

FINAL REPORT

Small Wetland Inventory and Construction in the Ash River Watershed

08.W.ASH.01

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EXECUTIVE SUMMARY

The mild climate and varied terrain of Vancouver Island have resulted in relatively high species diversity and endemism, as well as conditions desirable for human occupation and resource extraction. This has resulted in extensive habitat loss and fragmentation in some areas. Small wetland habitats are particularly vulnerable to development due to issues associated with our ability to locate and map them and lack of protection. Vancouver Island is home to six native aquatic-breeding amphibian species, the majority of which make extensive use of small wetland habitats as stepping stones across the landscape, for breeding, cover, hydration, and for foraging.

Amphibian populations living in an around hydro facilities such as Elsie Lake near Port Alberni have been impacted by a number of confounding issues, such as wetland habitat loss, introduced species (e.g., fish stocking), and the creation of potential sink habitats due to fluctuating water levels. The objectives for this project in 2008 were to: confirm whether amphibians breed in Elsie Lake; determine the distribution of small wetland habitats and associated aquatic-breeding amphibians within a 1-km radius of Elsie Lake; construct a number of small, productive, ephemeral wetland habitats primarily for use by native amphibian species; and develop and deliver a wetland construction workshop for individuals involved with this type of work.

Small wetland habitats within 1 km of Elsie Lake were mapped by project partner Island Timberlands. The majority of these wetlands were ground truthed and surveyed for amphibians. Elsie Lake was surveyed in spring for egg masses and in summer for larvae. Small pools below the high water mark in Elsie Lake were also surveyed for amphibians. The majority of mapped small wetlands were surveyed, and the same number of unmapped wetlands were encountered during ground truthing and surveyed. A much higher density of small wetlands was encountered on the northeast side of Elsie Lake, where more gentle slopes and older forests occur, than along other shorelines. In total, 50 sites were surveyed and amphibians were found in 41 (82% of sites). Five amphibian species were observed— Northwestern Salamanders (*Ambystoma gracile*; 28% of sites), Long-toed Salamander (*Ambystoma macrodactylum*; 14%), Rough-skinned Newt (*Taricha granulosa*; 14%), Red-legged Frog (*Rana aurora*; 38%), and Pacific Treefrog (*Pseudacris/Hyla regilla*; 50%). Capture rates of amphibians in Elsie Lake were relatively low, and only one egg mass was observed in the lake. Small pools that had formed below the high water mark in the lake were used by breeding amphibians, but fluctuating water levels may have reduced survival rates.

Locating potential wetland construction sites around Elsie Lake was challenging due the presence of forested habitat around the lake (no trees were to be cleared), and soil and ground water conditions. Three sites were found approximately 10 km southeast of the Elsie Lake in recent clearcuts. Nine wetlands with an estimated area of 971 m² were constructed over a 5-day period. Total cost for the construction was \$11,000 (cost per wetland was approximately \$1,200). The wetland construction project was highlighted on the front page of a local Port Alberni newspaper in fall 2008.

Interest in the wetland construction workshop was overwhelming and 35 participants attended the 1.5-day event held in July. Participants were largely from consulting companies, government, and NGOs and from as far a field as Calgary and the Northwest Territories.

Recommendations for future work include monitoring the constructed wetlands to ensure that they hold water long enough for successful amphibian breeding and reshaping some shallow shelf areas in Elsie Lake where side pools develop to ensure that they don't act as habitat sinks.

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1.0 INTRODUCTION

Vancouver Island (VI) has a unique climate and terrain that has resulted in relatively high species diversity and endemism. However, these conditions have also made the area highly desirable for agriculture, urban development, and resource extraction. As a result, natural areas are becoming increasingly isolated and fragmented (Ward et al. 1998). For example, more than 2% of wetlands have been lost in the past 10 years alone on eastern VI (AXYS Environmental Consulting Ltd. 2005). One group of organisms particularly vulnerable to habitat fragmentation and isolation is amphibians—population declines have occurred on a global scale, and amphibians have been identified as indicators of environmental health. Almost 70% of native amphibians on VI are dependent on both aquatic and terrestrial environments to meet their annual life history needs and the ability to migrate between these habitats is critical. Many of these species utilize small, ephemeral wetlands for breeding (e.g., less than 0.5 ha), as they contain fewer predators (e.g., fish). These small wetlands also act as stepping-stones, maintaining genetic connectivity among populations. However, small wetlands are difficult to identify from air photos and maps (Wind 2003) and they have no legal protection. As a result, large numbers have been lost due to development.

In addition to habitat loss, native amphibians face confounding issues related to the introduction and spread of non-native species and disease. American Bullfrogs, Green Frogs, and a variety of non-native fish species all threaten native amphibians on VI. A chytrid fungus, *Batrachochytrium dendrobatidis* or Bd, has been identified as the major cause of many amphibian population declines around the world (Daszak et al. 1999) and has been confirmed on VI (Garner et al. 2006, Adams et al. 2007). For example, Western Toads have declined dramatically as a result of this fungus (Wind and Dupuis 2002). These issues are confounded, as Bullfrogs have been found to be carriers of this disease but not susceptible to it (Daszak et al. 2004). In addition, amphibian eggs are susceptible to infection by *Saprolegnia ferax*, a water mold that can be introduced to water bodies via fish from stocking programs (Kiesecker et al. 2001). Amphibian populations that are ‘stressed’ due to habitat degradation and loss may be more susceptible to disease and predation. Experts agree that one of the best ways to protect native amphibian populations in the face of introduced species and disease is through habitat protection, especially small, ephemeral wetlands that serve as oases from fish and Bullfrogs.

