

A prioritization of restoration and monitoring projects: Setting the stage for an Action Plan

## Preface

The purpose of this summary is to provide an overview of the ecological health of the Tsolum River and to introduce the Tsolum River Recovery Plan (TRRP). The Recovery Plan is a 'living document' and a tool developed to aid in the recovery of aquatic habitats. The Recovery Plan integrates several assessment reports that have been undertaken in the Tsolum River watershed and identifies a set of priorities that are intended to achieve the recovery goals for the watershed and its fish stocks.



Tsolum River Watershed

The TRRP is based on fieldwork and reports from the following assessments commissioned by the Tsolum River Restoration Society:

- *The Tsolum River Habitat Status Report* (Remillard & Clough, 2015)
- *The Tsolum River Fish Habitat Assessment Report* (FHAP) (Clough, 2015)
- *Tsolum Watershed Habitat Restoration Planning* (Clough, 2015)
- *Channel Morphology and Bedload Assessment* (Gooding, 2015)
- *Tsolum River Overview Assessment* (Gooding, 2013)
- *Tsolum River Biophysical Assessment Hydrology and Channel Assessment* (Gooding, 2010)
- *Tsolum River Limiting Factors to Pink Salmon Production* (Campbell, 2010).

These reports are supported by an interactive map which shows the study areas and the results of the four latest reports. The map can be viewed at: [www.tsolumriver.org](http://www.tsolumriver.org) (under 'Recovery Plan' tab).

## Context

There have been many factors associated with declines of fish stocks in the Tsolum River including: water quality, stream habitat loss stemming from historic deforestation, increased drainage and road development, and the degradation of riparian areas. Water quality impacts from the old copper mine on Mt. Washington have been addressed with the capping of the mine but we need to be vigilant and monitoring is required to ensure the water quality objectives continue to be met. This Recovery Plan focusses on the impacts on the freshwater ecosystem looking at upslope activities, riparian area health, and stream processes such as bed load movement and river flows. It does not address management issues associated with fisheries harvest, ocean survival or global climate change.

## History

The Tsolum River Restoration Society (TRRS) was established in 1998 as the business agent of the Tsolum River Taskforce (TRTF), a multi-stakeholder organization established to bring back the Tsolum River after it had been declared biologically dead due to long term mine pollution. After the TRTF dissolved the TRRS went on to form the first Tsolum River Partnership (TRP) to address the impacts from the abandoned copper mine at the headwaters. Once the mine site was successfully restored in 2009/10 the TRP was reformed and moved onto other issues facing the recovery of fish stocks in the Tsolum with a slightly different set of partners. The TRP now includes representation from the K'ómoks First Nation, Timberwest, Comox Valley Farmers' Institute, the City of Courtenay, the Comox Valley Regional District, the BC Ministry of Forest, Lands and Natural Resources Operations, the BC Ministry of Agriculture, Fisheries and Oceans Canada, the BC Conservation Foundation and the TRRS.

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The Mission of the TRP is to restore and maintain the ecological features of the Tsolum River watershed by acting to preserve the integrity and stability of the river and its biotic community which will provide the necessary conditions for a self-supporting fish population.



Board Members 'hard' at work potting donated tree plugs

## The Recovery Plan

The separate assessments for the TRRP included focus on both physical and biological factors within the watershed which could affect fish production potential. There was a need to distinguish between the physical or natural restoration processes (bed load movement, flow regime) and the biological response of the habitat and the fish stocks. These processes are linked in that the physical processes are the cause while the biological and habitat changes are the response. Both contribute to the productivity of the river. These processes are in turn driven by land use, climate change, and watershed disturbances. When prioritizing resources, effectiveness and effort, some habitat-based projects may be put on hold if the risk of instability and failure are greater due to broader physical situations that need to be addressed first or if the area simply requires time to heal.

The TRRP is intended to identify a prioritized list of restoration projects and monitoring requirements that are specific to recovery of the river and its fish

populations. The plan will present a summary of the detailed studies on all reaches in the mainstem and at least three reaches in the major tributaries of the Tsolum River to determine prescriptions necessary to achieve the restoration objectives. The plan will be updated regularly as projects are completed, resources are secured and in response to the ever changing conditions in the watershed.

