Phyllis Creek Watershed
Coast Tailed Frog Survey

Submitted to:

Doug Ransome, Wildlife Management Instructor
Fish, Wildlife & Recreation Program
British Columbia Institute of Technology
Burnaby, BC

And

David Marquis, R.P.F., Planning & Environment Forester
Terminal Forest Products Ltd
Richmond, BC

Submitted by:

Leah Proske
Jess Urquhart
Fish, Wildlife & Recreation Program
British Columbia Institute of Technology
May 16, 2004

ABSTRACT

Terminal Forest Products Ltd. has initiated an inventory for coast tailed frogs *(Ascaphus truei)* in the Phyllis creek watershed from October 2003 to May 2004. The objective of this study was to establish the presence of tailed frogs in the Phyllis creek watershed. Data collection included time-constrained searches consisting of searching an area for 60 person minutes and hand collecting tadpoles within each plot. Two creeks were found with ideal tailed frog habitat. Both creeks were surveyed for a total of 180 person minutes and only four tadpoles were found. The low number of tadpoles may be the result of high water events during data collection; tailed frogs become subterranean during high water events (RISK, 2000). This information will be used to determine appropriate timber harvesting techniques within this watershed as outlined in Terminal Forest Products Ltd. Tailed Frog Management Strategy (Appendix 3). Because tadpoles were found, a 50 m reserve adjacent to streams containing tailed frogs should be implemented.

ACKNOWLEDGEMENTS

We would like to thank David Marquis, R.P.F., Planning & Environment Forester for Terminal Forest Products Inc, for giving us the opportunity to conduct this survey. Thank you to Doug Ransome for helping us develop our sample plan and fine tune our report. A special thank you to Tom Saare for his expert advice on tailed frogs and, for guiding us in the right direction. We would also like to thank Bob Gunn for helping us obtain equipment. Finally, we would like to thank Dave Gill for familiarizing us with the area. All pictures are property of Jess Urquhart and Leah Proske unless otherwise stated.

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BACKGROUND & OBJECTIVES

The tailed frog *(Ascaphus truei* and *A. montanus)* ranges from northern California to southern British Columbia, extending into Idaho and Montana (USFWS, 2004). Within Canada tailed frogs are only found in British Columbia (MELP, 1998). British Columbia is the northern extent of the distribution of the tailed frog. Within British Columbia, in 2004, two separate species of tailed frogs were identified; the coast species *(A. truei*) and the Rocky Mountain species also known as the Kootenay populations *(A. montanus*) (MWLAP,2000) (Figure 1).

Tailed frogs are listed on Schedule 1 of the Species At Risk Act; the coast species is listed as special concern and the Rocky Mountain species is listed as endangered. The Species At Risk Act (Enviro. Can., 2003) is federal legislature which establishes species at risk within Canada and provides protection and recovery plans for those species. Schedule 1 of SARA is the official list of wildlife species at risk. All species that were previously designated at risk prior to 1999 by the Committee On the Status of Endangered Wildlife In Canada (COSEWIC) will be reassessed before being added to Schedule 1 of SARA. Once a species is listed on Schedule 1 measures to protect and recover this species are implemented.

Figure 1. Current distribution of the tailed frog in British Columbia showing the Rocky Mountain species *(Ascaphus montanus*) in red and the coast species *(A. truei*) in blue (MWALP, 2000).

Until the province wide inventories of Dupuis and Bunnell (1996), little was known about these two species in the province (Dupuis and Wilson, 1999). The Rocky Mountain species is isolated in a few small watersheds in the Rocky and Purcell Mountains and is on the provincial red-listed. The coast species extends from the Lower Mainland of BC north to the Prince Rupert area and is on the provincial blue-list.

> The Conservation Data Centre (CDC), in the Ministry of Sustainable Resource Management, assigns the provincial rank, which is based solely on its status within British Columbia. The Red list includes species that have been legally designated as Endangered or Threatened under the *Wildlife Act* (see below), are extirpated , or are candidates for such designation. The Blue List includes species not immediately threatened, but of concern because of characteristics that make them particularly sensitive to human activities or natural events. The Yellow List includes uncommon, common, declining and increasing species – all species not included on the Red or Blue lists (MSRM, 2004).

The newly implemented Forest and Range Practices Act has introduced results-based management, therefore requiring forest resource companies to conduct their own surveys for red-listed and blue-listed species (MoF, 2002). If red-listed or blue-listed species are present within their operations, resource use must be managed following Forest and Range Practices Act policy.

Due to the Forest and Range Practices Act and the Species at Risk Act Terminal Forest Products Ltd. has initiated an inventory for tailed frogs in the Phyllis Creek watershed. The objective of this survey is to establish the presence of tailed frogs in the Phyllis Creek watershed. The information obtained during this study will be used to determine appropriate timber harvesting techniques within this watershed.

LIFE HISTORY

Description and Reproduction

Tailed frog tadpoles can reach up to 65 mm before metamorphosis into adult forms, and in general, have a characteristic white spot on the tip of the tail (Figure 3). Tadpoles and adults can be slate-grey, black, olive or brown in color; some populations are very mottled. Adults have granular skin and range in size from 22 to 51 mm (Figure 2). Hatchlings are approximately 20 mm in length. Adults rarely move more than 50 m away from their natal stream, although they have been found up to 200 m away in wet weather (Dupuis and Wilson, 1999). In dry weather adults are typically found closer to their natal stream.

