Conservation Evaluation of a Wetland, within DL 42, Nanoose Land District, South of Qualicum Beach, B.C.

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for Qualicum Beach Streamkeepers Society

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Executive Summary

A conservation evaluation was performed on a 1.89 hectare wetland situated on Weyerhaeuser private land in DL 42, Nanoose Land District, south of the Town of Qualicum Beach on Vancouver Island. Plant cover surveys were done and the hydrology of the area was explored during September and December, 2001 and in May 2002. Wildlife species were recorded when they were observed. A report was produced at the request of Qualicum Beach Streamkeepers Society.

The wetland has been identified as a sensitive ecosystem (Polygon N1189) by the Sensitive Ecosystems Inventory (SEI), East Vancouver Island and the Gulf Islands, 1993 - 1997 (Ward et al. 1998 and McPhee et al. 2000), which was undertaken as a joint project of Environment Canada, BC Ministry of Sustainable Resource Management and BC Ministry of Water, Land and Air Protection.

Field observations of the wetland confirmed that it is currently a shrub swamp dominated by Hardhack with a riparian forest surrounding it on 3 sides. The wetland was evaluated and found to be in good ecological condition.

The report presents conflicting evidence about its stability. The presence of Lodgepole Pines throughout, and of upland shrubs such as Salmonberry and Red Elderberry among the Hardhack near the edges, coupled with the presence of an old drainage ditch, were considered as possible evidence that an accelerated ecological succession might be underway from shrub swamp, or shrub swamp and bog, to mixed forest.

The possibility that the study site is or was in the process of becoming a Lodgepole Pine - Peat Moss bog is also considered.

However, the report states that the ditches and culverts may not be fully functional and asks whether the condition of the ditches still allows them to affect the period and the depth of flooding today. A comparison was made with several other local shrub swamp sites.

Conservation values of the site are reviewed including quality, viability, size, representativeness. defensibility and current threats. Changes in the hydrology, even minor changes in the past or future which alter the annual flooding regime, are identified as a major threat. The overall conservation values of the site were found to be high.

Advantages and disadvantages of four management options are described which might maintain the conservation values of the sensitive ecosystems present:
1) Monitor the Wetland In Its Present Condition
2) Reestablish Hydrology Patterns of an Earlier Time
3) Create or Re-create a Bog
4) Construct Water Storage Capacity for Supplementing Water Flows

The report suggests some methods of baseline work, including further investigation into the past, and some recommendations for monitoring and periodic reassessment of management plans now and into the future. If conservation efforts are undertaken, the report urges that their future should be secured through purchase, tax deductible donation, conservation covenant, land management agreement or the use of other methods.

Finally, the report states that the areas surrounding the wetland, especially the riparian forest, are important to the conservation values of the wetland.

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Composite photograph of wetland, SEI Polygon N1189, looking southwest. Note shrubs in foreground and riparian forest in background.

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Introduction

Natural ecosystems provide numerous services to humans and to life on the planet as a whole. These include climate control; production of clean water, nutrients and oxygen; absorption of wastes; soil fertility on farms; fish as food; wood fibre: medicines; genetic material for improvement of crops and forests; shade for streams; erosion control; crop pollination and more. This list of economic services, however impressive it may be, does not include the personal value we place on the jobs, the recreation and the inspiration provided by natural ecosystems. Finally, ecosystems provide a model for planning sustainability; it is not possible to have a sustainable future without biological diversity in wild ecosystems.

Species and natural communities do not exist in isolation. An ecological element will not survive except as part of a viable unit, capable of maintaining itself into the foreseeable future.

Conservation evaluation uses scientific techniques to assess the ecological values of a site or property. In contrast, a typical land appraisal assesses only the economic value of a property within the marketplace.

However, a conservation evaluation is more than a collection of field data reports used for groundtruthing ecosystems, and it is neither simply a species inventory, nor a management document. The principal task of a conservation evaluation is to identify the likelihood of the presence of valuable (e.g. sensitive, rare, at-risk, vulnerable, endangered) ecological elements that are viable, and to give an indication whether further ecological investigation is warranted in developing a management plan.

Site Description

Location, Size, Access and Legal Description

The site is located south of Qualicum Beach, north of the Inland Island Freeway (Highway 19) and east of the Memorial Avenue connector. Access from Memorial Avenue is possible by travelling east along the BC Hydro right-of-way corridor until the wetland become visible to the south (see Figure 1 on preceding page and Figure 2). However, the maintenance road is gated and permission of landowners may be required. Caution should be used; there is active logging in the area. The study area is centred on a 1.89-hectare wetland that is part of the Weyerhaeuser private land described as DL 42, Nanoose Land District.

Surficial Geology, Landforms and Elevations

The topography of the area is low relief dominated by surficial deposits of mixed gravel, sand and clay of glacial and glacial-marine origin. The wetland occupies a shallow depression at approximately 80 meters above sea level. Within a one kilometre radius of the study site, there are two other wetlands of a similar size and others that are smaller.

Figure 2.
Air photo 1998 centred on SEI Polygon N1189

Immediately to the north of the study site, there are remnants of a large wetland complex. It is likely that the study site was once a small part of this wetland complex. Clay deposits appear to have been significant in the formation of several of the wetlands in the area.

Drainage is now to the north, towards Glengarry golf course and Qualicum Road through two routes, both of which have been ditched, with culverts under the utilities access road. Farther north, as the slope increases beyond the golf course, the water from the wetland becomes a component of Beach Creek which enters the Strait of Georgia near the junction of the Old Island Highway (19A) and Memorial Ave in Qualicum Beach.

Climate

Annual precipitation measured near the Englishman River in Parksville during the years 1978 to 1998 had an average yearly total of 950mm (K. Ryan pers. comm.). Rainfall is not distributed evenly throughout the year; only about 19% of the precipitation in an average year falls during the 5 months from May through September (Environment Canada). As a result, summer drought is often a limiting factor in the ecosystems of the southeast coast of Vancouver Island.

Temperature, on the other hand, is moderate throughout the year. The mean annual temperature, also measured in Parksville, was approximately 10 degrees Celsius.

Biogeoclimatic Zones

The site and its surrounding forests are entirely within the Coastal Douglas-fir (moist maritime) biogeoclimatic zone.

Anthropogenic Features

The northern edge of the wetland has been altered by the creation and maintenance of a utility corridor. High-voltage hydroelectric lines and an associated access road were the first to come through, converting the northern edge of the wetland into a weedy clearing dominated by nonnative plants. Gravel fill was dumped along the utility maintenance road. In the last decade, a buried natural gas pipeline was constructed parallel to and just south of the powerlines; it shaved another segment from the wetland and cut deeper into the core.

The largest anthropogenic influence is a ditch which nearly encircles the wetland. It would appear that at some time in the past, someone intended to drain the wetland by letting its water flow north. The circular ditch is drained by two ditches, each with a culvert under the utilities access road. One of these new drainage routes might be following close to an original watercourse that drained the wetland.

In addition, on the air photo there appears to be a straight line running north south near the centre of the wetland. This might mark the location of another ditch but it was not observed on the ground.

Neighbouring Land Uses

The wetland is surrounded on 3 sides by commercial forest land that is privately owned by Weyerhaeuser. Logging of the second growth timber on some of these lands nearby is currently under way and there are flagging tapes marked "Falling Boundary" adjacent to the wetland. The northern side of the wetland is bordered by a utility corridor which includes a natural gas pipeline near the wetland, high-voltage electrical lines, and a service road. Further north, beyond the utility corridor, there is a golf course.

