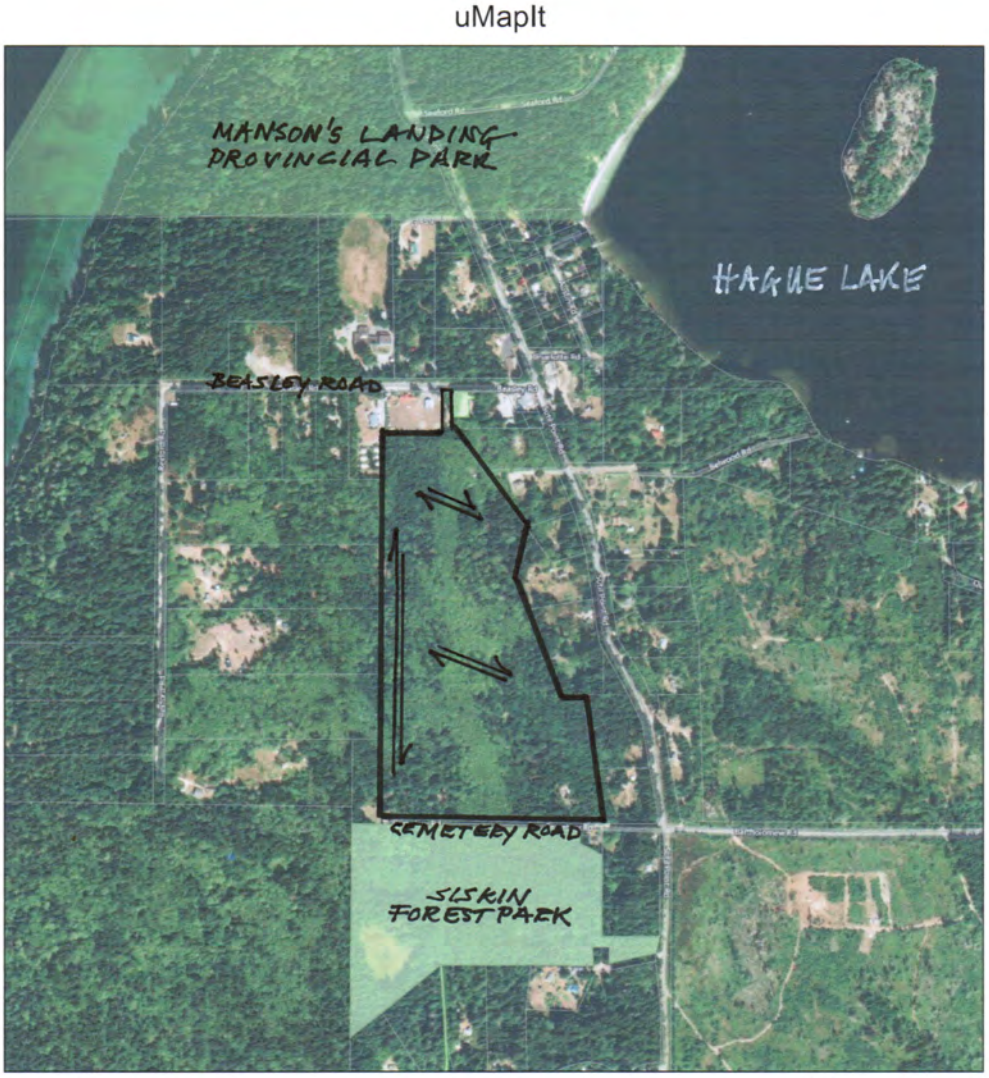


Photo 8. Douglas-fir wildlife tree in Polygon C. for retention.