Tailed frogs possess several traits that enable them to survive in fast flowing streams; adults have large heads, streamlined bodies, no ear membranes, broad flattened outer toes, and vertical diamond shaped pupils. Males also possess a tail-like extension of the cloaca that serves to internally fertilize the female's eggs. Tadpoles have a ventrally flattened body and a vertically flattened tail so they can move around more easily in fast water. Tadpoles also have a disc shaped mouth that serves as a sucker to cling to rocks.

Figure 2. Photograph depicting the characteristics of adult tailed frogs *(Ascaphus truei & A. montanus)*; only the male (right) has a tail.

Figure 3. Photograph showing the characteristics of tailed frog *(Ascaphus truei & A. montanus)* tadpoles; note the mouth structure.

Tailed frogs do not reproduce until approximately eight or nine years of age and can live up to twenty-one years of age (Brown, 1990 in RIC, 2000). In autumn, males internally fertilize females using their copulatory organs. Females will store sperm over winter (delayed fertilization) and lay 35 to 70 eggs in summer. Delayed fertilization is due to the summer months exhibiting low stream flows. Hatchlings emerge about six weeks later, in August or September.

Habitat Requirements

Tailed frogs live in cool cascading streams that flow year-round, have coarse cobble substrate, and anchored boulders (Figure 4). Tailed frogs are found in streams with temperatures ranging from 0 to 16 ^{0}C, anything above 18.5 ^{0}C is lethal. Coast tailed frogs are found from sea level to 1180 m. Adults are both terrestrial and aquatic, and are thought to stay in or near their natal stream (Daugherty and Sheldon, 1982 in RISC, 2000). They are terrestrial foragers, consuming pseudo scorpions, ticks, mites, spiders, centipedes, millipedes, and a variety of adult and larval insects.

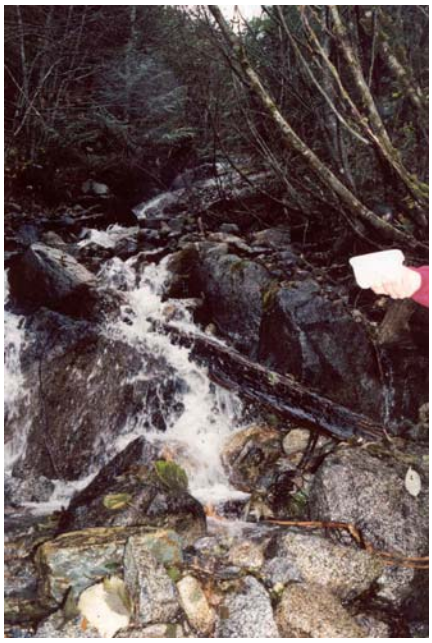

Figure 4. Ideal tailed frog *(Ascaphus truei)* habitat.

Tadpoles need large anchored boulders and interstitial spaces within the substrate to survive during high stream velocities. They will also use their vomerine teeth to scrape diatoms and algae off anchored boulders. Flooding, debris torrents, and logging can affect tadpoles adversely by filling in interstitial spaces with sediment. Tadpoles require overhanging trees and shrubs for protection from predators, sun and wind and to keep water temperatures low.

Cause for Concern

Tailed frogs are found in 1st, 2nd and 3rd order streams; those that do not contain salmonids (Bury and Corn, 1991 in RISC, 2000). From a management perspective these streams were viewed as less important and received little to no protection. Logging activities and road building remove streamside vegetation which provides protective cover and keeps streams cool and aerated. These activities also increase the amount of silt introduced into streams which can smother tadpoles.

In BC tailed frogs are at the northern extent of their range making them of special interest in terms of biogeography. “Declines in populations at the limit of their range may

alert attention to factors that could threaten the species as a whole” (Dupuis et al., in press, in RISC, 2000).

STUDY AREA

The inventory for tailed frogs was collected in the Phyllis Creek watershed located south of Britannia Beach (Figure 5). Phyllis Creek flows into Furry Creek before entering Howe Sound. Capilano watershed borders the headwaters of Phyllis Creek to the south east.