Sensitive Ecosystems Inventory Polygons

The entire wetland is a single SEI polygon designated Polygon N1189. Field data was collected when this polygon was groundtruthed for the SEI project (see Figure 3 and Appendix 1).

It is likely that this wetland was once part of a much larger network of wetland ecosystems that included Polygon N0421 and other areas in and around the golf course. Some of these areas are not now considered sensitive ecosystems because the plant communities there are no longer in a natural state. For example, the area north of the wetland, beyond the powerlines, currently supports a dense mat of graminoids, mostly invasive species, and Lodgepole Pine (*Pinus contorta*) similar in size and shape to those in the study site. Others such as Polygon N0421 have been field checked and are reported to have a bog component as well as a shrub swamp component (see Figure 4 and Appendix 2).

Two forested polygons are near the wetland. Polygon N1186 is classified as "Older Second Growth Forest" in the Sensitive Ecosystems Inventory; it is currently being logged. Polygon N1191, which is classified as "Older Forest", appears to be a mixed forest 80 to 100 years of age with many old-forest characteristics (i.e. old trees, large standing and fallen dead wood, a multi-age and multi-species mix, and multiple layers in the structure of the forest). This forest is separated from the northwest corner of the wetland by the treeless utility corridor.

Methodology

During September of 2001, the wetland was traversed through its approximate centre from north to south and then back across the wetland from the south side out through the western edge. A traverse bearing southwest across the eastern edge of the wetland was undertaken in September and again in May 2002.

On 25 September 2001 and 29 May 2002, a 100 square metre sample plot near the centre was chosen to estimate the vegetation coverage for each species. The two plots were not chosen randomly; each site was selected to be representative of the core of the wetland.