9 APPENDICES

9.1 Appendix I Site Investigation Map 1: Cadastral & Land Connectivity



Site Investigation Map 1. Cadastral and Land Connectivity

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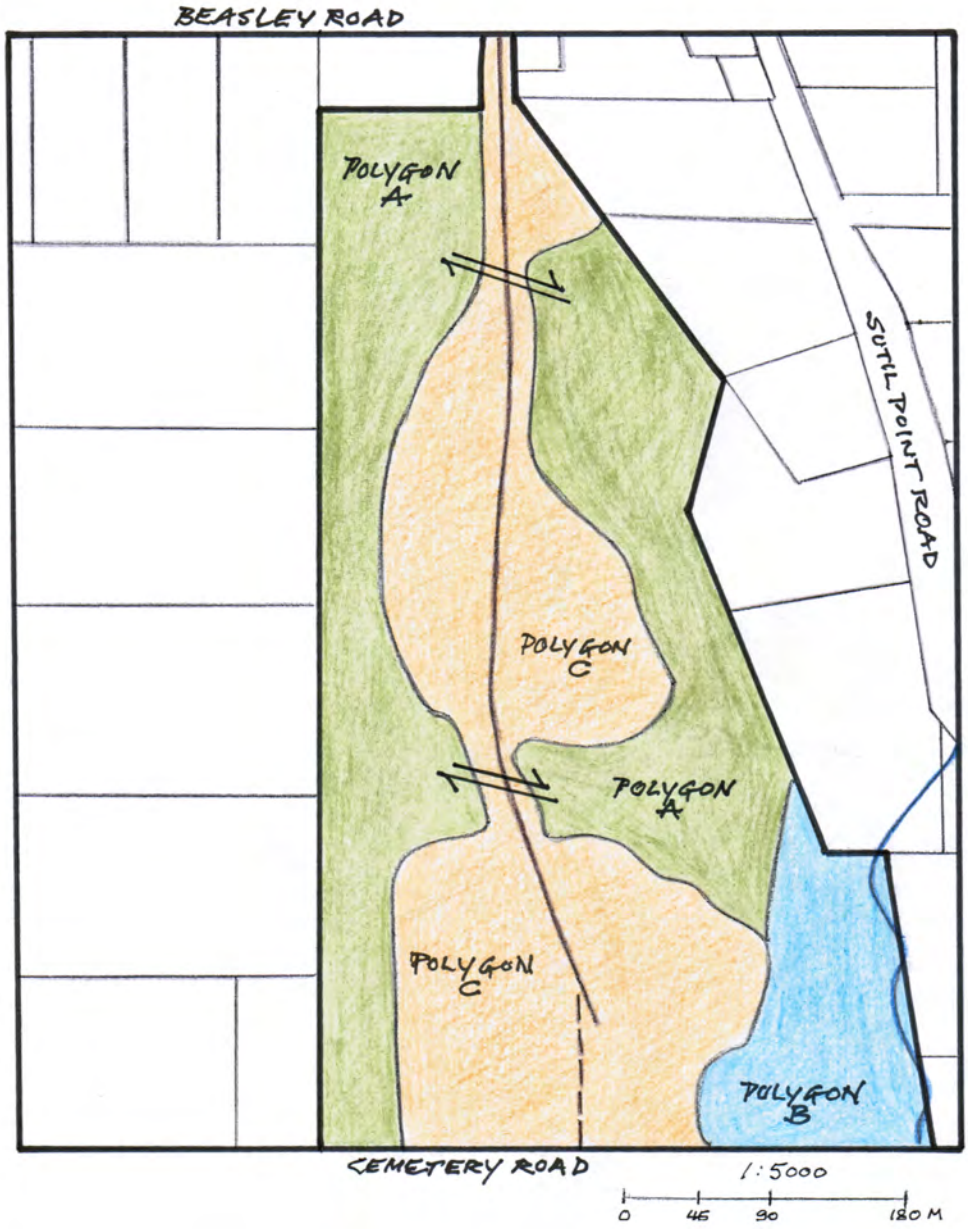
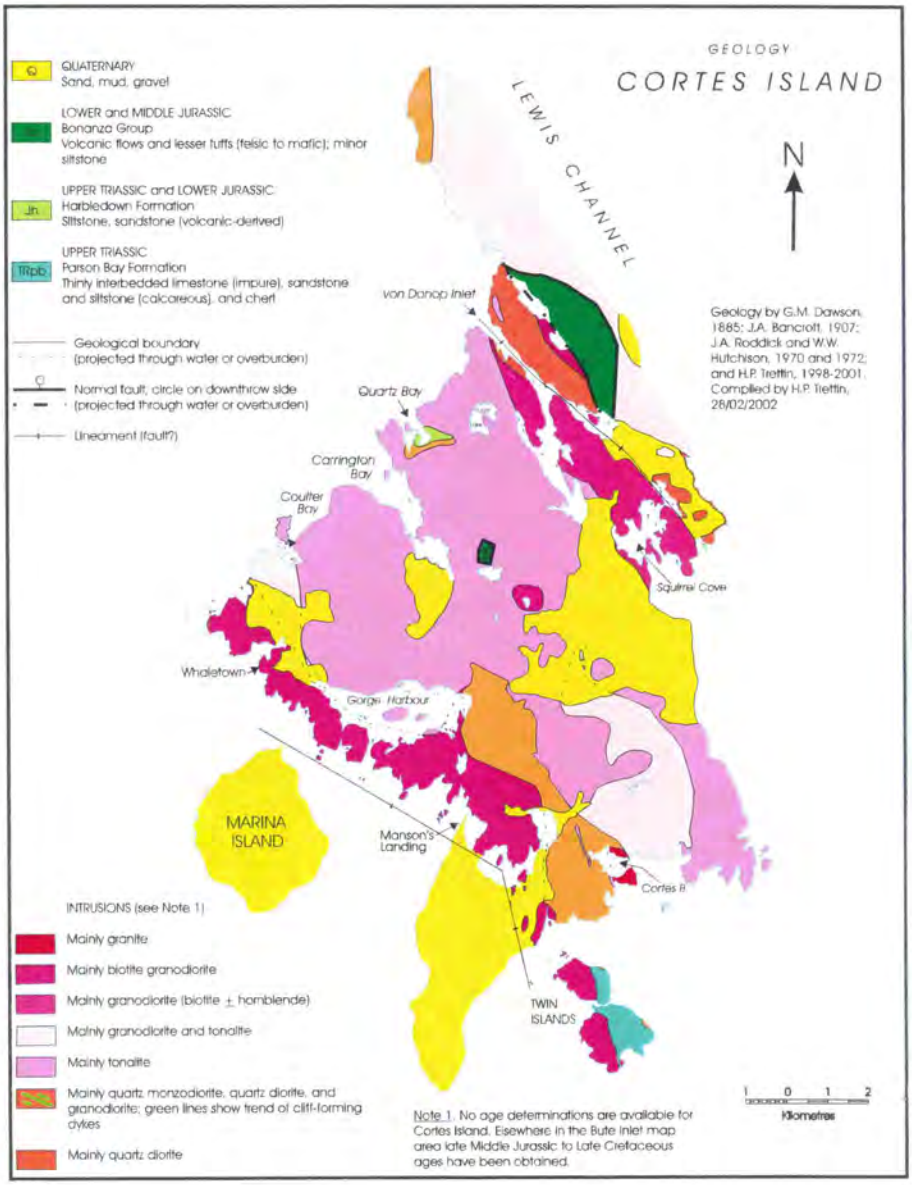
9.2 Appendix II Site Investigation Map 2: Forest Cover Types



