

*Pup Creek
Mapping and Inventory Project*

Sensitive Habitat Inventory and
Mapping (SHIM) Survey

Report Prepared by:

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For:

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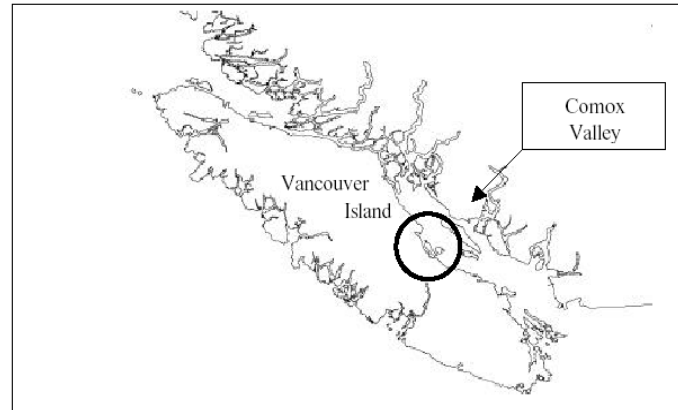
Executive Summary

During 2003 Comox Valley Project Watershed Society conducted a Sensitive Habitat & Inventory Mapping (SHIM) survey on Pup Creek. The SHIM method utilizes Trimble Pro XR GPS with stream inventory data collection, resulting in geo-referenced lines and point data for viewing in ArcView GIS. This report is the outcome of the survey and should be read in conjunction with the accompanying maps of Pup Creek.

This project was sponsored by the Habitat Conservation Trust Fund.

Pup Creek is located in the Merville area, north of the Comox Valley and flows through the jurisdiction of the Regional District of Comox Strathcona. Pup Creek is a tributary of the Tsolum River, watered primarily by runoff from Constitution Hill, located to the west of the Tsolum River. The Tsolum River is still suffering the effects of copper leachate from an abandoned mine in its headwaters and suffers from dewatering in the summer.

As a tributary of the Tsolum River, Pup Creek provides the Tsolum watershed with critical salmonid summer and over wintering habitat, as well as refuge from flow fluctuation and copper spikes. More details on the Tsolum River can be found at www.projectwatershed.bc.ca/newsite/tsolumpwsiteframe.html. Pup Creek flows year round and supports coho salmon, cutthroat trout and sculpins.



Survey Summary

Stream Gazette Name: **Alias:** Pup Creek

Watershed Code: – 920-55320-94100-44900

Map locations: – 92F075-3-1, 92F075-3-2

Start Date of Survey: **October 7th, 2003**

1.1.1.1.1 End Date of Survey: **October 30th, 2003**

Stream Length Surveyed: *Pup Creek Mainstem: 2.2 km*

Total Length with Tributaries: 3.9 km

List of Accompanying Documents:

Appendix 1: Pup Creek Overview Map (1:11,000 11 X 17)

Appendix 2: Pup Creek Obstructions Map (1:11,000 11 X 17)

Appendix 3: Pup Creek Features Map (1:11,000 11 X 17)

Appendix 4: Pup Creek Restoration Opportunities Map (1:11,000 11 X 17)

Appendix 5: Pup Creek Fish Habitat Map (1:11,000 11 X 17)

Appendix 6: Pup Creek Wetlands Map (1:11,000 11 X 17)

Report Prepared by: Joanne Ellefson, Comox Valley Project Watershed Society

Date of Report: January 22nd, 2004

Date of Survey: December 2nd, 2003 to January 20th, 2004

Purpose of Survey

The streams inventoried were chosen because of a need to collect information for the following purposes:

- Updates to the Regional District of Comox Strathcona's Sensitive Habitats Atlas
- Initiation of, or additions to, a set of "Streamkeepers Data" for the watershed
- Determining rehabilitation, restoration or protection opportunities for the Watershed.
- Locating existing rearing & spawning habitat
- Documenting "hydrological features" of the watershed
- Creation of accurate stream lines and wetland boundaries

Mapping Methodology

Streams

The methodology used for the stream mapping/inventory portion of this project was "*Sensitive Habitat Inventory Mapping*" (Mason et al 2001). Stream GPS mapping was conducted using Trimble Pathfinder Pro XR equipment. SHIM Version 2002 data dictionary was utilized for data gathering. To view the latest revisions for the SHIM methodology, visit the CMN website www.shim.bc.ca/method2.html.