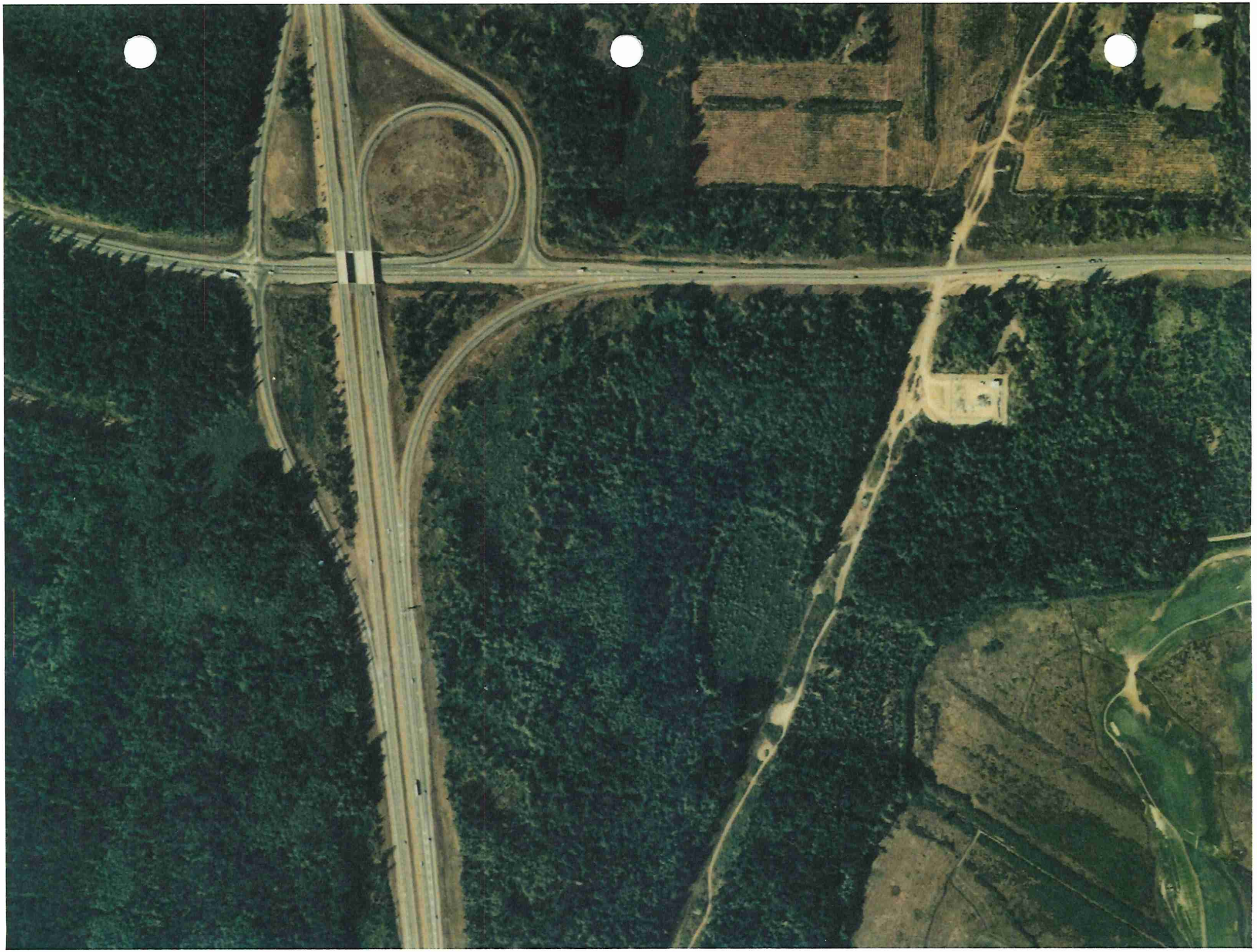

Figure 3.
Air photo 1998 enlarged to show SEI Polygon N1189

Sensitive Ecosystem Inventory

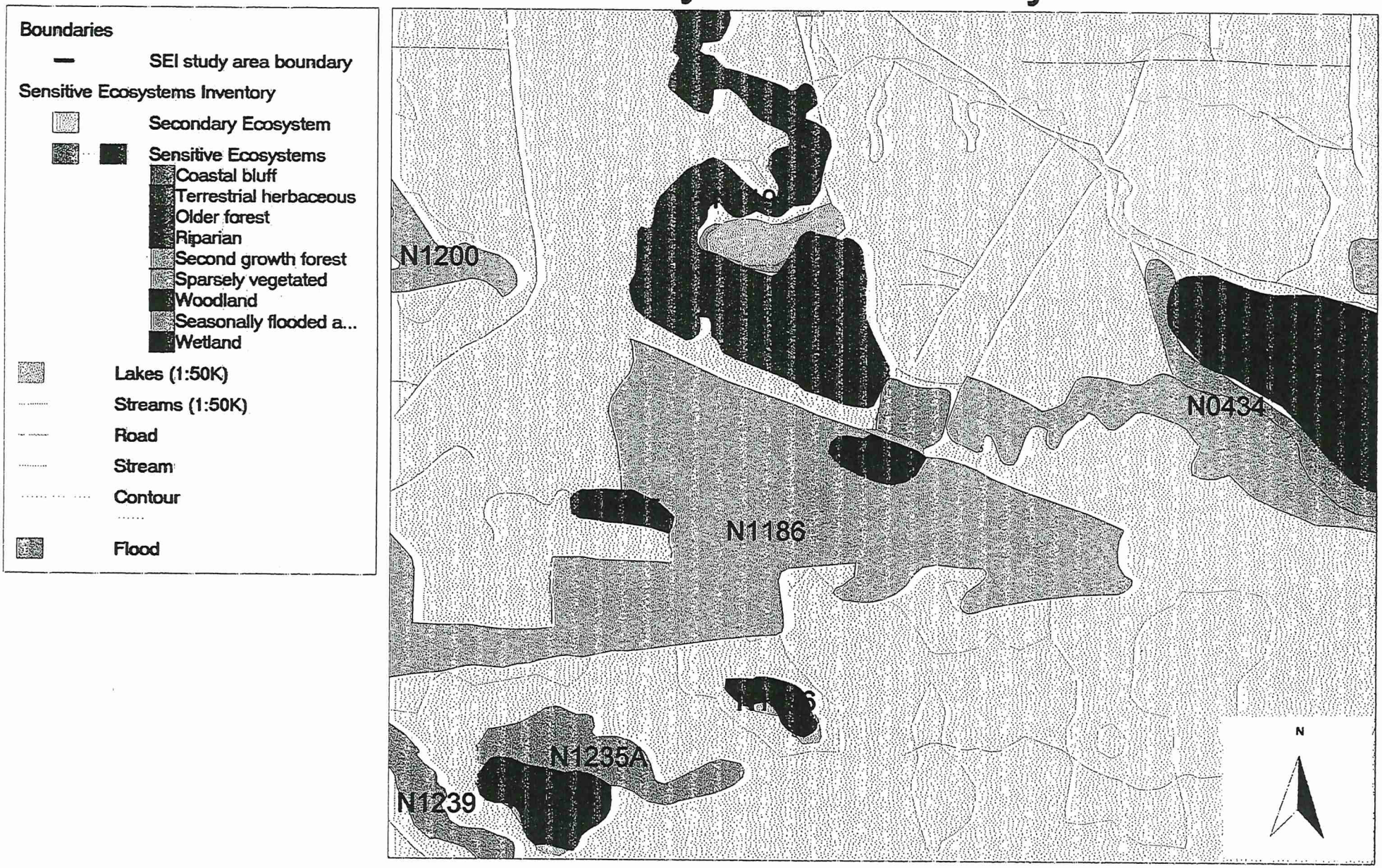

Figure 4.
Map of sensitive ecosystems in the vicinity of SEI Polygon N1189

A soil auger was used to determine the soil profile in the sample plot and also at a location on the western edge of the wetland within the riparian forest. A coring tool was used to measure the age of two typical Lodgepole Pines, one within the plot and another at the eastern edge of the wetland.

In winter, with the leaves gone from most of the underbrush, a complete circuit of the wetland was undertaken to look at the hydrology, especially the perimeter ditches, and to explore the surrounding riparian forest and the forest-wetland transition. Finally in May 2002, a visit was made to observe the wildlife that use the study site during the spring.

Observations

Wetland Core

Percentage plant cover in the sample plots near the centre of the wetland is summarized in Table 1.

Table 1. Plant cover by percentage in wetland core of SEI Polygon N1189, May 2002

English Name	Species Name	Percent Cover	Layer
Hardhack	*Spirea douglasii*	96%	low shrub
Lodgepole Pine	*Pinus contorta*	6%	tall shrub

The sample plots and the traverses showed that the entire wetland was dominated by Hardhack (*Spiraea douglasii*). Throughout the wetland, a total of approximately 70 to 100 scattered Lodgepole Pines was observed that were between 3 and 8 metres high. The two Lodgepole Pine trees that were sampled were approximately 30 and 28 years old with diameters (dbh) of 18.7 centimetres and 17.0 centimetres, respectively.

Several patches of Pacific Willow (*Salix lucida ssp. lasiandra*) were also present in the wetland core but this species was far more numerous all around the edge of the wetland and beyond, in the riparian forest.

Observations revealed no forb species present in the core of the wetland. Instead, the surface of the ground between the woody stems of the living Hardhack was covered by a thick layer of litter, mostly Hardhack leaves and sticks. The soil was organic to a depth of 101 centimetres, black and mesic near the surface and becoming gradually more brownish and fibric as the depth increased beyond 40 to 50 centimetres. Little or no anaerobic smell was detectable at the time the soil core was brought up. Beneath the organic material there was mottled blue-grey clay.

Wetland Margins
Around the western and eastern ends of the wetland, there was another species of willow present which was likely Sitka Willow (*Salix sitchensis*). Closer to the perimeter of the wetland, at the western end, Nootka Rose (*Rosa nutkana*) was abundant in addition to Hardhack. Salmonberry (*Rubus spectabilis*) and Red Elderberry (*Sambucus racemosa*) occurred nearest the edge of the wetland; these two species were more abundant in the riparian forest. Observations in the margins areas, as in the wetland core, revealed no forb species present.

Riparian Forest
An almost unbroken line of mature Red Alders (*Alnus rubra*) marked the margin of the riparian forest surrounding the wetland on three sides. Other canopy species in the riparian forest included Western Redcedar (*Thuja plicata*), Sitka Spruce (*Picea sitchensis*) and Lodgepole Pine. The shrub layer was Salmonberry, Red Elderberry, Pacific Crabapple (*Malus fusca*), Red-osier Dogwood (*Cornus stolonifera*), Nootka Rose, Hardhack and Black Gooseberry (*Ribes lacustre*). In the forb layer of the riparian forest, Stinging Nettle (*Urtica dioica*) was abundant and Sweet-scented Bedstraw (*Gallium triflorum*) was also present.

The soil of the riparian forest was black humus to a depth of 25 to 30 centimetres, with water-saturated fine sand forming a layer beneath. At a depth of approximately 95 centimetres, the fine sand was underlain by mottled blue-grey clay.

Upland Forest
The surrounding upland forest was dominated by Douglas-fir (*Pseudotsuga menziesii*). A more detailed analysis of the upland forest was not within the scope of this report.

Disturbed Areas
Parts of the disturbed area along the utility corridor were likely an upland forest once; other parts were once wetland. Some of the area north of the wetland is still occupied by patches of Hardhack. The route of the buried gas-line appears to be marked by a line of disturbed soil with mounds where the original plant community of the wetland has been replaced by native shrubs, especially Pacific Willow and likely Sitka Willow.

Much of the corridor area has been disturbed by clearing and fill which is now dominated by nonnative species such as Scotch Broom (*Cytisus scoparius*) which are common on roadsides. The area north of the wetland currently supports a plant community dominated by graminoids, mostly invasive species, and young Lodgepole Pines (*Pinus contorta*) similar in size and shape to those in the study site.

Wildlife Observations
Vertebrate species that were observed using the subject area are listed in Table 2.

Table 2. Some vertebrate species present in or near SEI Polygon N1189

English Name	Species Name	Location Observed
Red-legged Frog	*Rana aurora*	riparian forest NE
Pacific Tree-frog	*Hyla regila*	tadpoles in ditch W; adults in wetland margins
garter snake	*Thamnophis sp.*	near wetland margin N
Bushtit	*Psaltriparus minimus*	wetland core on willows
American Robin	*Turdus migratorius*	riparian forest W
Swainson's Thrush	*Catharus ustulatus*	riparian forest W
Common Yellowthroat	*Geothlypis trichas*	wetland margin N
Western Tanager	*Piranga ludoviciana*	riparian forest W
Song Sparrow	*Melospiza melodia*	wetland margin W
Spotted Towhee	*Pipilo maculatus*	riparian forest W
Black-Tailed Deer	*Odocoileus hemionus columbianus*	riparian forest W
Raccoon	*Procyon lotor*	wetland core

Hydrology
General information about drainage and ditching is presented in the above sections entitled "*Surficial Geology, Landforms and Elevations*" and "*Anthropogenic Features*". During September and May, the ground surface of most of the shrub swamp was not flooded. However, the water table was only 5 to 20 centimetres below the surface.