## Recovery Plan Summary

The report is written for a variety of audiences: land and resource managers, K'ómoks First Nation members, elected officials and concerned residents who desire to understand the issues related to the recovery and monitoring of the Tsolum River.

### I. River Recovery Planning Principles & Present Status (Section 1)

- Provides some guiding principles for recovery planning and describes present day status of the physical and biological features, water flow and use, and human activity in the Tsolum River watershed.
- River recovery should be planned and managed at a watershed scale and it should be evidence-based with knowledge of the history of development, natural physical processes, land use impacts, water flows and channel conditions in the watershed.

### II. Assessments (Sections 2&3)

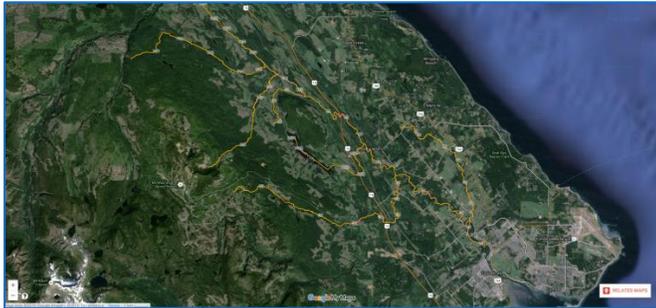
- Provides assessments of channel morphology (morphology describes the shapes of river channels and how they change over time), the riparian and in-stream habitat features and stock assessments.
- Provides reach summaries for main stem Tsolum and the main tributaries (Helldiver, Murex, Constitution, Headquarters, Dove and Portuguese Creeks).

### III. Watershed Targets & Strategies (Sections 4-8)

- Presents restoration priorities for both channel processes, riparian and in-stream habitat features.

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- Provides discussion of work to date and statements of information limitations.
- Lays out the objectives for both in-stream and riparian work, and for future monitoring, so we can track our progress towards our objectives.



Tsolum River Watershed – see map link at [www.tsolumriver.org](http://www.tsolumriver.org)

## IV. Recovery Plan & Implementation (Sections 9&10)

- All identified restoration opportunity recommendations (Table 1 – TRRP Summary Supplement) were reviewed against the criteria of: **status** (improving / stable / degrading), **feasibility** (factors such as ease of access, anchors available, current strength, etc.) and, **benefit** (priority of each activity within the reach).
- An Implementation Plan (Tables 2 & 3) was developed based on the priority issues.

## Key Findings

### Channel Assessment and Project Recommendations:

The majority of the Tsolum River system (with the exception of new impacts to middle Dove Creek) is recovering. However, bedload which flushed from the mountain side during the historic logging days is still moving through the system. Current restoration efforts can significantly reduce the recovery time.

Dove Creek has recently experienced slumps from unstable gullies along its left (north) bank that have added to bedload deposits and increased high bank erosion. A gravel trap has been recommended where the creek levels out above the Inland Highway in Reach

D5 or D6. This project is needed to reduce the risk of failure for recovery projects recommended downstream.

The mainstem Tsolum River can be divided into three main sections:

- Upper with lakes that act as bedload traps.
- Middle with the largest bedload deposits below source tributaries of Murex and Dove Creeks.
- Lower with bedload from upstream and agricultural and residential bank erosion adding more.

The middle stretch of the Tsolum (Reaches T9 & T10) contains large bedload deposits which need to be dealt with before any downstream work can be justified. The preferred option is gravel bar staking where willow and cottonwood stakes are used to stabilise these deposits and by collecting sediments from upstream; resulting in enough site specific elevation gain to establish a riparian area, and narrow and deepen the channel.

A large bedload accumulation in the lower river (Reach T1), just upstream from the Puntledge Indian Reserve was flagged as high priority because the river is prone to changing channels in this reach. A new channel cut through this accumulation after the assessment was completed so the risk may have abated. It will be reassessed in the spring after winter high water flows.

### Riparian Assessment and Project Recommendations:

Riparian planting has often been done on an opportunistic basis or tied to past restoration activities. Ideally, the watershed riparian zones should be assessed so the 'opportunistic' plantings are focused on the reaches most in need of bank stabilization.