Amphibian populations living in and around hydro facilities such as Elsie Lake have been impacted by a number of confounding issues. First, at least 72 ha of wetland habitat was lost when the 672 ha area was flooded after dam construction (Conlin et al. 2000); this is likely a low estimate due to issues associated with mapping small wetland habitats (Wind 2003). Small wetlands are critical for amphibians and some listed species may be particularly vulnerable to the loss of these habitats—e.g., studies have shown that Red-legged Frog (*Rana aurora*) breeding sites appear to be relatively rare on Vancouver Island (10% of small wetlands on EVI; Wind 2003). Second, current fish stocking and management practices have likely created an unsuitable or degraded environment for amphibians (Wind 2004)—due to a number of natural barriers, “anadromous fish stocks were historically absent from Elsie Lake” (Conlin et al. 2000). Third, the presence of stocked fish and access to the site for recreational use has created the potential for the introduction and spread of disease and non-native species. Lastly, it is highly likely, that the size of the reservoir in combination with reduced habitat complexity and the presence of fish have resulted in a barrier to movement for some amphibians between different areas of the watershed. However, the extent of use of the reservoir by amphibians has not been assessed (e.g., species richness of breeding amphibians).

2.0 GOALS AND OBJECTIVES

The objectives for this project in 2008 were to:

- 1) Confirm whether amphibians breed in Elsie Lake;
- 2) Determine the distribution of small wetland habitats and associated aquatic-breeding amphibians within a 1-km radius of Elsie Lake;

- 3) Construct small, productive, ephemeral wetland habitats primarily for use by native amphibian species; and
- 4) Develop and deliver a workshop for various agencies involved with wetland construction that outlines the importance of small, ephemeral sites, provides standard techniques, and fosters opportunities for partnerships

Although the primary focus of this project was amphibian populations, numerous other wetland-associated flora and fauna will benefit from an increase in the variety of wetland habitats available in the area.

3.0 STUDY AREA

The Ash River watershed is located on central Vancouver Island north of Port Alberni (Fig. 1). The area is located within the South Island Forest District and the Coastal Western Hemlock biogeoclimatic zone. Elsie Lake sits at an elevation of approximately 320 m and is 672 ha in size (7 km long and 1 km wide). The normal drawdown range of the lake is 15 m. The mean and maximum depths of the lake are 8 m and 30 m respectively. The majority of the area surrounding the lake consists of mature second growth forest approximately 20-60+ years old.

Amphibian and small wetland surveys took place within a 1-km radius around Elsie Lake in order to map their distribution in relation to standard dispersal distances for amphibians. All small wetlands less than 1 ha in size were mapped and surveyed. Potential wetland construction sites were assessed throughout the south end of the Ash River watershed from Elsie Lake to south of Dickson Lake. This area was affected by drawdown as outlined in Section 3.4 Objectives 2 and 3 of the BCRP Strategic Plan for the Ash River Watershed (Conlin et al. 2000). Only sites in recent clearcuts were considered for construction.



Figure 1. Elsie Lake in the Ash River watershed is located north of Port Alberni on Vancouver Island.

4.0 METHODS

4.1 *Small Wetland and Elsie Lake Surveys*

Island Timberlands donated time and resources to map all small wetlands on their private forestry land within a 1-km radius of Elsie Lake. Map features included:

1. Stand age / type (e.g., < 10 years, 11-20, 21-60, 61+, scrub)
2. Roads
3. Water features (lakes, large wetlands, rivers, streams)
4. All small wetlands < 1 ha in size
5. Contour lines
6. Other identifiable features (e.g., dams, parking lots, landings, gravel pits)

All small, mapped wetlands were ground-truthed and surveyed for amphibians from May to July 2008. Any incidental, unmapped small wetlands encountered within 1 km of the lake were also surveyed and their location recorded with a hand-held GPS. Each wetland was surveyed visually for amphibians. All life stages of amphibians observed and the general habitat features of each wetland were recorded (e.g., length, width, canopy cover, percent cover of emergent vegetation, water depth, etc.). A photo was taken of each site.

In addition to visual surveys for amphibian eggs in Elsie Lake in May, unbaited, mesh funnel traps were used to survey amphibian larvae in early August. A total of 58 traps were set in shallow shoreline areas throughout the lake over night and in shallow side pools. All individuals captured were recorded and released, including incidental macroinvertebrates. Trap locations were recorded with a hand-held GPS.

4.2 *Small Wetland Construction*

Small wetland construction and the associated workshop were run under the guidance of Thomas Biebighauser from the U.S. Forest Service who has built almost 1,000 wetlands during his career (see Biebighauser 2007).

During the small wetland surveys, potential wetland construction sites were assessed throughout the study area. Sites targeted were those with relatively clear access for machinery (e.g., road access), in recently harvested areas (i.e., to avoid the removal of trees), and suitable soil conditions to hold surface water or provide access to ground water. At potential wetland construction sites, a test hole was dug using a post-hole digger and a soil sample was collected at a 1.0 m depth. Soil samples were sent to T. Biebighauser to assess. The presence of ground water within the hole was also recorded. Each test location was recorded with a GPS.

Wetland construction was originally scheduled to occur in concert with the wetland construction workshop at the end of July. When T. Biebighauser arrived on site in July, all potential construction sites that had been identified were revisited and new sites were assessed. Once suitable sites were found, representatives from Island Timberlands visited the sites to give final approval for construction. However, extreme fire risk at that time prohibited construction—Island Timberlands would not allow machinery operation during the time of the workshop. Wetland construction was rescheduled for September 2008 at three sites southeast of Elsie Lake.

4.3 *Wetland Construction Workshop*

The wetland construction workshop scheduled to take place July 28/29, 2008 in Port Alberni was advertised on the Registered Professional Biologist listserv in April 2008. A maximum of 35 participants were accepted for the 1.5-day workshop. T. Biebighauser was the principle instructor for the course, while E. Wind organized the workshop and instructed a section on aquatic-breeding amphibians.

5.0 RESULTS

5.1 Small Wetland and Elsie Lake Surveys

The map that Island Timberlands provided of all small wetland within 1 km of Elsie Lake showed approximately 25 small wetlands in the vicinity of the lake (Fig. 2). Of these mapped wetlands, 19 were ground truthed and 18 surveyed for amphibians; one was a rock outcrop. Three of the 19 mapped wetlands were wetland complexes (i.e., multiple wetlands), consisting of seven additional wetlands. As a result, 25 mapped wetlands and Elsie Lake were surveyed. In addition to these, 20 unmapped wetlands were encountered during ground truthing, 15 of which were surveyed for amphibians. Nine small wetlands were also surveyed below the high water mark of Elsie Lake during surveys of the lake itself. From this, the total number of water bodies surveyed in 2008 was 50. The majority of mapped and unmapped wetlands occurred on the northeast side of Elsie Lake (Fig. 3a).