The ditch that almost encircles the wetland had open water which was not found elsewhere in the wetland. Most of the open water was in deep shade because of the trees and shrubs nearby. In one location the ditch was filled up with organic matter to a level that made it possible to walk across in May 2002.

Water flowing through the two culverts was observed during December 2001 but not during May 2002. The entrance to the eastern culvert seems to have been partially buried. Whenever the entrance to the western culvert was observed, it appeared to be partially flooded.

Analysis and Results

The key question in planning is whether the wetland on the study site is unstable in its present form, and if so, is human activity the cause of the changes. The evidence appears to be contradictory.

Prior to the construction of the drainage ditch and culvert, it is likely that more water was impounded by the natural topography than it is today. The past might have seen higher winter water levels than today and a flooded season that lasted longer into the spring-summer.

However, it is uncertain whether the lowest water levels in the wetland, the water levels of late summer and early autumn, would have been any different in the past. It is also uncertain how effective the ditches are at drainage today. The western culvert seems to be flooded much of the time, possibly indicating a vertical limitation in its ability to drain the wetland. Organic material that fills or partially fills the encircling ditch in at least one location might be another indication that the ditches do not remove water quickly.

This wetland is currently a shrub swamp. Although other shrub swamps in the area appear to have persisted for hundreds or perhaps thousands of years, based on the absence of stumps, the stability of this shrub swamp is uncertain. The presence of numerous stunted Lodgepole Pines throughout the core of the wetland indicates that it might have been a Lodgepole Pine - Peat Moss plant community (CDFmm site series 10) in the recent past. If so, Labrador Tea (*Ledum groenlandicum*) and peat moss (*Sphagnum spp*) would likely have been plentiful at that time. However, these species were not observed during this study and there was no clear evidence of them in the soil cores taken.

At least two other local wetlands or former wetlands have a scattered population of small Lodgepole Pines similar to the study area; one is Polygon N1235 (see Appendix 3) and the other includes the areas west and south of Glengarry Golf Course and east of the Memorial Avenue connector. Unfortunately, they have been modified. Parts of N1235 have been altered by grazing cattle and domestic goats. The latter area is overrun by invasive grass species, perhaps because of increased drainage in recent years; it might once have been a shrub swamp and bog similar to the nearby SEI Polygon N0421, but today it does not seem to be a sensitive ecosystem. It would be difficult to use these wetlands to identify the processes that have been at work on the study site.

A further indication of possible instability is the presence of Salmonberry and Red Elderberry among the Hardhack in the wetland margins; the entire wetland might be in the process of rapidly becoming a mixed forest. If the winter/spring water table is now lower as a result of the ditch, or the wetland soil dries out earlier in the year or more completely in late summer and early autumn, bog species (if present at that time) would have been the first to be eliminated. Wetland species like Hardhack often take time before they give way to upland species like Salmonberry and Red Elderberry.

In this scenario, the scattered pines might only *appear* to be similar to a bog community. Their young age suggests they could be colonists that have arrived after construction of the ditches. If this is correct then the pines have nothing to do with a bog community. Instead, the Lodgepole Pines might be one seral stage ahead of Pacific Willow and two stages ahead of Salmonberry, Red Elderberry and Red Alder in the process of succession.

To understand this possibility, it is useful to compare the study site with SEI Polygon N1208, a Hardhack shrub swamp that lacks Lodgepole Pines in its core area. It is approximately 3.5 kilometres from the study site. A drainage ditch was constructed across the southern edge of Polygon N1208 within the last decade. Today, the Hardhack on SEI Polygon N1208 seems to be thinning in some areas. Marsh Cinquefoil (*Potentilla palustris*) is present as a forb layer between the Hardhack stems. However, there is still no evidence today of any young pines that have germinated since the drainage ditch was constructed.

In contrast, on the study site the Hardhack appears to be healthy, with abundant foliage and a high density of live stems. If the plant community on the study site is in decline, it does not seem to be declining as quickly as the plant community on Polygon N1208.

Other explanations for the current situation on the study site are possible. Some plant communities such as bogs have poor access to nutrients and they are not generally tolerant of an increase in nutrient availability. A catastrophic event involving the sudden availability of nutrients might have been caused by soil disturbances and erosion along the adjacent utility corridor during construction of the powerlines and access road.

It is also possible that the Lodgepole Pines on the subject site indicate that this wetland is or was in the process of becoming a Lodgepole Pine - Peat Moss bog and shrub swamp.

Installation of the buried gas pipeline was too recent to have caused this unusual plant community but it serves as an example of how fragile the wetland under study is. It appears that the Hardhack along this newly disturbed and mounded strip of land has been replaced by other native species such as willows.

Conclusions

Conservation Values

The conservation values present in the subject area are high. It is a sensitive ecosystem, a shrub swamp as identified in the Sensitive Ecosystems Inventory (SEI Polygon N1189). Sensitive ecosystems are by definition rare or vulnerable. During the Sensitive Ecosystems Inventory from 1993 to 1997, wetlands occupied approximately 1.7% of the study area (Ward et al. 1998). Some have been destroyed or damaged since then. However, shrub swamps accounted for more than half of all wetlands, and shrub swamps dominated by Hardhack are one of the more common wetland plant communities on the Nanaimo Lowlands.

The plant community on the study site appears to be in good ecological condition and of a size that is representative of many shrub swamps on the southeast coast of Vancouver Island. However, the presence of scattered small Lodgepole Pines in a shrub swamp without a significant bog component makes the species composition of the study site unusual. It is unclear whether this plant community is natural and rare and therefore more valuable for conservation purposes, or if it is an initial indication of instability due to drainage resulting from human activity in the past.

In any case, the wetland is valuable because of its important role in the local ecology. For example, in its present condition it stores winter rains, maintains surface water flows and recharges ground water levels. The wetland and the larger wetland-forest complex around it appears to be a source of water for Beach Creek in summer and fall when water supply is often limiting (Faye Smith, pers. comm.). Beach Creek supports Coho Salmon (*Oncorhynchus kisutch*) and Cutthroat Trout (*Oncorhynchus clarkii*). The subject wetland is also important to wildlife: 2 species of amphibians, 1 species of reptile, 7 species of birds and 2 species of mammals were observed using the wetland and riparian areas.

The study site is surrounded on three sides by a riparian forest which, if left intact, will help to provide a buffer against surrounding land uses such as forestry. Beyond the riparian forest there is an older second growth, mixed forest which is identified by the Sensitive Ecosystems Inventory as one of the "other important ecosystems" (SEI Polygon N1186). Older forest (SEI Polygon N1191) has been identified nearby, northwest across the powerlines. The proximity of all of these forest communities adds greatly to the conservation value of the wetland.

In contrast, the utility corridor on the north side lowers the conservation value of the wetland. The sparse vegetation which is controlled for height, and the access road means that migrating species such as amphibians might be subjected to injury and predation. The forest-wetland interface and the riparian forest which were used by several forest-bird species are missing on the north side of the wetland because of the utility corridor. However, the corridor is not a total barrier between the wetland and the older forest because there is some shrub cover and very little vehicle traffic on the access road most of the time. The utility corridor is also a corridor for invasive species and many are now present, but none of these species appear to have gained a foothold in the core of the wetland.

The largest threat to the wetland might be instability resulting from increased drainage created by the ditch that almost surrounds the wetland. Various conditions in the wetland indicate possible instability such as the ditch itself, the pines present in the core of the wetland, and upland plant species present in the margins. On the other hand, the perennially flooded culvert and the presence of organic material filling in the ditches might indicate that the ditches are not currently effective and the wetland has become relatively stable after a period of change caused by construction on the utility corridor. In either case, future viability of this ecosystem as a shrub swamp is dependant on what changes, if any, are made to the outflow.