Riparian areas throughout the watershed are in the process of recovery but most are large deciduous stands of alder, maple and cottonwood. Planting conifers, mainly cedar, is recommended for succession and future large woody debris (LWD) sources.

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It is recommended that any large, leaning deciduous trees be topped to reduce the weight of the crown and postpone their falling into the river, destabilizing the bank.

Both Dove Creek and Murex Creek have retained large volumes of bedload in the mainly older alder riparian areas below their falls. However, these alders are getting over-mature and there is no understory conifer to succeed them. Planting conifers, mainly cedar, is recommended.

Similar stands of alder dominating the riparian in the Upper Tsolum (Reach T13) near Helldiver Creek are functioning as LWD because flows are lower in the upper watershed and the alder is quite large.

The Tsolum needs LWD throughout the watershed both for channel diversification and habitat values. Stabilization of LWD is recommended when opportunities present themselves, like in the Babcock, trees spanning river project component, or with any bank stabilization project.



2015 Babcock Project large woody debris placement

Successful riparian recovery strategies would address the bedload problem by re-contouring the streambed.

In order to achieve this, in-stream restoration of LWD is the most critical component. Riparian restoration is necessary for ensuring a future source of LWD recruitment, as well as ensuring bank integrity, litter fall input, and shading.

Riparian vegetation removal has caused bank erosion under BC Hydro transmission lines and along some agricultural fields. The TRRS will work with BC Hydro and landowners to modify vegetation management practices in order to protect riparian vegetation and, where necessary, stabilize eroding banks.

### In-stream Habitat Recommendations:

- Spawning gravel, pool habitat, plentiful LWD, and healthy riparian buffers, are all required along all of the lower gradient mainstem.
- Newbury weir gravel stabilization is recommended in Tsolum mainstem near Helldiver confluence (Reach T12) and upstream of Headquarters confluence (Reach T7).
- Portuguese Creek Reach P1 needs spawning gravel rehabilitation and refuge pools, and Reach P2 needs bank stabilization.

### Stock Assessment Recommendations:

Of the salmon stocks in the Tsolum, Odd Year Pink salmon are recovering best with 129,000 counted in the fall of 2015. From smolt counts, Coho populations have been on a steady increase since the lowest record of only 86 in 1986. Chum and Even Year Pink numbers are more variable. Chinook and Sockeye have been recorded occasionally.

Stock enumeration methods such as rotary screw traps, smolt fences, fish trapping in designated reaches, and spawner counts are discussed and compared in the TRRP. As well as the regular rotary screw trap and smolt fence out migration monitoring, it is recommended that monitoring of fish use in the large wetland at Constitution Creek and Helldiver Creek. Critical low flow in the summer impact Coho fry to smolt survival.

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Changing climate predictions indicate warmer wetter winters and drier summers; planning must be flexible to cope with these changes.

### Riparian Restoration Objectives:

The TRRP recommends using the BC Riparian Assessment and Prescription Procedures as well as the Forest Practices Code Guidelines for recommended riparian width. On the Tsolum mainstem this would be a 30m riparian reserve and an additional 20m management zone.

Riparian land is primarily in private ownership so development of education programs and building relationships is imperative.



Riparian planting by school group – 2015 Babcock Project

### In-Stream Restoration Objectives:

In-stream restoration cannot proceed without buy in and permission from the various stakeholders in the watershed and approval by DFO and BC MOFLNR.

Operational principles in sequencing stream rehabilitation are:

- As a general principle, undertake riparian stabilization first, but not exclusively.
- Examine the biological need for off-channel mitigation before riparian work to maintain or salvage fish stocks at risk from destabilized channels.
- Focus restoration efforts on sub-basins that are less highly impacted to ensure more rapid recovery and watershed-level benefits to fish stocks.

- Emulate nature by using natural examples within undisturbed reaches of streams as the key to successful stream restoration strategy.