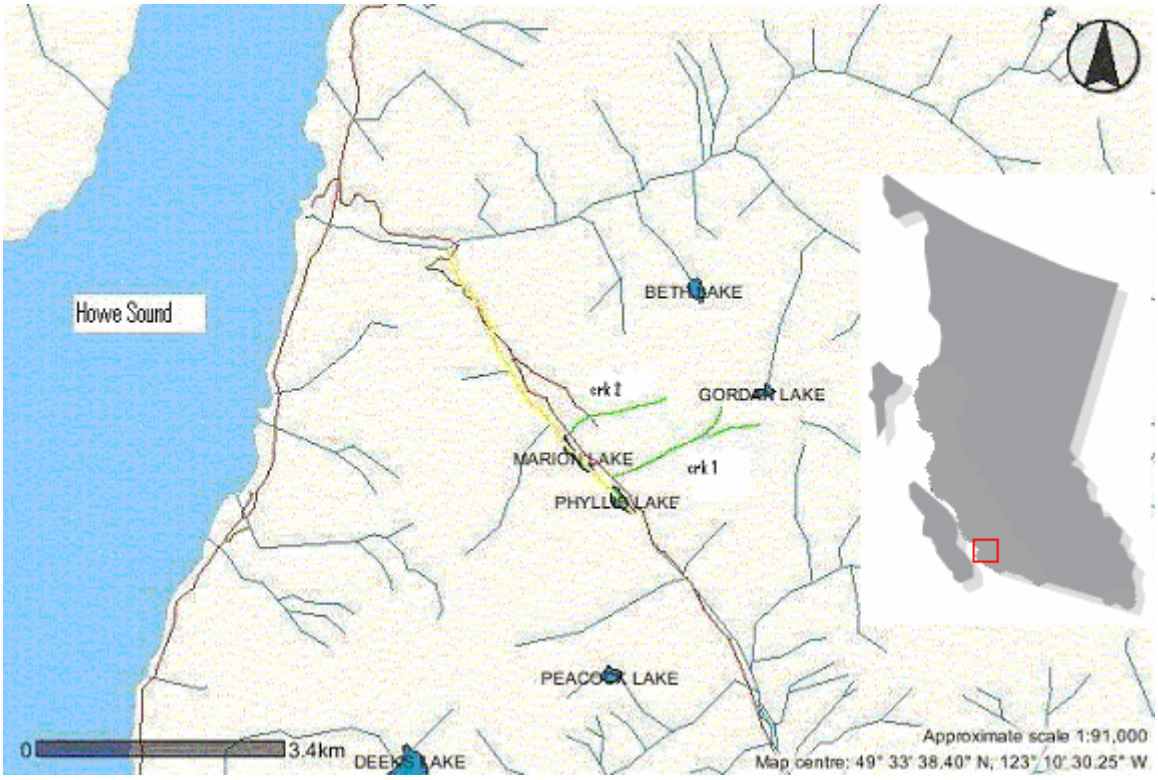

Figure 5. Phyllis Creek watershed, Squamish, BC; tailed frog *(Ascaphus truei)* study area. Creeks One and Two are highlighted in green. Phyllis creek is highlighted in yellow.

The watershed lies in the southwestern portion of the Coast and Mountains Ecoprovince in BC. As described in Ecosystems of BC (Meidinger and Projar, 1991), biogeoclimatic zones include Coastal Western Hemlock (CWH), Mountain Hemlock (MH) and Alpine Tundra (AT). The CWH zone occupies elevations from sea level to approximately 1000 m. It has a mean annual temperature of 8 ^{0}C and mean annual precipitation is 2228 mm. The CWH zone has a cool mesothermal climate of cool summers and mild winters. The MH zone occupies elevations from approximately 900 to 1500 m. This zone has a mean annual temperature of 2.5 ^{0}C and a mean annual precipitation of 3350 mm.

Majority of this precipitation falls as snow resulting in a short growing season. The AT zone occupies elevations above 1650 m and has a mean annual temperature of -2 ^{0}C and mean annual precipitation of 1900 mm which falls mostly as snow. A very short frost free period is characteristic of this zone.

Dominant forest is second-growth stands ranging from 80 to 100 years old. Dominant tree species include Douglas fir *(Pseudotsuga menziesii)*, western hemlock *(Tsuga heterophylla)* and western red cedar *(Thuja plicata)*. The dominant understory vegetation between 500 – 600 m was salmonberry *(Rubus spectabilis)*, sword fern *(Polystichum munitum)* and deer fern *(Blechnum spicant)*. Amabilis fir *(Abies amabilis)* and yellow cedar *(Chamaecyparis nootkatensis)* dominated at higher elevations; the understory consisted of salal *(Gaultheria shallon)* and yew *(Taxus brevifolia)*. The terrain was steep (70 - 100% slope) with many rocky outcrops.

The inventory focused on tributaries flowing into Phyllis Creek which exhibited excellent tailed frog habitat. This habitat included fast, cascading, well aerated flow and contained large, anchored substrate. Two creeks showed these characteristics. Creek Two was 823 m from the spur road which is located 3.6 km from the Hydro gate (beginning of logging road). Creek One was 488.8 m south east of Creek Two. Creek One had an average gradient of 40%, temperature of 3.5 ^{0}C and depth of 0.14 m. The wetted width was 4.6 m with a maximum width of 5.2 m. Stream substrate was dominated by large boulders and cobbles. Plot A was located at an elevation of 560 m and was 70 m (slope distance-SD) from the main logging road. Western hemlock dominated one side of the creek while the other bank was unvegetated and slumped. Creek Two had an average gradient of 68%, temperature of 3.0 ^{0}C and depth of 0.17 m. The wetted width of Creek Two was 4.2 m; maximum width was 5.7 m. Dominant substrate consisted of cobbles and angular boulders. Plot A on this creek was at an elevation of 530 m and a distance of 66.7 m (SD) from the logging road. One bank was dominated by alder *(Alnus rubra)* and salmonberry while the other side was dominated by western hemlock and western red cedar.