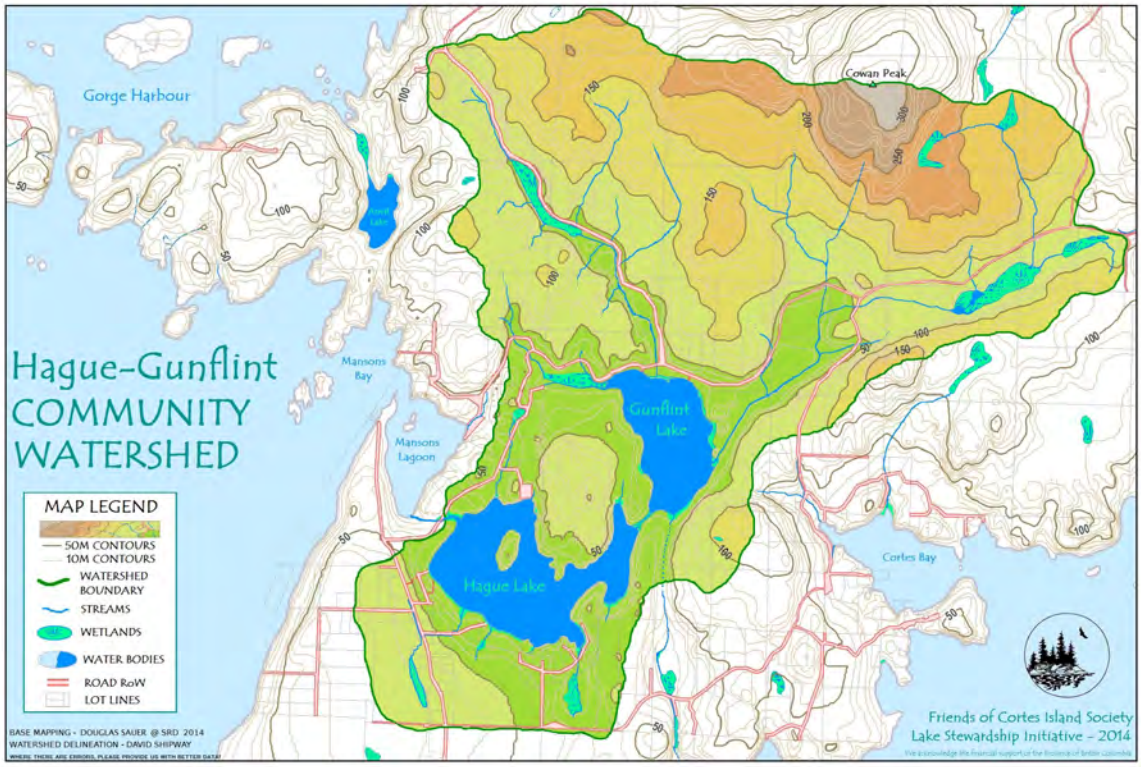
Site Investigation Map 2. Forest Cover Types