Wetlands

Due to the nature of wetlands defined channels are not generally evident. In areas of beaver created ponds and large wetland complexes, the mapping of a consistent stream centerline was often impractical. From a field mapping perspective, the logistics of traversing wetlands to determine location and existence of channels through wetland areas requires time and resources beyond the scope of the survey. Furthermore assigning a "channel" to a wetland area is misleading and not truly descriptive of the hydrology of the watercourse. If a channel were evident within a wetland then it was mapped using SHIM methods. However, as was often the case, no channel was evident and standing water was dominant across an area. These areas were treated in one of two ways:

- *Sensitive Ecosystem Inventory Wetlands:* If the Sensitive Ecosystem Inventory already surveyed the area, then technicians would walk the approximate boundary looking for sources of inflow. These would be followed to their source and if the channel was defined, it was mapped using SHIM methods.
- *Wetland not Delineated or Inventoried:* If the wetland was not identified by SEI methods, air photo interpretation using 3D viewing software (DiAP viewer) was used to delineate the boundary. Boundaries of these wetlands were walked when possible, using the GPS for assistance in geo-referencing. These wetlands were not classified due to the lack of time and money for this type of survey.

Limitations of Survey

The SHIM survey was confined to the lower and mid reaches of Pup Creek. Due to time and budget limitations surveying was stopped at the base of the mountain, as the gradient started to rise. TRIM stream lines and a DiAP viewer were used to determine watercourse location in the upper watershed.

Stream segments were defined according to the criteria established by SHIM for fish habitat inventories. However, due to time and budget limitations segment breaks were limited and confined to general characteristics. Channel dimensions, dominant hydraulic type, substrate characteristics and gradient change > 5% were determinants for segment breaks. Detailed cross sections for each segment were not conducted due to budget limitations. The need for accurate stream location and habitat conditions was deemed a priority.

This survey is not exhaustive in its presentation of information, but is intended as a base for further surveys and data collection. This report highlights basic features of interest within the Pup Creek Watershed and the accompanying maps depict accurate (+/-5m) streamlines and wetlands. The Pup Creek SHIM data will be available for viewing on the CMN website, www.shim.bc.ca/projectwatershed/main.htm.

Overview

Pup Creek is a tributary of the Tsolum River, watered primarily by runoff from Constitution Hill, to the west of the Tsolum River. The Tsolum River is still suffering the effects of copper leachate from an abandoned mine in its headwaters and suffers from dewatering in the summer. As a tributary of the Tsolum River, Pup Creek provides the Tsolum watershed with critical salmonid summer and over wintering habitat, as well as refuge from flow fluctuation and copper spikes. More details on the Tsolum River can be found at www.projectwatershed.bc.ca/newsite/tsolumpwsiteframe.html. Appendix 1 contains an overview map.

Pup Creek flows year round and supports coho salmon, cutthroat trout and sculpins. From the mouth of Pup Creek to the new Inland Island Highway, Pup Creek has excellent fish refuge and juvenile over-wintering habitat. Beaver activity, historical and recent has created natural reservoirs, adjacent to and instream of Pup Creek's mainstem. The beavers dams are functioning as filtration traps and flow regulators and the ponds provide fish habitat. Some of the beaver dams may function as juvenile migration barriers during times of low flow. West of the new Inland Island Highway there is less refuge habitat and minimal spawning opportunities. However these areas still have fish habitat potentials. Beaver activity is present in the mid-reaches of Pup Creek, creating significant water retention areas. Appendix 2 contains a map of potential obstructions. During this survey technicians observed adult coho traveling upstream across a beaver dam and a coho pair were observed spawning above several beaver dams.

Fish Presence

Coho Salmon, Cutthroat Trout & Sculpin are fish species present in Pup Creek. www.pisces.env.gov.bc.ca provides further information on Pup Creek and fish distribution. At the time of this survey technicians observed adult fish (most likely coho) in the wetlands and low gradient reaches of Pup Creek.