METHODS & MATERIALS

This survey was conducted from October to December 2003 by a two man crew. The inventory was collected during the rainy season, thus limiting both stream accessibility and sightings of adult frogs. During October of 2003 BC's south coast experienced record breaking rainfall, possibly affecting tadpole presence. The RISK manual (2000) suggested summer to be the best time of year to conduct a survey because the chance of sighting an adult frog is higher and streams accessibility is easier due to low stream flows.

Presence/not detected was the desired level of effort for the survey. If tailed frogs were found within the first survey plot it was assumed that they existed within the entire creek because creeks one and two did not exceed the known maximum elevation for coast tailed frogs (1180 m). Therefore time-constrained searches (TCS) were used as recommended by the RISC manual (2000). Hand collection techniques were used to search potential tailed frog habitat; fast, cascading, well aerated, perennial streams with large, anchored substrate (RISC, 2000).

Hand collection involved turning over objects, raking gravel by hand, sweeping large boulders, and scanning banks. Dip nets were used to catch tadpoles. Work was completed in an upstream direction to ensure the study areas were not contaminated by silt. Well anchored substrate was left in place to make sure stream stability was not compromised. All removed bedload was returned to its original location after each survey.

Each study area was sampled for 60-person minutes. Study areas were not placed randomly, but instead focused primarily on potential habitat. The searches were not spatially confined to maximize possibility of finding tadpoles due to their clustered distribution. Before commencement of each TCS, a stream site card was completed (Appendix 1).

Each captured tadpole was kept in a bucket while the search continued, to ensure it was not counted twice. An animal field observation form (BC Conservation Data Centre) was

filled out for tadpoles found in each creek (Appendix 2). Tadpoles were released upstream of the altered reach.

RESULTS

Tailed frog inventories have been completed for two tributaries of Phyllis Creek. Because presence/not detected was the objective of this survey, once tailed frogs were found in a creek it was assumed the entire creek contained tailed frogs. Microhabitats tailed frogs were found in were similar in both Creeks One and Two. Microhabitats consisted of small shallow pools below cascades with large cobble and large gravel (Figure 6).

Figure 6. Location where tailed frog *(Ascaphus truei)* tadpole was found in Creek One, Phyllis Creek watershed, Squamish, BC. Survey was conducted October to December 2003.

CREEK ONE

In Creek One, plot A, one large tadpole (sex unknown) was found measuring approximately 4 cm. This tadpole was found clinging to the underside of a boulder in a shallow pool. It was an olive colour with a moderate amount of orange/pink mottling on the end of its tail (Figure 7). This tadpole was found with two minutes remaining in the survey.

Figure 7. Tailed frog *(Ascaphus truei)* tadpole found in Creek One, Phyllis Creek watershed, Squamish, BC. Survey was conducted October to December 2003.

CREEK TWO

In Creek Two, plot A, three tadpoles (sex unknown for all) were found; two tadpoles were quite small measuring approximately 2 cm and the third was much larger, approximately 5 cm (Figures 8 & 9). The two smaller tadpoles were found first in the same small pool. The first one was found clinging to the underside of a boulder and the second was found in the gravel below where the boulder had been resting. These tadpoles were slate colour and partially transparent. Both had distinctive white spots and some white mottling on the tips of their tails. The large tadpole was found 10 m upstream from the smaller two. It was found on the side of a rock in a high velocity section of the stream. This tadpole was olive coloured with moderate orange/pink mottling on the end of its tail. A small tadpole was found within the first five minutes of the survey. The larger tadpole was found 15 minutes into the survey and, the second small one was found with 10 minutes remaining in the survey.

Figure 8. Small tailed frog *(Ascaphus truei)* tadpole found in Creek Two, Phyllis Creek watershed, Squamish, BC. Survey was conducted October to December 2003.

Figure 9. Large tailed frog *(Ascaphus truei)* tadpole found in Creek Two, Phyllis Creek watershed, Squamish, BC. Survey was conducted October to December 2003.

DISCUSSION AND RECOMMENDATIONS

On the map and aerial photos of Phyllis Creek watershed there appeared to be many creeks. The reconnaissance survey of the east portion showed only lake-fed creeks were perennial; only two exist. A reconnaissance survey of the remaining watershed, including both the east and west portions, was completed as of December 2003. No other suitable perennial streams were found.

The week prior to conducting the inventory a reconnaissance survey was completed for the upper portions of creeks One and Two. At 800 m, substantial amounts of ice were found in and around the creeks (Figure 10). At this elevation tadpole presence was not detected. Therefore, the inventory focused on lower portions of the creeks.

Figure 10. Ice found in top portion of creeks One and Two, Phyllis Creek watershed, Squamish, BC. Survey was conducted October to December 2003.

In October the Lower Mainland experienced extreme flood events. Tadpoles may become subterranean in high water events (RISK, 2000). This may have had an effect on the presence and distribution of tadpoles within creek one and creek two.

The RISC (2000) manual stated that tadpole densities decreased when unstable banks were present due to sediment deposition. In plot A of Creek One the bank on the west side was unvegetated and appeared unstable; one tadpole was found. In plot A of Creek Two the banks on both sides were well vegetated and three tadpoles were found. Although this could be coincidence, with more data a pattern may be identified.