Of the 50 sites surveyed visually and/or with funnel traps, amphibians were observed at 41 (82% of wetlands; Fig. 3b and Appendix 1). Five amphibian species were observed— Northwestern Salamanders (*Ambystoma gracile*; 28% of sites), Long-toed Salamander (*Ambystoma macrodactylum*; 14%), Rough-skinned Newt (*Taricha granulosa*; 14%), Red-legged Frog (*Rana aurora*; 38%), and Pacific Treefrog (*Pseudacris/Hyla regilla*; 50%). The greatest number of species found at any given site was three (seven sites had at least three species breeding), and the median was one. Both anuran species frequently occurred together—e.g., 75% of Red-legged Frog breeding sites also had breeding Treefrogs.

Only one egg mass was observed during the spring visual survey of Elsie Lake on May 9, 2008, that of a Northwestern Salamander. The water level at this time was below the high water mark and nine side pools were identified and surveyed for amphibians, mostly along the northeast shore (e.g., Fig. 3 and 4). Four amphibian species were found in five of the side pools in spring (174-178; see Appendix 1). During a site visit on May 20, the reservoir appeared full and all side pools were likely now connected to the lake. The side pools were resurveyed in August when water levels in the lake were once again below the high water mark. All but two of the pools were too shallow or dry to trap. Traps were set in two side pools (116 and 117) in August and four species were captured, including Red-legged Frog tadpoles; no eggs or amphibians were observed in these pools in May.

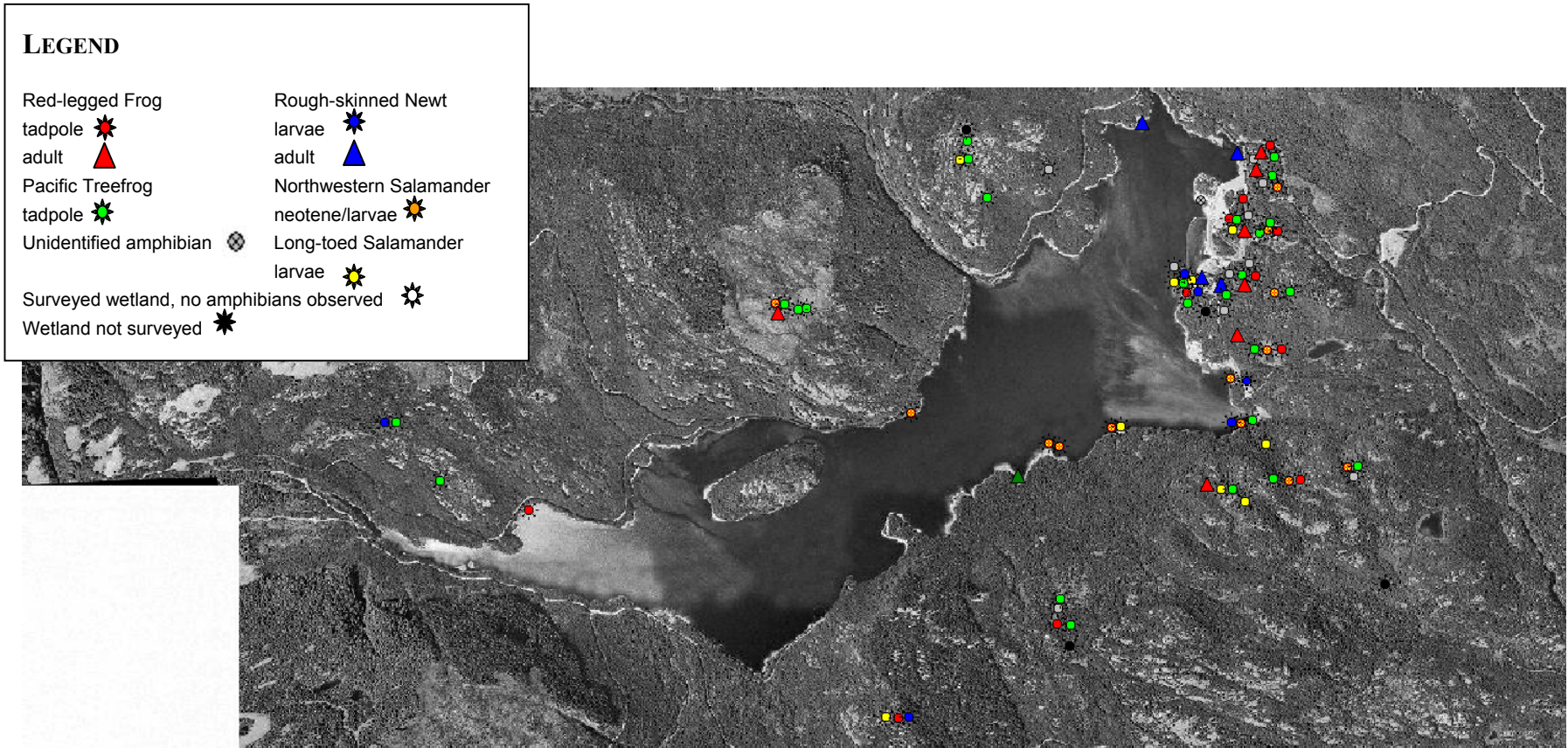
A total of 10 individuals of four species were captured in 67 traps set in Elsie Lake, including Red-legged Frogs (Table 1). Capture rates in Elsie Lake were relatively low compared to other lakes sampled on Vancouver Island (E. Wind, pers. obs.). Both Red-legged Frog tadpoles captured in Elsie Lake were found at the northwest end of the lake on a shallow shelf (Fig. 2 and 5).

Table 1. Species and life stages of amphibians captured in 67 funnel traps set in Elsie Lake.