Landowners and Special Interest Groups

Pup Creek is under the jurisdiction of the Regional District of Comox Strathcona. The primary landowner through the middle and upper reaches is Timber West. The lower portions run through a locally owned and managed woodlot.

The Tsolum River Restoration Society (TRRS) is interested in fish habitat restoration opportunities on Pup Creek. This survey was conducted with the intention of providing baseline data on Pup Creek to the TRRS.

Anthropogenic Alterations/Impacts

As with most streams in the vicinity of the Comox Valley logging activities, hydro lines, gas pipeline construction and road construction have impacted Pup Creek. However, in the vicinity of the hydro lines Pup Creek has made an excellent recovery and the area beneath the hydro lines has evolved into beaver created wetlands, providing ideal fish habitat, regulating seasonal flow fluctuation and retaining water during the drier months. The portion of Pup Creek within the vicinity of the gas pipeline crossing was the focus of a Centra Gas Community Environmental Project Outreach (CEPO) Program. This restoration project conducted in conjunction with the TRRS involved the improvement of a poorly defined channel through the placement of large woody debris and cobbles and the construction of a berm to prevent flooding and potential isolation of fish. For more on this project www.gas1.terasen.com/pdf/CEPO_2002.pdf

The primary land use within the Pup Creek watershed is logging. The forest cover is predominately second growth. In the upper reaches of Pup Creek road building and clear cutting of land may further interfere with the hydrology of Pup Creek.

Features of Interest, Enhancement, Restoration and Protection.

This section should be read in conjunction with the Features map in Appendix 3

Feature 1: *Potential Enhancement Site.* An approximately 44 meter side channel connected to the mainstem at its downstream end, could have potential for off channel or possibly spawning habitat. Currently it has a raised lip, either sediment accumulation or constructed, at its confluence and its flow is sluggish to non-existent. Good Access.

Feature 2: *Log Jam.* A log jam is altering the channel morphology. A small pool has been created and the channel is flowing around the log jam. During low flows may be a potential barrier to juvenile migration.

Feature 3: *Wide Span Bridge.* A wide span bridge crosses Pup Creek at this point. The bridge is still utilized by woodlot owners. Not a barrier.

Feature 4: *Log Jam.* A log jam has created stream back watering. Several small channels have been created, providing off channel refuge to salmonids. During low flows may be a potential barrier to juvenile migration.

Feature 5: *Wetland Complex Begins.* Start of beaver dams/wetland complex. The beaver dam at this point has a 4.0 meter breach in it. Pools upstream of dam provide excellent juvenile fish habitat.

Feature 6: *Wide Span Bridge.* A wide span bridge along BC Hydro's right of way crosses Pup Creek here. Wetlands continue upstream of the bridge.

Feature 7: *Ephemeral tributary.* This 106.0 meter tributary ends here. Flow is dissipated sub surface. This tributary flows into the Hydro ROW wetlands.

Feature 8: *Ephemeral tributary.* This tributary originates in a ditch adjacent to a logging road and drains a clear cut area into the Hydro wetlands.

Feature 9: *Pipeline Crossing.* The Centra Gas Pipeline crosses Pup Creek. This area was the site of a restoration project conducted by Centra Gas with the assistance of the Tsolum River Restoration Society. For details on this project:
http://gas1.terasen.com/pdf/CEPO_2002.pdf

Feature 10: *Decommissioned bridge.* Both banks are rip rapped where an old logging road/highway construction bridge has been dismantled.

Feature 11: *Backwater channel.* An approximately 100.0 meter backwater channel extends from the Hydro Wetlands until bisected by a dirt road. The backwater channel north of the road provides over wintering habitat but is likely ephemeral.

Feature 12: *Tributary 5.* This tributary drains a swampy wetland immediately east of the Inland Island Highway. Extending for 214.0 meters before entering Pup Creek, this tributary, with good complexing, excellent riparian cover and small gravels appears to be excellent trout habitat. However it is probably ephemeral. No beaver activity is evident along this tributary or in the wetland from which it drains. ***It should be noted that the area around Tributary Sand Tributary 6 is flagged for logging. The designated falling boundary is inadequate for sufficient protection of fish habitat.***

Feature 13: *Tributary 6.* This tributary drains the same swampy wetland as Feature 12. Sharing similar characteristics with Tributary 4, this tributary travels for 170.0 meters from the wetland to Pup Creek. No beaver activity is evident along this tributary or in the wetland from which it drains.