9.2 Appendix III Site Investigation Map 3: Prescriptive Delineation

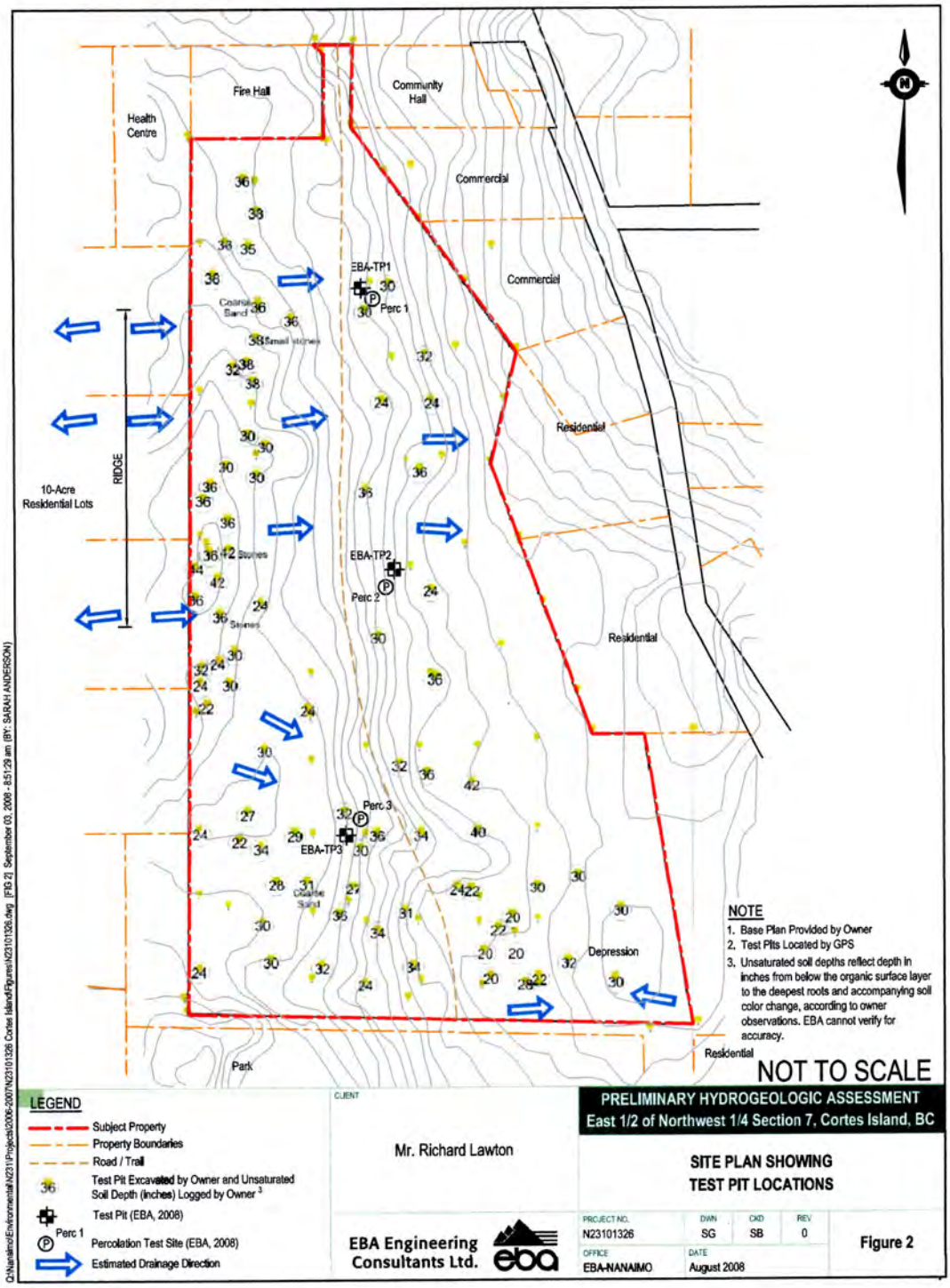
9.3 Appendix IV Geology of Cortes Island