Species	Life Stage	Number trapped
Northwestern Salamander	neotene/larva	2
Rough-skinned Newt	adult	2
	larva	3
Unidentified salamander	larva	1
Red-legged Frog	tadpole	2
Pacific Treefrog	tadpole	(incidental obs.)



Figure 2. The map produced by Island Timberlands showed approximately 20 small wetlands within 1 km of Elsie Lake (blue line).



b) Amphibian species and life stages observed.

Figure 3. Distribution of small wetlands and amphibians in and around Elsie Lake in 2008.



a) Side pool of Elsie Lake where Red-legged Frog tadpoles were captured in funnel traps in August (see WP 117 Appendix 1).



b) Side pool created by tire tracks that contained numerous Treefrog egg masses and calling adults in May (WP 175).



c) Side pool that contained breeding Northwestern Salamanders and Rough-skinned Newts in May (WP 174)

Figure 4. Examples of side pools below the high water mark of Elsie Lake searched visually and/or funnel trapped for amphibians in spring and summer 2008.



Figure 5. Shallow shelf along northwest shore of Elsie Lake where Red-legged Frog tadpoles were captured.

5.2 Small Wetland Construction

It was very difficult to find sites that could allow the construction of either a surface or groundwater fed wetland in the Ash River watershed. The lack of young clearcut areas near Elsie Lake precluded wetland construction in that area. In harvested areas, soils were too rocky and no ground water could be found near the surface. As a result, the wetlands were constructed farther from Elsie Lake (i.e., the BC Hydro impact area) than originally planned (Fig. 6 and 7).

A medium sized (200-series) excavator with a bucket and thumb attachment was moved to the first of three sites on Sept. 22, 2008 and construction lasted for five days. Eight of the wetlands were constructed using the ground water technique and one used the surface wetland technique (i.e., clay soils were compressed and shaped to hold surface water; Biebighauser 2007). Two bucket sizes were used, a smaller 36-inch wide bucket for handling trees and stumps and a 60-inch bucket for removing and spreading soil. The total cost for constructing the nine wetlands is summarized in Appendix 2.

Wetland construction consisted of the following steps:

1. Flagging (ribbon) was hung along the upper boundary of the to-be constructed wetland (an indicator to the operator of the maximum extent of vegetation clearing)
2. All downed wood, stumps, and vegetation were removed from inside the flags to the outside – clumps of native plants were saved (set aside)
3. All topsoil was removed and saved as well
4. A rod and level were used to identify the lowest point along the wetland rim (i.e., exit point for water during peak flooding)
5. A test hole was dug in the centre of the wetland to determine current ground water depth and estimated maximum water depth in spring (this was compared to ground water depths measured in spring)
6. The maximum depth of the wetland and the slope of the shorelines were calculated based on area, ground water depth, and wetland rim low point
7. The wetland was dug and the spoil spread throughout the outside area of the wetland
8. The clumps of salvaged plants and some downed wood were placed randomly along the upper slopes of the wetland and over the spoil
9. The area was sparsely seeded with winter wheat to prevent erosion (fast germinating, grows in fall/winter, and will not self reproduce)
10. Straw was spread as mulch over the site to prevent erosion. Although great efforts were made to find a clean source of mulch, a non-native, invasive plant species (i.e., reed canary grass) was shipped to site 1 and some was distributed over the wetland before it was identified. The remaining bales were

removed from the site and as much of the material as possible was removed by hand and burned. Continued observations will be needed to ensure that reed canary grass does not take over the site.

Nine wetlands were constructed in three clearcut areas for a total wetland area estimated to be 971 m². The approximate size, depth, and type of wetlands constructed are summarized in Table 2. Site 1 consisted of three wetlands built into a low area that had ground water near the surface. Sites 2 and 3 were drainages above and below logging roads that contained logging debris. The debris was removed and depressions dug deeper to hold more water, longer. A summary of before and after photos of each site can be found in Appendix 3. The wetland construction project obtained front-page media coverage with a local Port Alberni newspaper (see Appendix 4).

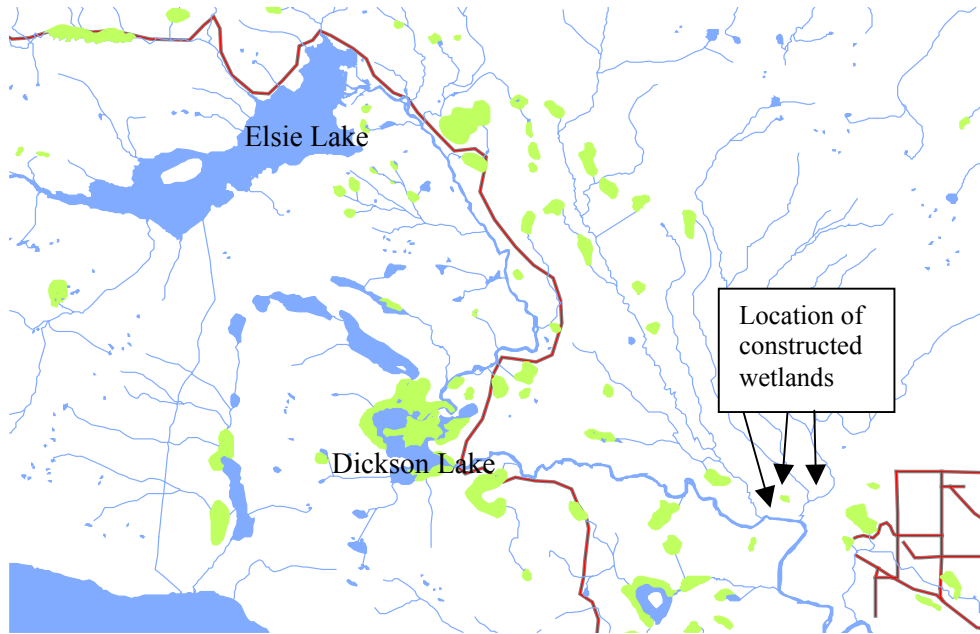


Figure 6. Location of constructed wetlands relative to Elsie Lake.