MANAGEMENT STRATEGIES

Terminal Forest Products Ltd. had Jennifer Heron complete a literature review on tailed frogs to identify recommended management strategies These strategies are effective for the protection of tailed frogs. Below is the summary of the Terminal Forest Products Ltd. Tailed Frog Management Strategy (Appendix 3).

Establish a 50 m reserve adjacent to streams containing tailed frogs. Within the 50 m reserve include a 30 m management zone and a 20 m riparian core. Connectivity of riparian forested habitat between reserves should be maintained. Roads should not be constructed within 30 m of streams and, roads crossings should not be placed within the tailed frog habitat reserve. While harvesting and building roads and road crossings, water quality and natural flow regimes should be maintained. Ensure no slash enters the stream during harvesting. Avoid the use of pesticides; herbicides may be used where it can be demonstrated that it will not be harmful to tailed frogs.

For future silviculture practices, a complete inventory should be conducted for creeks one and two as well as any other ideal tailed frog habitat within Terminal Forest Products land. Time constraint searches are sufficient for presence/not detected surveys. A time constraint search of 60-person minutes at 100 m intervals is ideal. If population data is desired an area constraint survey should be designed and implemented. It is recommended that any further surveys be completed during the summer months because tadpoles may become subterranean during the rainy season (RISK, 2000).

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APPENDICES

APPENDIX 1 – FIELD OBSERVATION FORM (ANIMALS)

APPENDIX 2 – STREAM SITE CARDS

APPENDIX 3 – MANAGEMENT STRATEGY

APPENDIX 1 – FIELD OBSERVATION FORM (ANIMALS)

B.C. Conservation Data Centre
FIELD OBSERVATION FORM (ANIMALS)
Complete only for Red or Blue listed species. Complete as many fields as able, particularly ones denoting exact location.

EO: Create ___
Update ___
EO #: ___
DONE: ___

SPECIES: ~~Coastal~~ Tailed frog

Name of recorder/reporter: Jess Urquhart
Address: 3564 Graham St Pt Coq BC V3B 5L8

Phone#: 604 464 3139 **e-mail:** jurqie@hotmail.com.

Location: *(We use the information you provide to map locations, and to relocate sites on the ground. Please be as precise as possible. Provide written directions below and sketch a map. A photocopy of a 1:50,000 topographic map or other showing the location would be appreciated).*
Phyllis Crk watershed, Furry Crk, Squamish BC
Creek 2 - plot A

UTM grid reference: (from blue grid on 1:50,000 NTS map) **NTS MAPSHEET NO.:** ___
Please note which North American Datum (NAD) was used (found below the contour interval scale on NTS map): 27 or 83
ZONE: *(e.g. 10U)* ___ ___ **NORTHING:** ___ ___ ___ ___ ___ ___ ___ **EASTING:** ___ ___ ___ ___ ___ ___ **NAD:** ___

Did you use a GPS unit to determine this UTM point? Y / N **Precision of point:** *(+/- metres)* ___

Date			Numbers						Comments	Observer
year	month	day	Adult			Immature				
			m	f	u	m	f	u		
2003	NOV	12						3	2 tiny slate colour 1 larger olive colour ~~[illegible]~~	Jess & Leah.

Evidence of breeding: ☒ none ☐ mating observed ☐ nest found ☐ young being fed out of nest
☐ singing/displaying male(s) ☐ egg-laying observed ☐ larva/pupa found
☐ other: ___
Comments: ___

Habitat: *(include. dominant plants if possible; a general description of area):* ___
Red Alder
Salmonberry - small tadpoles found in pool in substrate
< Red Cedar & Hemlock - large tadpole found right in cascading flow
steep fast flowing creek on side of large boulder

Elevation: 530 (metres) feet *(circle one)* **Slope %:** 68 **Aspect:** 210°

Comments/Remarks: 2 small tadpoles ≅ 2cm - mottling white on end of tail
large tadpole 5 cm - mottling pink/orange on end of tail

B.C. Conservation Data Centre
FIELD OBSERVATION FORM (ANIMALS)
Complete only for Red or Blue listed species. Complete as many fields as able, particularly ones denoting exact location.

EO: Create ___
Update ___
EO #: ___
DONE: ___

SPECIES: Coastal tailed frog

Name of recorder/reporter: Jess Urquhart
Address: 3564 Granamst Pt Coq BC V3B 5L8

Phone#: 604 464 3139 **e-mail:** juraic@hotmail.com
Location: *(We use the information you provide to map locations, and to relocate sites on the ground. Please be as precise as possible. Provide written directions below and sketch a map. A photocopy of a 1:50,000 topographic map or other showing the location would be appreciated).*
Phyllis Crk Watershed, Furry Crk, Squamish BC
Creek 1 plot A

UTM grid reference: (from blue grid on 1:50,000 NTS map) **NTS MAPSHEET NO.:** ___
Please note which North American Datum (NAD) was used (found below the contour interval scale on NTS map): 27 or 83
ZONE: *(e.g. 10U)* ___ ___ **NORTHING:** ___ ___ ___ ___ ___ ___ ___ **EASTING:** ___ ___ ___ ___ ___ ___ **NAD:** ___

Did you use a GPS unit to determine this UTM point? Y / N **Precision of point:***(+/- metres)* ___

Date			**Numbers**						**Comments**	**Observer**
year	month	day	Adult			Immature				
2003	NOV	12	m	f	u	m	f	u		
2003	NOV	12						1	olive colour, lots of mottling @ end of tail pink/orange mottling	Leah.