Feature 14: *Coho pair observed spawning.*

Feature 15: *Highway bridge.* The Inland Island Highway crosses Pup Creek Main Stem at this location.

Feature 16: *Tributary.* This tributary appears to originate sub-surface from a clear cut hillside west of the Inland Island Highway. Moderate flow at the time of the survey, was draining into the wetland area west of the Highway.

Feature 17: *End of SHIM Survey.* The gradient increases from this point forward. No ground surveying or SHIM surveying of Pup Creek mainstem was done beyond this point.

Feature 18: *Wetland drainage.* Drainage from this wetland flows southeast into a series of beaver ponds adjacent to Pup Creek's mainstem.

Feature 19: *Culvert.* Wetland 3 drains through a 0.5 diameter steel culvert beneath the Inland Island Highway, into a sediment settling pond. During flood flows this pond would overflow into Wetland 2.

Feature 20: *Culvert.* A 0.5 m circular steel culvert beneath the Inland Island Highway was not draining flow at the time of this survey.

Feature 21: *Culvert.* A 1.6 m circular steel culvert beneath the Inland Island Highway was not draining flow at the time of this survey.

Feature 22: *Culvert.* Wetland 3 drains through a 1.8 m circular steel culvert beneath the Inland Island Highway, into Wetland 5.

Feature 23: *End of SHIM Survey.* The gradient increases from this point forward. No ground surveying or SHIM surveying of Pup Creek tributary 6 was done beyond this point.

Feature 24: *Culvert.* Wetland 3 drains through a 1.8 m circular steel culvert beneath the Inland Island Highway, into Wetland 2.

Feature 25: *Flow divide.* The backwater channel extending south from wetland 1 has wetland characteristics. Flow is minimal and is blocked by a dirt road with no culvert. Some seepage does make it across the road and continues flowing southeast becoming a significant entrenched channel with strong flow. The channel southeast of the dirt road, which functions as a watershed divide, drains into Headquarters Creek.

Feature 26: *Tributary 1.* A 77.0 meter tributary flows from Wetland 1, a beaver pond/wetland complex. Should this tributary receive year round flow from wetland 1, it would provide excellent refuge habitat with potential for functioning as rearing habitat.

Feature 27: *Drainage.* General drainage from the clearcut hillside enters this area.

Feature 28: *Tributary.* Wetland 1 receives drainage, beginning around the Inland Island Highway and traveling from the northwest, parallel to the Hydro ROW. These lines are represented as tributaries on the maps. Ground surveying revealed that they are significant drainages with wetland characteristics.

Restoration Opportunities

Appendix 4 contains a Restoration Opportunities map.

- 1. Unknown.** This man made channel (see feature 1) may have been constructed to mitigate flood waters at the confluence of The Tsolum River and Pup Creek. It could have potential for a restoration project, either spawning or off-channel habitat, as it is accessible. However, it is probably too close to the confluence to maintain stability of enhancement efforts.
- 2. Riparian Re-vegetation.** Streambank stabilization at the Centra Gas/Pup Crossing site could improve habitat conditions.
- 3. Spawning channel construction.** This area is accessible with a 4 wheel drive and hence could be the site of a restoration project. Further study is required.
- 4. Riparian re-vegetation.** The left bank of Tributary 8, immediately east of the Inland Island Highway, has sparse or non-existent vegetation for approximately 119.0 meters. Areas that are logged to the stream edge may develop erosion problems.
- 5. Riparian re-vegetation.** Approximately 120.0 m of the right bank of Pup Creek's main stem, immediately west of the Inland Island Highway, is cleared to the stream edge.