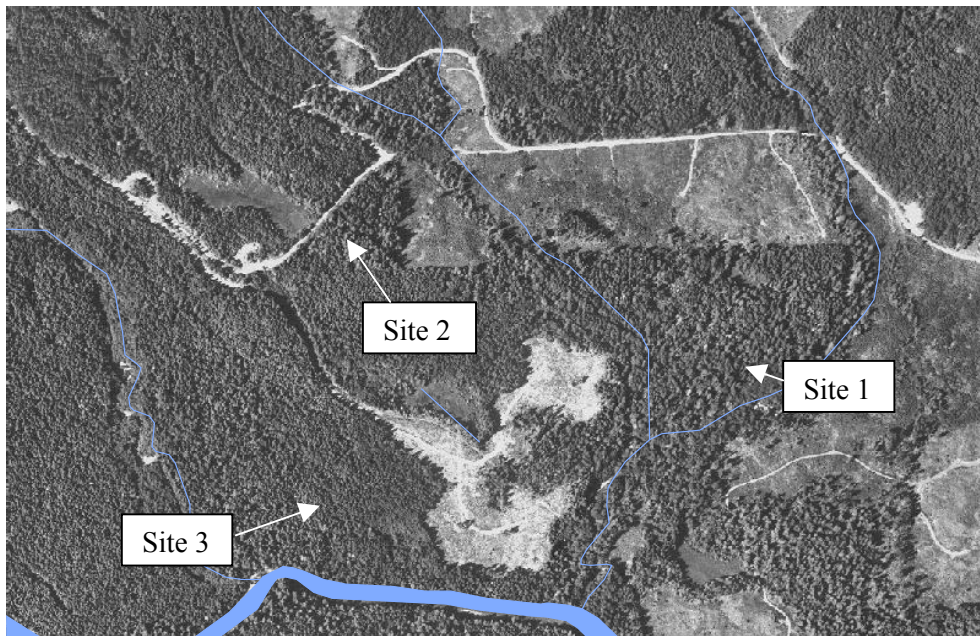


Figure 7. Location of constructed wetlands (*note*: all sites were in recently harvested areas).

Table 2. Number, size, and type of wetlands constructed near Port Alberni, BC in 2008.

Site	Pond	Construction Area (m ²)	Max. water area (m ²)	Estim. max. water depth (cm)	Construction / Wetland Type
1	A	690	120	100	ground water wetland
	B	1696	385	150	ground water wetland
	C	576	273	122	ground water wetland
2	A	126	70	150	surface wetland created
	B	36	12	40	wetland restoration and enhancement
	C	23	9	40	wetland restoration and enhancement
	D	25	10.5	40	wetland restoration and enhancement
3	A	75	56	60	wetland enhancement
	B	77	35	30	wetland enhancement
TOTAL		937	971	Average = 82	

5.3 Wetland Construction Workshop

Interest in the wetland construction workshop was overwhelming and registration was full in less than 10 days. Registrants included individuals from consulting companies, government, and NGO's / stewardship groups. The majority of participants were from BC, but included individuals from as far away as Calgary and Yellowknife.

Once it was confirmed that construction was not possible due to fire risk, the possibility of building a wetland on another site was investigated (e.g., on private property in town, such as the Hupacasath House of Gathering). No alternatives could be found on such short notice so the workshop structure was changed to a combination of in-class instruction, visits to existing wetland sites (natural and constructed), and numerous hands-on activities to teach wetland construction techniques. A popular activity was T. Biebighauser's "Wetland in a Box" where participants used techniques they had learned during the day to build a miniature wetland appropriate to the conditions created in the box in terms of soils, water source, and possible drainage issues (Fig. 8).



Figure 8. Wetland construction workshop participants discuss and compare their "Wetland in a Box" activity results.

6.0 DISCUSSION

Numerous small wetlands exist around Elsie Lake for amphibian breeding. Island Timberland's map showed only half of the existing small wetlands around the lake, reinforcing the need to ground truth areas and record the location of all small wetlands encountered. The location and density of the mapped and unmapped wetlands was not evenly distributed around the lake. The majority of wetlands were located on the northeast side of the lake. This area has relatively gentle slopes, resulting in a high density of wetlands, and some older forest (aged 61+ years). It is also the area with the greatest human presence and disturbance (e.g., the dam, high road density, boat access, campsites, etc.). The south, west, and north sides of the lake have steeper slopes and wetlands were frequently found on hilltops, singly or in small clusters. In this case, the distance between amphibian breeding populations may be a kilometre or more.

Amphibians used the majority of small side ponds situated below the high water mark of Elsie Lake for breeding. These shallow pools are attractive for breeding because they are warmer than deeper water bodies in spring (such as Elsie Lake). The high richness and abundance of amphibians in pools immediately adjacent to the lake may reflect a preference for these ponds or an avoidance of the lake. However, the origin of species found in the lake was unclear—eggs may have been missed during visual surveys, or larvae may have come from side ponds that flooded after breeding. The side ponds become inundated when lake waters rise after breeding, exposing eggs and larvae to colder water and predation (e.g., fish). Larvae in the lake are likely attracted to shallow, shelf areas of the lake during their development, which may trap them in isolated ponds when water levels drop rapidly in summer—e.g., the lake level dropped by at least 10 cm overnight when we trapped the area on Aug. 7. As such, the timing and duration of low and high water levels likely affects the breeding success of local amphibians.

Of the two potential listed amphibian species in the area, Red-legged Frogs bred in many of the wetlands around Elsie Lake. In fact, it was one of the most common species observed. However, its abundance in Elsie Lake was very low. It was disappointing to not find any signs of breeding by Western Toads (*Bufo boreas*) in the Elsie Lake area. One adult was observed approximately 10 km southeast of Elsie Lake, just west of Moran Swamp. This species is believed to be declining on Vancouver Island and breeding sites are relatively rare (Wind and Dupuis 2002). The non-native and invasive American Bullfrog (*Rana catesbeiana*) was not observed in the area even though the species occurs in Port Alberni.