Management Options

"With so few of these rare and fragile ecosystems left in the study area, the need to treat seriously each one of the sites identified, and to fully evaluate all possible land use options before initiating any changes, is paramount" (McPhee at al. 2000). Management options for the wetland depend on the objectives of the managers, but it is assumed (for reasons described in the above sections entitled "*Introduction*" and "*Conservation Values*") that the only options which will be considered are those that maintain or reestablish the values of the sensitive ecosystems In addition, each option might include other opportunities to improve fish, wildlife, recreation and education uses of the land, provided they do not degrade the sensitive ecosystems.

The depth and the period of flooding are critical factors in the ecology of any wetland. Small changes in the hydrology could dramatically change the wetland and the riparian forest on the site, or create conditions suitable for their continued functioning. Thus, four management options have been presented. They are not intended as discrete options but rather as highlighted points on a continuum. For example, options 1 and 4 can both be pursued initially, with the intent of including option 2 if the data from monitoring over a period of time supports moving to that management option. Because of the size of the project (see calculations under management option 4 below) and the time required to assess impacts, it is likely that improvements to the flows on Beach Creek will need to planned in stages.

1) Monitor the Wetland In Its Present Condition

Secure the wetland and riparian forest primarily for conservation of sensitive ecosystems. Leave the ecological system including the hydrology patterns as they exist today and monitor the progress of ecological succession to see if the wetland will survive (see Monitoring section below). Management would need to remain open to the possible need for moving to a more active plan as new information becomes available. This option involves the lowest costs and the lowest short-term risks to the wetland.

However, if the wetland is left permanently in the condition it is today, this management option might offer the lowest potential conservation values. Water flow patterns on Beach Creek will remain disrupted. In winter, when water is already available for groundwater recharge or to supplement surface flows downstream, it is likely that water will continue to leave the study site more quickly than it would have prior to construction of the ditch. As each spring turns to summer, the water stored on the site in its present condition might be insufficient to maintain the wetland ecosystem in the long term.

2) Reestablish Hydrology Patterns of an Earlier Time

Secure the wetland and riparian forest primarily for conservation of sensitive ecosystems. Attempt to reestablish the hydrological conditions as they existed prior to the utility corridor and the ditching, and then allow the wetland to develop with minimal human involvement. To achieve this, a weir could be placed on the outflow. Monitoring of ecological changes would still be required to evaluate and adjust the height of the weir until its final position was established. The final position would involve fixing the height and the maximum rate

of flow under the weir so that fluctuations in weather would recreate the natural flood/drought cycle that was once imposed by the topography prior to development. The weir could have a height that matched the height from the depth of the constructed ditch to the natural surface grade of the land. Initially the rate of flow through the bottom of the weir should be designed so that the water from the wetland is released in June and July, enhancing downstream flows in those months, but not later because the shrub swamp needs to dry out sometime in July. Beach Creek flows in August and September would likely have to rely on other water storage options, some of which are discussed as part of management option 4 (see number 4, this section).

This option is similar to the first management option except that it involves a more active role for human intervention. The monitoring commitment would be the same but the installation and maintenance of the weir would cost more. Increasing human intervention also creates the threat of greater damage to the wetland because, as information becomes available, goals that initially appeared to be mutually supportive may eventually turn out to be conflicting. In that case, even good intentions may lead to results other than the conservation of the wetland.

Low-impact recreational and educational opportunities of this option might include a dead-end trail into the riparian forest or a viewing platform on the northern edge of the wetland.

3) Create or Re-create a Bog

Secure the wetland and riparian forest primarily for conservation of sensitive ecosystems. Attempt to recreate the conditions which might have allowed a bog to exist or to develop on this site, and then attempt to reestablish bog species by introductions. There are records of bogs or bog-like communities nearby such as SEI Polygon N0421; these plant communities could serve as a model, if they are still in good condition.

The conservation values of a old bog in a natural condition on this part of Vancouver Island would be very high. Of the 1.7% occupied by wetlands in the southeastern Vancouver Island study area, bogs comprise only 2.5% of this wetland area. Bogs are a rare plant community even among wetlands. The highest conservation use of the property would be to reestablish a bog.

However, this option involves many uncertainties. Did a bog actually exist on this site or is the current plant community something else? If there was a bog, what conditions created the bog and what conditions were present to maintain it? For example, if the bog was created following the last glaciation, it might not be possible to recreate those conditions today. Can local bog species be transplanted and which sensitive ecosystem would be impacted by becoming the donor of this living plant material? This management option would only make sense if there was solid evidence that this area had once been a bog or was in the process of becoming a bog. This study found no such evidence.

4) Construct Water Storage Capacity for Supplementing Water Flows

Secure the wetland and riparian forest primarily for conservation of the sensitive ecosystems present. Adjacent to the wetland, on the utility corridor and/or immediately north of the corridor, excavate a pond that is isolated from the wetland. Create an open water wetland community that is productive of waterfowl and other wildlife on site. Construct a weir below the powerlines which will release water during late summer and early fall. The primary goal of the excavation and weir could be to benefit fish and other aquatic life downstream in a manner that does not jeopardize the survival of the shrub swamp on the study site.

Monitoring of the water levels and vegetation cover would be needed, both to ensure that the water storage regime was not adversely affecting the sensitive ecosystems of the study site, and to help plan the optimum storage and release cycle for fish and wildlife. If this option is pursued in combination with management option 2 (above), the water from the wetland should be released first, before the release of the water from the storage ponds, so that the shrub swamp has a chance to dry out in late summer. The low impact recreational opportunities of this option might include a wildlife viewing tower, an elevated walkway or a floating pontoon for watching aquatic insects in the artificial pond.

The size of the constructed ponds needed depends on whether the wetland under study will be flooded by a weir, and on the depth to which the wetland is flooded. For example, if the 1.89 hectare wetland is flooded to depth of 30 centimetres at the beginning of July, the storage there will be approximately 5670 cubic metres of water. The water requirement for supplementary flows in Beach Creek at Garden Road is 14200 cubic metres (Eakins and Reksten, 2001). Therefore, the wetland can provide 40% of the water required for July. To achieve the remaining 37000 cubic metres of storage needed through to September, ponds 3 metres in depth would have to have an total area of approximately 1.24 hectares.

Recommendations for Monitoring and Reassessment

All of the management options require monitoring of the wetland before and after any changes, if any are imposed. Reassessment of the management plan can be done in response to new information. Because of the ditches, the stability of the ecosystem over time cannot be assumed. The first step is to establish a baseline prior to any changes.

The wetland should continue to be checked for signs, past or present, of bog species such as Labrador Tea and peat moss. For example, material from auger samples should continue to be analysed. Historical photographs, air photographs and other documents can be sought to determine when the ditching was done and when the Lodgepole Pines began to appear. Permission to core some Lodgepole Pines in several of the neighbouring wetlands that have shrub swamp and bog components can be sought to provide a reference for comparison with the ages of the trees on the study site. This kind of baseline work would help to develop the best plan for the site, regardless of what management option is eventually chosen.

Monitoring should include the establishment of three permanent plots (e.g. three squares, at least 10 metres by 10 metres, marked by orange iron posts or flags) The first measurement of vegetation should be done before any changes are made to the hydrology. The percentage of ground area covered by each plant species in each of the plots is estimated and recorded. This would need to be repeated regularly every year. Changes in ground cover can indicate subtle changes in hydrological and other ecological variables. Volunteers might be trained to perform this task with reliable consistency.