9.4 Appendix V Hague-Gunflint Community Watershed



9.5 Appendix VI EBA Preliminary Hydrogeologic Assessment



9.6 Appendix VII B.C. Wildlife Tree Classification System (conifers)

	LIVE		DEAD					DEAD FALLEN	
Decay class	1	2	3	4	5	6	7	8	9
						approx.2/3 original height	approx.1/2 original height	approx.1/3 original height	
Description	**Live/healthy** no decay; tree has valuable habitat characteristics such as large, clustered or gnarled branches or horizontal, thickly moss-covered branches.*	**Live/unhealthy** internal decay or growth deformities (including insect damage, broken tops); dying tree.*	**Dead** needles and twigs present; roots healthy.	**Dead** no needles/twigs; 50% of branches lost; loose bark; top usually broken; roots stable.	**Dead** most branches/bark absent; some internal decay; roots of larger trees stable.	**Dead** no branches or bark; sapwood/heartwood sloughing from upper bole; decay more advanced; lateral roots of larger ones softening; smaller ones unstable.	**Dead** extensive internal decay; outer shell may be hard; lateral roots completely decomposed; hollow or nearly hollow shells.		**Debris** downed trees or stumps.
Uses and users	Nesting (e.g., bald eagle, great blue heron colonies, marbled murrelet); feeding; roosting; perching.	Nesting/roosting[1] -strong PCEs[2] (woodpeckers); SCUs[3]; large-limb and platform nests (ospreys); insect feeders.	Nesting/roosting-strong PCEs; SCUs; bats.	Nesting/roosting-PCEs; SCUs; insect feeders.	Nesting/roosting-weak PCEs (nuthatches, chickadees); SCUs; bats; insect feeders.	Weaker PCEs; SCUs; insect feeders; salamanders; small mammals; hunting perches.	Insect feeders; salamanders; small mammals; hunting perches; occasionally used by weak cavity excavators such as chickadees.		Insect feeders; salamanders; small mammals; drumming logs for grouse; flicker foraging, nutrient source.

[1] Large witches' brooms provide nesting/denning habitat for some species (e.g., fisher, squirrels).
[2] PCE = primary-cavity excavator
[3] SCU = secondary-cavity user
* This classification system does not recognize root disease trees specifically. Such trees become unstable at or before death.