It was difficult to find wetland construction sites around Elsie Lake where either surface or ground water techniques could be used. If a liner were used, a small, ephemeral wetland could be built on any level ground, especially given the amount of precipitation the west coast receives. However, this increases the cost of each wetland by at least \$3,000 (the nine wetlands constructed in 2008 cost an average of \$1,222 each). The uneven distribution of wetlands available for amphibians around Elsie Lake and the challenges associated with finding suitable construction sites suggests that replacing lost wetland habitat is not easy or inexpensive and that protecting existing wetland habitat is important for amphibians.

Wetland construction is commonly used to compensate for lost habitat. However, our ability to replace a functioning wetland habitat is unclear and the technique is not widely supported. A study in Washington State found that only 13% of compensatory wetland-mitigation projects were fully successful, and that 60% of constructed wetlands were at least moderately successful (Johnson et al. 2002). Numerous objectives may exist in relation to wetland construction projects but long-term monitoring is needed to identify what objectives can be realistically met with construction / compensation. The majority of our native amphibian species will use constructed wetlands for breeding and may be one of the best groups targeted for conservation using this technique.

7.0 RECOMMENDATIONS

- Monitor amphibians in side pools below the high water mark of Elsie Lake to determine whether these habitats are acting as reproductive sinks (e.g., adults are attracted to breeding there, larvae are trapped in areas that dry prematurely)
- Adjust the timing of low and high water in Elsie Lake to reduce impacts to amphibians. If that is not possible, consider reshaping some shoreline areas to
 - isolate ponds so that they are not impacted by a rise in lake levels, and/or
 - create deeper pools to ensure they hold water longer in the summer
- Support more wetland construction workshops as interest is high and the technique is being widely used to compensate for lost wetland habitat
- Build more small wetlands in the Elsie Lake area, especially where wetlands are scarce. Island Timberlands is interested in this technique and the area now has a qualified, experienced machine operator.
 - Consider using liners to expand the number of potential sites where wetlands can be built
 - Make efforts to exclude 4-wheel drive trucks and ATVs (e.g., build in out of the way areas, place logs along shorelines)
 - Non-native plant species are problematic (e.g., use of common names) and need to be investigated thoroughly when constructing a wetland. Don't trust local knowledge—identify plant species yourself. Agriculture Canada promotes the use of plants such as reed canary grass so it can be difficult to keep it out of the site. Many plant species promoted in nurseries can also be invasive, such as cattails, duckweed, milfoil, pond lilies, and iris.
- Continue monitoring the constructed wetlands
 - work with Island Timberlands to use the site as a model for wetland construction, partnerships, and education
 - remove invasive plant species as needed to avoid invasion and infilling
 - record amphibian species using the site for breeding
 - record water levels and hydroperiod to ensure that the sites retain water long enough for successful breeding; adjust the site as needed (e.g., make them deeper if they are drying too quickly and acting like sinks)

8.0 ACKNOWLEDGEMENTS

Financial support for this project was provided by the BC Hydro Bridge Coastal Fish and Wildlife Restoration Program. The Hupacasath First Nations provided a field assistant, maps, reports, access information, and use of their facility for the wetland construction workshop—Steve Tatoosh and Aaron Hamilton provided logistical support for fieldwork and the workshop. Island Timberlands developed maps of small wetlands around Elsie Lake and allowed wetland construction to occur on their land—thanks to Ken Epps and Rod Christie for their support. Thomas Biebighauser donated personal time and materials to the wetland construction workshop. Jim Cuthbert helped obtain local media coverage about the construction work. A special thanks to Tony Tatoosh for his assistance with small wetland surveys and to Julie Micksch for kayak surveys on Elsie Lake.

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APPENDICES

Appendix 1. Wetland sites surveyed in 2008 in the Ash River watershed north of Port Alberni.

a) Amphibian data per site

Site ID	Easting / Lat	Northing / Long	Visual survey &/or funnel trap	NWSA ^a N/L ^b	LTSA L	RLFR A/J & L	RSNE A & L	PTFR L	IT Mapped	Nothing observed	Not surveyed
Elsie Lake			VS & FT	E/N/L		L	A		Y		
694	49.46155	-125.10819	VS				A		N		
695	346322	5481708	VS						N	X	
174	49.45560	-125.10396	VS	L			L		N		
175	49.45307	-125.10193	VS					L	N		
176	49.45258	-125.11550	VS	L	L				N		
177	49.45142	-125.12058	VS	L					N		
178	49.45150	-125.12122	VS	L					N		
116	49.46127	-125.10781	VS & FT		L		A,L&inc.	L	N		
117	49.46089	-125.10805	VS & FT			L	L	L	N		
702	347572	5481335	VS			L		L	N		
703	347601	5481294	VS		L?	A/J only		L	N		
704	347859	5481303	VS	N/L		L		L	Y		
704a	347702.6	5481327.4	VS						Y	X	
705	347673	5481465	VS			L			Y		
706	347794	5480421	VS	N/L		L		L	Y		
707	347595	5480530	VS			A/J only			N		
708	347861	5480814	VS	N/L				L	N		
709	347735	5480935	VS			L		L	Y		
710	347692	5480935	VS			A/J only			N		
712	347632	5480945	VS						N	X	
713	347700	5480985	VS						N	X	
714	347488	5480873	VS				A		N		
715	347506	5480815	VS					L	N		
716	347503	5480703	VS						N	X	
717	347428	5480712							N		X
734	348543	5482451	VS	N/L		A/J only		L	Y		
735	347781	5481720	VS						Y	X	
736c	347777	5481655	VS			A/J only		L	Y		
736d		VS							Y	X	
737	347822	5481779	VS			A/J only			Y		
738	347822	5481779	VS			L		L	Y		
739	347861	5481585	VS	N/L					N		
W4	347901	5479522	VS	N/L		L		L	Y		
W5	348318	5479603	VS	N/L				L	Y		
W1	347424.8	5479476.0	VS		L	A/J only		L	Y		
744	347589	5479385	VS		L				N		
743	347609	5479408							N		X
745	347755	5479779	VS		L				N		
W01	346260	5478752	VS					L	Y		
746	346246	5478691	VS						N	X	
W02	346234	5478583	VS			L		L	Y		
W03	345985	5478767	VS	N/L		L		L	Y		
749	346311	5478428							N		X
W04	345006	5477975	VS		L	L	L		Y		
W05A	348318	5479604	VS						Y	X	
W05B	341961	5479688	VS					L	Y		
W06	341591	5480097	VS				L?	L	Y		
W07	344364	5480839	VS	N/L				L?	Y		
002	344410	5480877	VS			A/J only			N		
08	344587	5480796	VS					L	Y		
003	344524	5480790	VS					L	N		
10A	345768	5481917	VS					L	N		
10	345781	5481951							Y		X
09	345708	5481790	VS		L			L	Y		
11	49 28 40.52 125 06 00.43		VS					L	Y		