The plots should not be random. Two should be in an area that is strongly dominated by Hardhack so that they are typical of the wetland; one of these should be near the centre of the wetland where Lodgepole Pine is present along with Hardhack and the other in an area where some of the forest species like Salmonberry and Red Elderberry are present among the Hardhack. The third plot should be established in the riparian forest; for sampling trees, a 20-metre-by-20-metre plot is easier and more informative.

For all the management options, an increasing proportion of certain species should serve as a warning. Some forest species to watch for are Salmonberry and Red Elderberry. The list of invasive wet meadow species which can destroy a natural wetland includes Reed Canary Grass (*Phalaris arundinacea*) which is already present on the utility corridor. In response to changes, the management regime should be reviewed. Perhaps flooding to a greater depth or for a longer duration might be needed, if the wetland is to be maintained.

On the other hand, for management options 1, 2 and 4, an increasing presence of aquatic species such as Duckweed (*Lemna minor*), Pacific Water-parsley (*Oenanthe sarmentosa*) and White Water-Buttercup (*Ranunculus aquatilis*), plants which are all present nearby, should be seen as an indication of other problems. The shrub canopy might be thinning as the shrub swamp loses its integrity because of flooding that is too great in depth or duration.

If the monitoring is to be used effectively to maintain the existing values of the sensitive ecosystem, it is important that changes in flood depth and duration are not imposed on the wetland suddenly. For example, if a maximum flood depth of 50 centimetres is the target, the management plan should consider incremental changes of 15 to 20 cm and then allow for several years of vegetation monitoring before further changes are considered.

Methods for Conservation

The immediate threats to conservation of this wetland appear to be related to hydrology. However, there are other threats which are related to ownership and tenure.

If those who are managing for conservation values are not the owners of the land, they will eventually have to face the influences of competing land uses. Any owner may sell at any time or opt for changing the use of their land in such a way that all efforts for conservation are impeded. For example, a cottonwood plantation on this study site might do well under the existing conditions. Agriculture or a tree plantation of conifers might do well if this site was fully drained.

Advocates of conservation need to consider the amount of time and money they are willing to spend prior to entering some arrangement with the land owner that will ensure their efforts are not wasted. Obtaining title to the property is one of the most powerful options but it can be expensive. In any case, ownership should be coupled with a conservation covenant held by another conservation group to protect against policy changes within the group over time. In some cases, tax benefits are available as an incentive for the owner to donate the land to a charity. For example, Weldwood of Canada Limited donated ecologically sensitive lands to the Village of Cumberland as part of Environment Canada's expanded EcoGifts Program. Some options for conservation (such as conservation covenants, land management contracts and the granting of resource rights without transferring land ownership) are described briefly in *Sensitive Ecosystems Inventory: East Vancouver Island and Gulf Islands, 1993 - 1997. Volume 2: Conservation Manual* (McPhee et al. 2000). The Conservation Manual includes further references for more details.

Conservation goals for protecting native plants or fish or any of the other species dependent on this natural community might also come into conflict with each other or with other management partners on the project. Thought should be given to who decides critical factors such as the water levels, and who physically controls the weir, if one is constructed. Aquatic life may end up in competition with other demands for the stored water, such as the golf course, the town or users of the aquifer. A conflict-resolution mechanism should be in place from the start.

Efforts at conservation of this wetland would need to include the riparian forest that surrounds it on three sides as well as a buffer to protect that forest. Without this forest, the conservation values of the wetland itself would be reduced. For example, if flooding causes dieback in the riparian forest, the buffer area will then function as the riparian forest.

Acknowledgements and Copyright

Any errors are, of course, the responsibility of the author alone.
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Appendix 1

Sensitive Ecosystems Inventory of East Vancouver Island & Gulf Islands

Field Data Report

12-Jun-02

Polygon ID: N1189 Sub-unit: NANAIMO-VI Polygon Size (ha): 1.89

Map Sheet(s): 92F 038 Air photo(s): 92130-074

Location: QUALICUM BEACH, SOUTH OF

Ecosystem 1: WN:sp Ecosystem 2: Forest Age:

Data Source: SM,GT Soil Unit: C0PT:12CO

Ecosystem 1 or 2: 1 Multiple Plots: No Ecoplot No(s).:

Landscape Condition: Highly Fragmented (>25% landscape fragmentation)

Polygon Description

Environmental Uniformity: Medium Vegetation Uniformity: High

Forested Site Association(s):

Environmental Characteristics

Slope Slope Range: Mesoslope: n/a

Elevation: Elevation Range: Aspect:

Mineral Soil: Yes Organic Soil: Drainage: n/a

Moisture Regime: n/a Nutrient Regime: n/a

Hydrology: other Hydrology Data Source: Not verified

Fish Observations: Not Detected

Disturbance History (Natural)

Fire: ○ Flooding: ○ Animal Use: ◉ Erosion: ○ Disease: ○ Windthrow: ○ Other: ○

Disturbance History (Anthropogenic)

Logging: ○ Grazing: ○ Agriculture: ○ Construction: ○ Recreation: ○ Water Level Control: ○

Dyking: ○ Dredging: ○ Pollutants (Dump): ○ Other: ◉

Adjacent Land Uses: AGRICULTURAL; FOREST LAND

Known Threats:

Polygon ID: N1189 12-Jun-02

Comments: HYDRO RIGHT-OF-WAY BISECTS POLYGON; WETLAND IS PECULIAR - PERHAPS A VERY WET VERSION OF CDFMM 10 AT AN EARLY SUCCESSION; SCATTERED LODGEPOLE PINE ~6-8M TALL; HYDRO.: PROBABLY INFLOW

Vegetation Data

In general, dominant species only are recorded for each vegetation type. Rare, uncommon or indicator species may also be included.

Non-vegetated Type: _____

	Vegetation Type	Percent Cover
1	Coniferous Trees:	5
2	Hardwood Trees:	10
3	Tall Shrubs:	15
4	Low Shrubs:	55
5	Forbs:	3
6	Grasses:	5
7	Rushes:	15
8	Sedges:	
9	Mosses/Lichens:	
10	Aquatics:	
11	Non-vegetated:	
12	Introduced Species:	3

Type	Species Code	Scientific Name	Common Name	Percent Cover
1	PICESIT	Picea sitchensis	sitka spruce	5
1	PINUCON	Pinus contorta	lodgepole pine	2
1	THUJPLI	Thuja plicata	western redcedar	1
2	ALNURUB	Alnus rubra	red alder	5
2	SALIX	Salix sp.	willow	5
3	PICESIT	Picea sitchensis	sitka spruce	
3	PINUCON	Pinus contorta	lodgepole pine	10
4	ROSAGYM	Rosa gymnocarpa	baldhip rose	10
4	SPIRDOU	Spiraea douglasii	hardhack	45
5	CIRSARV	Cirsium arvense		3
7	JUNCEFF	Juncus effusus	common rush	15
12	CIRSARV	Cirsium arvense		3

Appendix 2

Sensitive Ecosystems Inventory of East Vancouver Island & Gulf Islands

11-Jun-02

Field Data Report

Polygon ID: N0421 Sub-unit: Polygon Size (ha): 23.15

Map Sheet(s): 92F 038 Air photo(s): 92126-232

Location: GLENGARRY GOLF COURSE

Ecosystem 1: WN:bg:sp Ecosystem 2: Forest Age:

Data Source: SM,GT Soil Unit: MT.12CO

Ecosystem 1 or 2: 1 Multiple Plots: No Ecoplot No(s).:

Landscape Condition: Highly Fragmented (>25% landscape fragmentation)

Polygon Description

Environmental Uniformity: Medium Vegetation Uniformity: Medium

Forested Site Association(s):

Environmental Characteristics

Slope Slope Range: Mesoslope: n/a

Elevation: Elevation Range: Aspect:

Mineral Soil: Organic Soil: Yes Drainage: n/a

Moisture Regime: n/a Nutrient Regime: n/a

Hydrology: other Hydrology Data Source: Not verified

Fish Observations: Not Detected

Disturbance History (Natural)

Fire: ○ Flooding: ○ Animal Use: ○ Erosion: ○ Disease: ○ Windthrow: ○ Other: ○

Disturbance History (Anthropogenic)

Logging: ○ Grazing: ○ Agriculture: ○ Construction: ○ Recreation: ○ Water Level Control: ◉

Dyking: ○ Dredging: ○ Pollutants (Dump): ◉ Other: ○

Adjacent Land Uses: GOLF COURSE; FOREST LAND

Known Threats: ALTERED HYDROLOGY - SEE COMMENTS

Polygon ID: N0421 11-Jun-02

Comments: ENTIRE POLYGON ENCIRCLED BY TRENCH TO REDUCE WATER TABLE TO CONSTRUCT GOLF GREEN; POSSIBLE USE OF CHEMICALS ON GOLF COURSE; THEY WOULD LIKE TO GET RID OF HARDHACK (SPIRAEA); HYDRO.: PROBABLY INFLOW

Vegetation Data

In general, dominant species only are recorded for each vegetation type. Rare, uncommon or indicator species may also be included.

Non-vegetated Type: OPEN WATER IN DITCHES

	Vegetation Type	Percent Cover
1	Coniferous Trees:	40
2	Hardwood Trees:	5
3	Tall Shrubs:	50
4	Low Shrubs:	
5	Forbs:	5
6	Grasses:	
7	Rushes:	0.5
8	Sedges:	
9	Mosses/Lichens:	
10	Aquatics:	1
11	Non-vegetated:	1
12	Introduced Species:	

Type	Species Code	Scientific Name	Common Name	Percent Cover
1	PINUCON	Pinus contorta	lodgepole pine	40
2	MALUFUS	Malus fusca	pacific crab apple	5
3	LEDUGRO	Ledum groenlandicum	labrador tea	15
3	SPIRDOU	Spiraea douglasii	hardhack	35
5	GENTSCE	Gentiana sceptrum	king gentian	4
7	JUNCENS	Juncus ensifolius	dagger-leaved rush	0.5
10	LEMNMIN	Lemna minor	common duckweed	0.5
10	SPARANG	Sparganium angustifolium	narrow-leaved bur-reed	0.5

Appendix 3

Sensitive Ecosystems Inventory of East Vancouver Island & Gulf Islands

Field Data Report

11-Jun-02

Polygon ID: N1235 Sub-unit: NANAIMO-VI Polygon Size (ha): 4.44

Map Sheet(s): 92F 038 Air photo(s): 92128-120

Location: HAMILTON MARSH AREA

Ecosystem 1: WN:bg:sp Ecosystem 2: Forest Age:

Data Source: SM,EP,GT Soil Unit: MTS0:1CO

Ecosystem 1 or 2: 1 Multiple Plots: No Ecoplot No(s).: 94-00346

Landscape Condition: Partly Fragmented (5-25% landscape fragmentation)

Polygon Description

Environmental Uniformity: High Vegetation Uniformity: High

Forested Site Association(s):

Environmental Characteristics

Slope Slope Range: Mesoslope: n/a

Elevation: 85m Elevation Range: Aspect:

Mineral Soil: Organic Soil: Yes Drainage: n/a

Moisture Regime: n/a Nutrient Regime: n/a

Hydrology: other Hydrology Data Source: Field checked

Fish Observations: Not Detected

Disturbance History (Natural)

Fire: Flooding: Animal Use: Erosion: Disease: Windthrow: Other:

Disturbance History (Anthropogenic)

Logging: Grazing: Agriculture: Construction: Recreation: Water Level Control:

Dyking: Dredging: Pollutants (Dump): Other:

Adjacent Land Uses: PIPELINE; HIGHWAY

Known Threats:

Polygon ID: N1235 11-Jun-02

Comments: EP #94-00346; TREED BOG; SHRUB SWAMP; HYDRO.; ISOLATED

Vegetation Data

In general, dominant species only are recorded for each vegetation type. Rare, uncommon or indicator species may also be included.

Non-vegetated Type: _____

	Vegetation Type	Percent Cover
1	Coniferous Trees:	10
2	Hardwood Trees:	
3	Tall Shrubs:	12
4	Low Shrubs:	85
5	Forbs:	
6	Grasses:	
7	Rushes:	
8	Sedges:	5
9	Mosses/Lichens:	80
10	Aquatics:	
11	Non-vegetated:	
12	Introduced Species:	

Type	Species Code	Scientific Name	Common Name	Percent Cover
1	PINUCON	Pinus contorta	lodgepole pine	10
3	PINUCON	Pinus contorta	lodgepole pine	12
4	KALMMIC	Kalmia microphylla	western bog-laurel	15
4	LEDUGRO	Ledum groenlandicum	labrador tea	60
4	OXYCOXY	Oxycoccus oxycoccos	bog cranberry	10
8	CARESIT	Carex sitchensis	sitka sedge	3
9	SPHACAI	Sphagnum capiltifolium		60
9	SPHAGIR	Sphagnum girgensohnii		20

Appendix 4

Sensitive Ecosystems Inventory of East Vancouver Island & Gulf Islands

Field Data Report

11-Jun-02

Polygon ID: N1208 Sub-unit: NANAIMO-VI Polygon Size (ha): 1.44

Map Sheet(s): 92F 038 Air photo(s): 92130-082

Location: QUALICUM WEST

Ecosystem 1: WN:sp:bg Ecosystem 2: Forest Age:

Data Source: SM,GT Soil Unit: C0PT:1CO

Ecosystem 1 or 2: 1 Multiple Plots: No Ecoplot No(s).:

Landscape Condition: Highly Fragmented (>25% landscape fragmentation)

Polygon Description

Environmental Uniformity: High Vegetation Uniformity: High

Forested Site Association(s):

Environmental Characteristics

Slope Slope Range: Mesoslope: n/a

Elevation: 100m Elevation Range: Aspect:

Mineral Soil: Organic Soil: Yes Drainage: n/a

Moisture Regime: n/a Nutrient Regime: n/a

Hydrology: Hydrology Data Source:

Fish Observations: Not Detected

Disturbance History (Natural)

Fire: ○ Flooding: ○ Animal Use: ● Erosion: ○ Disease: ○ Windthrow: ○ Other: ○

Disturbance History (Anthropogenic)

Logging: ○ Grazing: ○ Agriculture: ○ Construction: ○ Recreation: ○ Water Level Control: ○

Dyking: ○ Dredging: ○ Pollutants (Dump): ○ Other: ○

Adjacent Land Uses: FOREST LAND; PROPOSED SUBDIVISION

Known Threats: DIRECTLY ADJACENT TO PROPOSED SUBDIVISION

Polygon ID: N1208 11-Jun-02

Comments: SHRUB SWAMP; SPIRAEA SUCCESSION WITH SOME SEDGE STILL; LIKELY HAS STANDING WATER DURING PERIODS OF PROLONGED/HIGH PRECIPITATION; HYDRO.: PROBABLY INFLOW; NEW SUBDIVISION ROADED PRIOR TO NEW HIGHWAY CONSTRUCTION

Vegetation Data

In general, dominant species only are recorded for each vegetation type. Rare, uncommon or indicator species may also be included.