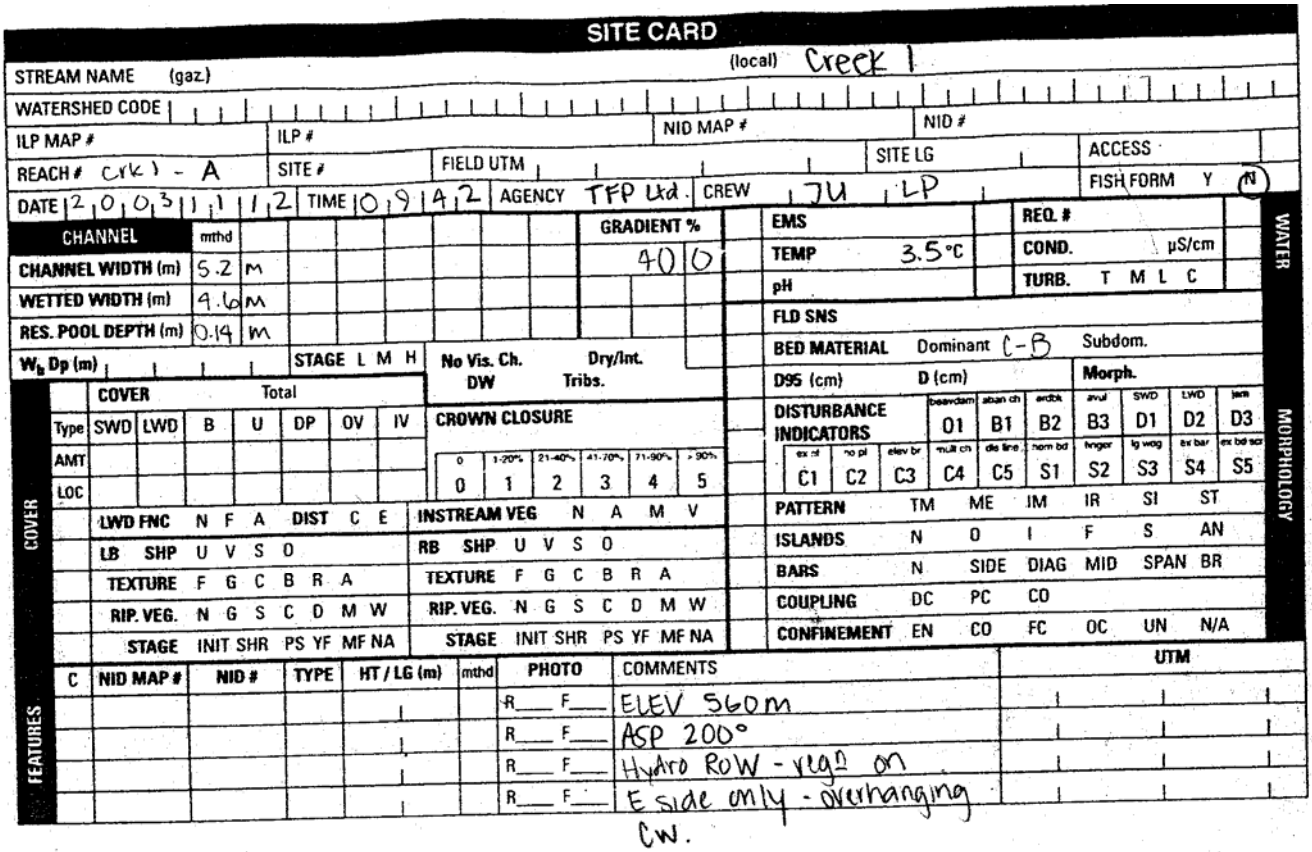
Evidence of breeding: ☒ none ☐ mating observed ☐ nest found ☐ young being fed out of nest
☐ singing/displaying male(s) ☐ egg-laying observed ☐ larva/pupa found
☐ other: ___
Comments: ___
Habitat: *(include. dominant plants if possible; a general description of area):*
overhanging CW & lesser Hw, heavily mossed rocks
-cascading
-shallow -deepest pool 14cm

Elevation: 560 [metres] feet *(circle one)* **Slope %:** 40 **Aspect:** 200°

Comments/Remarks: minimal water,
clinging to rock
boulder sized

III

APPENDIX 2 – STREAM SITE CARDS



SITE CARD

STREAM NAME (gaz.) (local) Creek 1

WATERSHED CODE

ILP MAP # | ILP # | NID MAP # | NID #

REACH # Crk 1 - A | SITE # | FIELD UTM | SITE LG | ACCESS

DATE 2003/11/12 | TIME 0942 | AGENCY TFP Ltd. | CREW JU LP | FISH FORM Y (N)

CHANNEL mthd

CHANNEL WIDTH (m) 5.2 m

WETTED WIDTH (m) 4.6 m

RES. POOL DEPTH (m) 0.14 m

W_b Dp (m)

STAGE L M H

GRADIENT % 4.0 0

No Vis. Ch. DW | Dry/Int. Tribs.