^a NWSA=Northwestern Salamander; LTSA=Long-toed Salamander; RSNE=Rough-skinned Newt; RLFR=Red-legged Frog; PTFR=Pacific Treefrog

^b N=Neotene; L=Larva; A= Adult; J=Juvenile; inc.=incidental observation

b) Habitat data per site

Pond ID	Date	Length	Width	Percent Cover										% Searched		Comments		
				W. Temp.	W. Depth	canopy	cwd	trees	shr	moss	herb	gram	sh wat	open w	wtld		shore line	
Elsie L.	09-May-08			13.8														
694	09-May-08	8	3	15	20													side pool below high water of Elsie Lake
695	09-May-08	8	3.5	12	50													side pool below high water of Elsie Lake
174	09-May-08	15	5	18	15													side pool below high water of Elsie Lake
175	09-May-08	15	1	7														side pool below high water of Elsie Lake
176	09-May-08	15	12	20	15													side pool below high water of Elsie Lake
177	09-May-08	12	5	17	43													side pool below high water of Elsie Lake
178	09-May-08	40	15	21	13													side pool below high water of Elsie Lake
116	09-May-08	12	60															side pool below high water of Elsie Lake
117	09-May-08	12	60															side pool below high water of Elsie Lake
702	20-May-08	33	7	14	55	10	5	0	45	0	10	trace	5	40	80			
703	20-May-08	15	5	14	42	20	15	0	15	0	trace	25	100	50	90			
704	20-May-08	75	30	13.8	300+	trace	trace	0	5	0	trace	5	5	100	10	100		beaver sign and fish boggy channel between 704 and 705
704a	20-May-08																	
705	20-May-08	35	5	15	150	5	trace	0	5	5	0	5	50	95	85	85		
706	21-May-08	175	175	17	150	trace	5	5	30	40	trace	10	15	90	25	100		
707	21-May-08	17	12	10.2	55	35	20	0	10	10	5	5	95	95	95	100		
708	21-May-08	55	40	17.5	50	trace	trace	20	50	25	trace	5	100	95	20	90		
709	21-May-08	60	15	16	30	trace	trace	trace	45	trace	5	10	100	80	85	85		
710	22-May-08	22	10	11	75	10	trace	0	60	0	0	30	55	35	80	10		
712	22-May-08	40	10	11	17.5	15	35	20	20	trace	5	60	100	75	75	75		
713	22-May-08	25	12	10	45	35	15	0	60	trace	trace	trace	100	40	80	60		
714	22-May-08	15	15	13	46	10	trace	0	20	0	30	25	100	90	90	20		
715	22-May-08	35	25	14.2	45	trace	5	0	40	0	10	trace	100	95	100	90		
716	22-May-08	25	12	10.8	48	20	20	0	35	90	trace	trace	100	30	90	40		
717	22-May-08	30	10	N/A	80	25	5	0	25	10	trace	10	N/A	N/A	N/A	N/A		pond is dry
734	04-Jun-08	55	35	10.5	36	trace	10	trace	45	trace	10	10	100	80	40	40		
735	04-Jun-08	30	15	15	10	10	trace	trace	90	trace	10	10	100	trace	10			
736c	04-Jun-08	20	8	12	39	5	trace	0	10	trace	10	50	100	30	75			
736d	04-Jun-08	25	8	11.5	39	35	5	0	40	trace	5	trace	100	50				
737	04-Jun-08	15	10															
738	04-Jun-08	30	7	13	46	trace	10	0	25	trace	trace	15	100	60	85			
739	04-Jun-08	60	15	12	42			trace	70	trace	trace	65	100	25	20			channel dammed by road
W4	05-Jun-08	130	25	15	75	trace	trace	5	40	5	5	5	50	75			100	lots of algae
W5	05-Jun-08	80	60	15	85	trace	trace	10	45	45	trace	5	40	95			75	
W1	05-Jun-08	80	10	14.9	22	5	5	trace	25	trace	trace	40	100	25	80			
744	05-Jun-08	35	8	10.8	33	15	25	0	5	0	10	20	100	60	65			surveyed quickly
743	05-Jun-08																	not surveyed
745	05-Jun-08																	not surveyed
W01	06-Jun-08	40	25	15.5	16	trace	10	0	20	5	trace	25	100	5	75			
746	06-Jun-08																	
W02	06-Jun-08	70	20	17	48	trace	5	trace	30	0	trace	10	100	90	80			
W03	06-Jun-08	120	35	13.9	75	trace	5	5	50	40	trace	20	80	80			80	
749	06-Jun-08																	not surveyed or data collected
W04	06-Jun-08	35	20	23	28	trace	5	0	20	0	trace	10	100	85	50			
W05A	01-Jul-08	20	8	26	40	5	0	0	10	0	trace	90	100	trace	75			
W05B	01-Jul-08	35	12	27	37	trace	10	0	15	trace	25	20	100	35	90			
W06	01-Jul-08	65	25	18	76	trace	trace	5	95	15	5	85	60	55	90			
W07	01-Jul-08	70	35	28	80	0	trace	trace	25	50	40	15	25	35	90			alligator lizard (saw one on road up as well)
002	01-Jul-08																	not surveyed or data collected
08	01-Jul-08			26.5	61	trace	trace	5	80	trace	10	30	100	50	50			
003	01-Jul-08	17	17	26.5	80													little data collected
10A	02-Jul-08	28	15	23.5	30	5	5	trace	10	5	30	60	100	15	60			
10	02-Jul-08																	rock outcrop? (or coordinates off?)
09	02-Jul-08	30	20	25.5	65	trace	15	0	trace	trace	10	15	95	80	75			
11	02-Jul-08	65	20	31	15	trace	trace	0	20	trace	20	60	100	trace	75			

Appendix 2. Wetland construction materials and costs to build nine small wetlands near Port Alberni.