Non-vegetated Type: _____

	Vegetation Type	Percent Cover
1	Coniferous Trees:	
2	Hardwood Trees:	
3	Tall Shrubs:	
4	Low Shrubs:	95
5	Forbs:	5
6	Grasses:	
7	Rushes:	
8	Sedges:	10
9	Mosses/Lichens:	15
10	Aquatics:	
11	Non-vegetated:	
12	Introduced Species:	

Type	Species Code	Scientific Name	Common Name	Percent Cover
4	SPIRDOU	Spiraea douglasii	hardhack	95
5	POTEPAL	Potentilla palustris	marsh cinquefoil	4
8	CAREEXS	Carex exsiccata	inflated sedge	10
9	SPHAGNU	Sphagnum sp.		15

Appendix 5

Sensitive Ecosystems Inventory of East Vancouver Island & Gulf Islands

Field Data Report

12-Jun-02

Polygon ID: N1195 Sub-unit: Polygon Size (ha): 1.72

Map Sheet(s): 92F 038 Air photo(s): 92130-074

Location: QUALICUM BEACH, SOUTH OF

Ecosystem 1: WN:sp Ecosystem 2: Forest Age:

Data Source: SM;GT Soil Unit: MT:1CO

Ecosystem 1 or 2: 1 Multiple Plots: No Ecoplot No(s).:

Landscape Condition: Highly Fragmented (>25% landscape fragmentation)

Polygon Description

Environmental Uniformity: High Vegetation Uniformity: High

Forested Site Association(s):

Environmental Characteristics

Slope Slope Range: Mesoslope: n/a

Elevation: Elevation Range: Aspect:

Mineral Soil: Organic Soil: Yes Drainage: n/a

Moisture Regime: n/a Nutrient Regime: n/a

Hydrology: other Hydrology Data Source: Not verified

Fish Observations: Not Detected

Disturbance History (Natural)

Fire: ○ Flooding: ○ Animal Use: ◉ Erosion: ○ Disease: ○ Windthrow: ○ Other: ○

Disturbance History (Anthropogenic)

Logging: ○ Grazing: ○ Agriculture: ○ Construction: ○ Recreation: ○ Water Level Control: ○

Dyking: ○ Dredging: ○ Pollutants (Dump): ○ Other: ◉

Adjacent Land Uses: RURAL RESIDENTIAL; AGRICULTURE; NEW ISLAND HIGHWAY; FOREST LAND

Known Threats:

Polygon ID: N1195 12-Jun-02

Comments: SHRUB SWAMP; DIST. HIST. (ANTHRO.): FIBRE OPTIC RIGHT-OF-WAY THROUGH 1 EDGE OF POLYGON, FIBRE OPTIC INSTALLATION ~3 YEARS AGO; HYDRO.: ISOLATED, SEEPAGE

Vegetation Data

In general, dominant species only are recorded for each vegetation type. Rare, uncommon or indicator species may also be included.

Non-vegetated Type:

	Vegetation Type	Percent Cover
1	Coniferous Trees:	
2	Hardwood Trees:	
3	Tall Shrubs:	10
4	Low Shrubs:	95
5	Forbs:	5
6	Grasses:	
7	Rushes:	5
8	Sedges:	
9	Mosses/Lichens:	
10	Aquatics:	
11	Non-vegetated:	
12	Introduced Species:	

Type	Species Code	Scientific Name	Common Name	Percent Cover
3	MALUFUS	Malus fusca	pacific crab apple	3
3	RHAMPUR	Rhamnus purshiana	cascara	
3	SALIX	Salix sp.	willow	3
4	SPIRDOU	Spiraea douglasii	hardhack	95
5	ASTER	Aster sp.		
5	GENTSCE	Gentiana sceptrum	king gentian	
5	HYPEANA	Hypericum anagalloides	bog St. John's-wort	
7	JUNCEFF	Juncus effusus	common rush	

Appendix 6

Sensitive Ecosystems Inventory of East Vancouver Island & Gulf Islands

Field Data Report

12-Jun-02

Polygon ID: N1196 Sub-unit: Polygon Size (ha): 1.59

Map Sheet(s): 92F 038 Air photo(s): 92130-074

Location: QUALICUM BEACH, SOUTH OF

Ecosystem 1: WN:sp Ecosystem 2: Forest Age:

Data Source: SM,GT Soil Unit: MTS0:1CO

Ecosystem 1 or 2: 1 Multiple Plots: No Ecoplot No(s).:

Landscape Condition: Highly Fragmented (>25% landscape fragmentation)

Polygon Description

Environmental Uniformity: High Vegetation Uniformity: High

Forested Site Association(s):

Environmental Characteristics

Slope Slope Range: Mesoslope: n/a

Elevation: Elevation Range: Aspect:

Mineral Soil: Organic Soil: Yes Drainage: n/a

Moisture Regime: n/a Nutrient Regime: n/a

Hydrology: other Hydrology Data Source: Not verified

Fish Observations: Not Detected

Disturbance History (Natural)

Fire: ○ Flooding: ○ Animal Use: ○ Erosion: ○ Disease: ○ Windthrow: ○ Other: ○

Disturbance History (Anthropogenic)

Logging: ○ Grazing: ○ Agriculture: ○ Construction: ○ Recreation: ○ Water Level Control: ○

Dyking: ○ Dredging: ○ Pollutants (Dump): ○ Other: ○

Adjacent Land Uses: RURAL RESIDENTIAL; RECENT LOGGING ON 1 SIDE

Known Threats: NEW ISLAND HIGHWAY MAY INTERFERE WITH WATER FLOW/SEEPAGE

Polygon ID: N1196 12-Jun-02

Comments: SHRUB SWAMP; HYDRO.: ISOLATED

Vegetation Data

In general, dominant species only are recorded for each vegetation type. Rare, uncommon or indicator species may also be included.

Non-vegetated Type: BARE & COARSE WOODY DEBRIS (FROM OLD LOGGING)

	Vegetation Type	Percent Cover
1	Coniferous Trees:	
2	Hardwood Trees:	
3	Tall Shrubs:	15
4	Low Shrubs:	85
5	Forbs:	5
6	Grasses:	
7	Rushes:	
8	Sedges:	5
9	Mosses/Lichens:	
10	Aquatics:	0.5
11	Non-vegetated:	5
12	Introduced Species:	

Type	Species Code	Scientific Name	Common Name	Percent Cover
3	MALUFUS	Malus fusca	pacific crab apple	10
3	POPUTRE	Populus tremuloides	trembling aspen	1
3	PRUNEMA	Prunus emarginata	bitter cherry	1
3	SALIX	Salix sp.	willow	1
4	SPIRDOU	Spiraea douglasii	hardhack	85
5	OENASAR	Oenanthe sarmentosa	pacific water-parsley	
5	RANUFLA	Ranunculus flabellaris	yellow water-buttercup	
5	VEROBEC1	Veronica beccabunga ssp. a	american speedwell	
8	CAREEXS	Carex exsiccata	inflated sedge	2
8	CAREOBN	Carex obnupta	slough sedge	3
8	ELEOPAL	Eleocharis palustris	common spike-rush	0.5
10	SPARANG	Sparganium angustifolium	narrow-leaved bur-reed	0.5