Conclusions

Pup Creek appears to be a relatively healthy stream for salmonids, as it flows year round, has sufficient fish rearing and refuge habitat in the form of tributaries and wetlands and some spawning gravel. The primary limitation to fish productivity in Pup Creek would appear to be the lack of spawning habitat. However, during drier months juvenile fish access to rearing areas, such as beaver ponds and wetlands may be limited. Conversely, fish may be trapped in ponds with poor water quality and perish there. Pup Creek's main channel is periodically scoured and at the time of the survey (moderate to high stage) flows were of sufficient volume and intensity to render walking instream impossible. The predominate substrate is fines, with areas of cobble and finely packed clay. Gravel is minimal and may be gradually being smothered by a build up of fines.

Low Flow Access to Refuge & Rearing Habitat

This section should be read in conjunction with Appendix 5, a fish habitat map. From Pup Creek main stem, in the area immediately northeast of the Hydro ROW, fish would probably be able to access, year round, the wetlands and ponds of Wetland 1. The stream channel is immediately adjacent to the wetland and the low gradient and lack of beaver dams provide easy fish access from the channel to the wetland. The portions of Wetland 1 beneath the Hydro ROW are also accessible to fish as these wetlands *are* the main channel, though during low flows the beaver dams may restrict juvenile migration. Portions of Wetland 5, east of the Inland Island Highway are immediately adjacent to Pup Creek's mainstem and may also provide year round habitat. However, it is unlikely that the northern portion of Wetland 5 is sufficiently watered year round to host fish. Fish accessibility to Wetland 3 during low flows is unlikely, but possible if the channel from Wetland 5 stays watered. Despite, at the time of this survey, the presence of standing water throughout Wetland 2, this forested swamp is unlikely to hold much standing water during dry months and no channel was evident at the time of this survey. Wetland 4 consists of beaver ponds and could provide fish habitat, though beaver dams may be obstructions.

Wetlands

The beaver dams and wetlands of the Pup Creek Watershed, are significant in maintaining year round flow, reducing sediment deposition in the channels and providing rearing and refuge habitat for juvenile salmonids. Appendix 6 contains a Pup Creek Wetlands map. Without the beaver ponds and wetlands high flows would undoubtedly flood the lower reaches, scouring the channel and destroying fish habitat. The presence of beaver dams may also have mitigated the effects of excess sedimentation that generally results from logging in the upper watershed. There is evidence of fine sediment deposition in reaches where stream velocity is slowed, generally due to the presence of a beaver dam downstream.

Riparian

In logged areas through the mid-reaches of Pup Creek, the remaining riparian buffer zone is predominantly inadequate and in several areas non-existent. The land around Tributaries 5 & 6 is currently still vegetated, though flagged for logging. Along tributaries 5 & 6 falling boundaries are at located at the top of bank, insufficient to protect fish habitat. While these are smaller tributaries they are significant in contributing to flow and may potentially be trout habitat.

Restoration Opportunities

The potential for restoration opportunities was determined primarily by the possibility of access, secondarily by the need for restoration and taking into consideration the likelihood of landowner cooperation. It is beyond the scope of this survey to provide details as to the feasibility of suggested restoration and further studies should be conducted to determine need and feasibility of these projects.

Recommendations

- ◆ **Spawning Survey:** A spawning survey be initiated; documenting the number and location of spawning fish.
- ◆ **Smolt Survey:** A smolt fence be utilized to determine the number of smolts leaving the Pup Creek system.
- ◆ **Wetland Pond Water Quality Testing:** Water quality testing in wetland ponds be conducted during dry months.
- ◆ **Low Flow Habitat Assessment:** A low flow survey be conducted focusing on available instream habitat during dry months and determining fish accessibility to off channel habitat such as wetlands.
- ◆ **Increased Hydro Wetland Riparian Zones:** Hydro cease cutting immediately adjacent to wetland areas beneath hydro lines and leave a riparian buffer around wetlands. Consideration could be given to planting low growing native species such as Red-Osier Dogwood (*Cornus stolonifera*) or Willow species (*Salix*).
- ◆ **Increased Stream Riparian Zones:** In areas of logging activity increased riparian buffer zones be left adjacent to Pup Creek, Pup Creek Tributaries and Pup Creek Wetlands.
- ◆ **Determine hydrological conditions** in the vicinity of feature 1, the man made channel near the confluence of Pup Creek and the Tsolum River.
- ◆ **Consult a restoration specialist** as to the feasibility of restoration projects being conducted at identified sites.