EMS

TEMP 3.5°C

pH

REQ. #

COND. µS/cm

TURB. T M L C

FLD SNS

BED MATERIAL Dominant C-B Subdom.

D95 (cm) D (cm)

Morph.

DISTURBANCE INDICATORS: beavdam O1 | aban ch B1 | avdit B2 | avul B3 | SWD D1 | LWD D2 | jam D3

ex ril C1 | no pl C2 | elev br C3 | mult ch C4 | dis line C5 | horn bd S1 | hinger S2 | lg wag S3 | ex bar S4 | ex bd scr S5

PATTERN TM ME IM IR SI ST

ISLANDS N O I F S AN

BARS N SIDE DIAG MID SPAN BR

COUPLING DC PC CO

CONFINEMENT EN CO FC OC UN N/A

WATER

MORPHOLOGY

COVER

	COVER Total						
Type	SWD	LWD	B	U	DP	OV	IV
AMT							
LOC							

CROWN CLOSURE: 0 | 1-20% | 21-40% | 41-70% | 71-90% | >90%

0 | 1 | 2 | 3 | 4 | 5

LWD FNC N F A DIST C E

LB SHP U V S O

TEXTURE F G C B R A

RIP. VEG. N G S C D M W

STAGE INIT SHR PS YF MF NA

INSTREAM VEG N A M V

RB SHP U V S O

TEXTURE F G C B R A

RIP. VEG. N G S C D M W

STAGE INIT SHR PS YF MF NA

FEATURES

C	NID MAP #	NID #	TYPE	HT / LG (m)	mthd	PHOTO	COMMENTS	UTM
						R___ F___	ELEV 560m	
						R___ F___	ASP 200°	
						R___ F___	Hydro ROW - veg on	
						R___ F___	E side only - overhanging	

CW.

SITE CARD

STREAM NAME (gaz.) (local) Creek 2

WATERSHED CODE

ILP MAP # | ILP # | NID MAP # | NID #

REACH # crk 2 - A | SITE # | FIELD UTM | SITE LG | ACCESS

DATE 2003/11/12 | TIME 1210 | AGENCY | CREW JU LP | FISH FORM Y (N)

CHANNEL	mthd									GRADIENT %
CHANNEL WIDTH (m)	5x7	M								68.0
WETTED WIDTH (m)	4.2	M								
RES. POOL DEPTH (m)	0.17	M								
W_b Dp (m)			STAGE L M H							

No Vis. Ch. Dry/Int. DW Tribs.

COVER	Total						
Type	SWD	LWD	B	U	DP	OV	IV
AMT							
LOC							

CROWN CLOSURE

0	1-20%	21-40%	41-70%	71-90%	> 90%
0	1	2	3	4	5

LWD FNC N F A DIST C E

LB SHP U V S O

TEXTURE F G C B R A

RIP. VEG. N G S C D M W

STAGE INIT SHR PS YF MF NA

INSTREAM VEG N A M V

RB SHP U V S O

TEXTURE F G C B R A

RIP. VEG. N G S C D M W

STAGE INIT SHR PS YF MF NA

COVER

WATER

EMS

TEMP 3.0 °C

pH

REQ. #

COND. µS/cm

TURB. T M L C

FLD SNS

BED MATERIAL Dominant C-B Subdom. G1

D95 (cm) D (cm) Morph.

DISTURBANCE INDICATORS

beavdam	aban ch	erdbk	avul	SWD	LWD	jam
O1	B1	B2	B3	D1	D2	D3

ex rif	no pl	elev br	mult ch	dis line	hom bd	hrgar	lg wog	ex bar	ex bd acr
C1	C2	C3	C4	C5	S1	S2	S3	S4	S5

PATTERN TM ME IM IR SI ST

ISLANDS N O I F S AN

BARS N SIDE DIAG MID SPAN BR

COUPLING DC PC CO

CONFINEMENT EN CO FC OC UN N/A

MORPHOLOGY

FEATURES

C	NID MAP #	NID #	TYPE	HT / LG (m)	mthd	PHOTO	COMMENTS	UTM
						R___ F___	ELEV 530 M	
						R___ F___	ASP 210°	
						R___ F___	E side veg? Alder & Salmonberry	
						R___ F___	W side veg? Cw & HW	

APPENDIX 3 – MANAGEMENT STRATEGY

Terminal Forest Products Ltd.

TAILED FROG MANAGEMENT STRATEGY

The Tailed Frog is a small blue-listed amphibian at-risk due to human disturbances, particularly logging. This species primarily occurs in headwater streams lacking fish and therefore not otherwise afforded riparian protection. Other factors contributing to its rarity are the fact that the species is endemic to the pacific coastal region north of California through to Prince Rupert and does not reach sexual maturity until eight or nine years of age.