Item	Cost
Wages for wetland construction expert	\$400/day x 5 days = \$2000
Tile probe to check ground water level	\$50
Hay bales and shipping (mulch)	\$450
Winter wheat (to seed site and prevent erosion)	\$130
Machinery operator, usage, and transport	\$8370
TOTAL	\$11,000
Cost per wetland	\$1222

Appendix 3. Pre and post images of constructed wetlands.



Overview of site pre construction



Overview of site post construction, with wetlands A to C completed



Partially filled wetland B post construction

a) Site 1



Wetland A pre construction



Wetland A post construction

b) Site 2



Pre construction



Wetland A and B post construction

c) Site 3



SUSAN QUINN/Alberni Valley News Biologists Elke Wind, left, of Nanaimo and Tom Biebighauser from the U.S. Forest Service have built a series of wetlands that they hope will rejuvenate amphibians near Wolf Creek. Alberni Valley News

BUILDING SOMETHING FROM NOTHING

By Susan Quinn - Alberni Valley News

Published: October 02, 2008 1:00 PM

In a small clearing down a bone-jarring, winding logging road and upstream from Wolf Creek, an excavator methodically digs a hole in the scrub. The 100-horsepower motor competes for decibels with the chainsaw of an independent logger just up the road. Behind the excavator, four people in bright orange workvests can be seen gathered around the sides of a depression seemingly littered with the detritus of a clearcut: stumps pulled out by the roots and knocked over, and pieces of rotting logs jutting up a gentle slope.

The insects and noseems are relentless on a recent sunny morning, perhaps drawn by the stagnant water gathered in the bottom of the depression. But the biologists don't notice: they are too excited about the area, a pilot project for a manmade wetland.

"It looks messy," Tom Biebighauser says, surveying the area. Biebighauser is a wildlife biologist with the USDA Forest Service in Kentucky and is considered the premier builder of manmade wetlands in North America. He has built more than 700 seasonal, permanent, emergent and forested wetlands since 1988. He was in Port Alberni last March to present a workshop on creating wetlands.

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Spend a little time walking the circumference of the depression and order can be found: the stagnant water is a combination of groundwater and rainwater from a recent storm, collected in the bowl of the clay-filled soil. The rotting logs have been placed pointing up the slope, to give native plants a place to take hold.

Barley has been spread on the ground, awaiting the next solid rainfall, to root quickly and provide a ground cover so the soil doesn't erode. The area has also been covered with hay, again to deter soil erosion.

Elke Wind of Nanaimo is the biologist looking after this particular project. The funding comes from BC Hydro as compensation for wetlands lost during a hydroelectric dam at Elsie Lake. The project comprises three wetlands, the largest being 15 metres by 40 metres. (She is also working on another project within the footprint of Elsie Lake.)

Wetlands don't need to be big, Wind said. Location is most important; these wetlands are vernal pools, designed to dry out every year so bullfrogs or fish won't survive. Wind is hoping that different types of tree frogs will flourish, along with abundant insects.

Wetlands are important to a region because of their biodiversity, says Jim Cuthbert, a biologist with The Land Conservancy of B.C. "They have been largely lost through primarily development and other changes...in land use. Wetlands are very vulnerable to losing their existence," he said, because they are usually found in flatland valleys, also a draw for development. "This program is intended to try and reverse that trend, if possible."

The Land Conservancy is involved because its mandate is to protect lands for public access, as well as to protect farmland. The TLC is interested not only in knowing how to build a wetland themselves, but to apply the knowledge on some of their own sites, Cuthbert said. He pointed to Madrona Farm in Saanich, which the TLC has an agreement to manage, where a wetland would benefit the region by attracting more insects and animals.

Ian McIntosh is one who has already put this tool to good use at the Toronto Zoo, where he co-ordinates a wetland conservation program and Adopt-A-Pond. McIntosh was at the Comox Main wetlands site to learn more from Biebighauser – this was McIntosh's third workshop with the American biologist.

McIntosh built two wetland habitats for tree frogs and wood frogs at the zoo, and says he wants to get more involved in creating wetland habitat in Ontario.

Dave Barrett of North Vancouver was also onsite. The forestry consultant is looking at getting into building wetlands as a private contractor.

Biebighauser smiles at the thought. "Most wetlands are being built because they have to in the States," he said. "It is a wonderful situation where we can build wetlands because it's a good thing for the environment."

Island Timberlands has donated the land for the three small wetlands, Wind said. One of the reasons the site is so far away from Elsie Lake is because Wind promised Island Timberlands that the site would not impact on their logging operations, and that she would use a site that had already been logged. The project needed certain soil conditions and groundwater access, and "this was the only place we could find that was suitable," she said.

“Although we can build wetlands to compensate for lost habitat, it’s very difficult to find suitable places for them.”

Wetlands ideally exist in valley floors and near rivers. Choose a poor location and you could lose the water in your wetland, Cuthbert said.

Island Timberlands considers the arrangement win-win. “It’s not because we have to,” forest management analyst Ken Epps explained. “It’s because it’s in a research phase, we’d like to see if it does work.

“We support this kind of thing. It’s a matter of providing an opportunity for them to do the research.”

Epps said it was an easy decision to relinquish the land for several reasons. The total area is not that large and it is not taking up productive land.

“This could be a potential tool of the future for us,” he said.

What do you think? Give us your comments by fax at 723-6395 or by e-mail: editor@alberniavalleynews.com. Be sure to spell out your first and last names.

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