OBJECTIVE

- Maintain the current population of tailed frogs through management and protection of identified habitat.
- Maintain the water quality and natural flow regime of identified tailed frog streams.
- Maintain structural elements and microclimatic conditions of mature forest adjacent to stream.
- Maintain coarse woody debris in and around stream.
- Maintain a database of sightings/sign of tailed frogs by having woodlands staff complete *Rare Species Observation Forms*.
- Improve woodlands staff and contractor knowledge by training personnel to recognize tailed frogs, their respective habitat and be able to carry out appropriate management practices to preserve such habitat.

KEY HABITAT CHARACTERISTICS

- Biogeoclimatic Zones
  - Coastal Western Hemlock (CWH): dm, ds1, ds2, ms1, ms2, vh1, vh2, vm, vm1, vm2, wm, ws1, ws2, xm1
  - Mountain Hemlock (MH): mm1, mm2
  - Interior Douglas Fir (IDF): ww, dk2, xh1
  - Alpine Tundra (AT): ATp
- Elevation
  - Sea level to timberline (5 – 2140m)
- Streams with the following features:
  - Steep gradient, steep-walled, fast flowing, cascading streams
  - Year round permanent water flow streams within the windward and leeward drainages of the Coast Mountains
  - Temperature 0 – 16 degrees Celcius
  - Stable channel beds - do not change location during times of extreme water flow.
  - Side pools and channels – ephemeral and permanent
  - Coarse rocky substrates & permanently anchored rocks, cobbles and boulders.
  - Adjacent to old growth or mature timber with low coarse woody debris, substantial forest cover, significant understory, plant diversity and shade.
  - Generally, streams that lack fish or other aquatic predators although tailed frogs are often in fish streams.

PLANNING LEVEL MANAGEMENT STRATEGY

- Identify potential tailed frog habitat by identifying streams with 'Key Characteristics'.
  - Label and identify potential habitat on 1:20,000 maps.
- Identify potential Tailed Frog Habitat Reserves
  - Follow guidelines under Engineering Management Strategy
    - 50 m reserve adjacent to stream

        - 20 m riparian core
        - 30 m management zone
    - Include within areas that provide connectivity of riparian forested habitat, particularly between other reserves, OGMA's, etc.
- Establish reserves on streams branching from main 'identified tailed frog' headwater stream. Identify reserves as per guidelines in Riparian Management Guidebook.
- Where several streams with these characteristics occur, priority should be given to:
    - Sites adjacent to mature or old forest,
    - Sites with the greatest potential to establish and maintain mature forest connectivity (e.g., riparian reserve zones)
    - Sites with the highest density of tadpoles.

ENGINEERING MANAGEMENT STRATEGY

Where it has been confirmed there are tailed frogs within a stream, a Tailed Frog Habitat Reserve is to be established.

- Tailed Frog Habitat Reserves cover a minimum of 500 m along the length of the stream.
    - Extend 50 m from the stream edge on both sides of stream.
    - This 50 m includes a 20 m riparian core and a 30 m .
- Traverse the length of the stream & identify boundary of Tailed Frog Habitat Reserve
- No harvesting is to occur in the 20m riparian core.
- Partial harvesting systems may occur in the buffer - maintain 80% basal area unless there is no other practicable option. Partial harvest should be oriented towards the creation of old forest characteristics such as large diametre trees, multilayered canopies, snags and coarse woody debris
- No salvage logging should be carried out within the reserve.
- Minimize risk of windthrow

ROAD LAYOUT

- Do not construct roads within 30m of stream unless there is no other practicable option.
- Do not place road crossings within the Tailed Frog Habitat Reserve unless there is no other practicable option.
- Maintain water quality and natural flow regime of stream and all smaller tributaries flowing into the stream, including ephemeral seepages.
- Do not channel water flow from ditches and/or culverts directly into tail frog habitat.

ROAD BUILDING

- Road crossings within, above or below reserve zone should be constructed such that:
    - Water flow is maintained in as much as possible an unaltered state.
    - Minimal sediment enters the stream - use wood box culverts, geotextile cloth, strategic placement of boulders, hay bales, silt fences, etc.

DURING HARVEST ACTIVITIES

- Ensure that no machinery enters the 20 m reserve zone
- Ensure that any logging above or downstream of reserve zones maintains all natural stream features
    - Fall and yard away from stream
        - Maintain some kind of buffer adjacent to the stream & maintain some shade for the stream.

    - Maintain all trees sloping into the stream.
    - Maintain all understory trees.
    - Minimize slash from entering stream.
- Ensure large accumulations of coarse woody debris are left in tact.
    - Fall and yard away.

POST-HARVEST SILVICULTURE

- A 50 m reserve (20 m riparian core and 30 m buffer) will be maintained adjacent to creeks known to contain tailed frogs.
- Avoid the use of pesticides. Spot treaments with herbicides may be used in exceptional circumstances (e.g., noxious weeds) where it can be demonstrated that the herbicide will not be harmful to the species or habitat being managed.
- Headwater creeks should be kept slash-free and forested riparian buffers should be maintained and restored, especially within fragmented areas.
- For logging above or downstream of the reserve, clean the stream of any slash or debris following all harvest activities.
- Any roads crossing the stream above or below the reserve should be periodically monitored for:
    - The maintenance of good water quality and natural stream flow.
    - The entry of sediment into the stream.