### Monitoring and Recovery Plan Evaluation

Proper monitoring is needed to determine the success or failure of watershed recovery. The TRRS will use a modified version of the BC Ministry of Environment Routine Effectiveness Evaluation Forms to monitor projects and report on the state of recovery of the Tsolum River. This approach will provide direction on the best monitoring strategy to follow and with successes; future Recovery Plan targets will adapt and change in response. There are three types of monitoring needed:

1. Local performance monitoring of constructed in-stream works such as weirs and bank protection.
2. Riparian monitoring: there is still the need for baseline data, however as plantings occur, they will need local monitoring and care.
3. Overall habitat restoration trend monitoring in reaches of the Tsolum:
  - a. Monitoring quality of fish habitat in selected sample reaches. Using FHAP results as a baseline, habitat quality can be monitored by repeating measurements of selected FHAP parameters.
  - b. Monitoring channel morphology and bedload condition, using thalweg depth measurements as baseline data, the channel condition can be also monitored by repeat measurements.

Monitoring and evaluation of the recovery of Tsolum River watershed and its salmonid populations will consist of:

- Fish Stock Monitoring
- Thalweg Depth Monitoring
- Water Quality Monitoring
- Water Flow Monitoring
- Land Use monitoring
- Project / Activity Effectiveness Monitoring
- Watershed Recovery Evaluation
- Indices of Level of Response Evaluation

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## Limitations and Information Needs

### Stock Condition:

Limited data on stock condition exists. Strategies to capture comparable data for all species of interest need to be developed.

### Marine Survival:

Marine survival is an important but not well understood factor affecting returns of anadromous species. The support of the K'ómoks Estuary Working Group and associated recovery efforts in the marine nearshore environment is key.

### Influence of Fisheries:

The watershed is currently closed to fishing but in-migrating stocks are fished in the marine waters and Courtenay River approach waters. An assessment of harvesting impact (capacity and resilience) on salmonid populations is needed.

### Stewardship and Education:

There is a need for greater connection between public and TRRS. Improved outreach through web and social media and information sharing is ongoing.

### Responding to Unplanned Events:

Unplanned natural events have the potential to have different consequences on the river. By developing generic response plans to different events, the TRRS can be ready to enhance or improve river function.



Dec 2014 flood view and location of 2015 Babcock Trees Spanning River project component (red circle)

## Future Development:

As the CVRD population continues to increase, working with partners to monitor watershed and land use development as a key pressure indicator is important.

## Volunteers Needed for Watershed Monitoring!

There is a need for locals to step-up and volunteer some time to assist in the important task of monitoring. The TRRS will be offering training to those interested.

**Training will be offered in the following areas:**

### Fish Monitoring

- Operate downstream traps, Rotary screw trap and fish fences to enumerate out migrating salmon fry and smolts.
- Fry salvage in pools on the river during summer flows.
- Assess fish use in selected wetlands.

### Water Flow Monitoring

- Measure low water flows in the summer.

### Water Quality Monitoring

- Collect water quality samples and benthic invertebrates to compare with Water Quality Objectives.

### Observe Record Report

- Take the Streamkeepers Course and learn more.

### Photo Point Monitoring

- Take standardized photos at key areas on the river and at special locations to monitor project effectiveness as well as river recovery.

### Invasive Species Monitoring

- Participate in mapping and plant removal.

### Public Awareness

- Help promote community interest in the many Tsolum River issues.

## Contact Us!

Anyone interested should contact us at [tsolumriver@shaw.ca](mailto:tsolumriver@shaw.ca) or through our website at [www.tsolumriver.org](http://www.tsolumriver.org)

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## Implementation Plan

**Table 1 – 5 Year In-stream Restoration Activities Implementation Plan – Priority Projects (all are funding dependent)**

Ranked Priority / Stream / Reach	Recovery Objective	Target Species	Activity – Project Description	Anticipated Timing
<b>PRIORITY 1</b>  Tsolum – <b>red flag</b> <b>T1 - 12 pts</b>	Removal of mobile bedload, rehabilitation of bed and habitat.	All Species	Removal of bedload from deposits upstream of the maple and Puntledge campsites and downstream of the Babcock project. The K'ómoks First Nation may consider stockpiling and selling removed gravel from their adjacent lands. Work with CVRD, KFN, etc.	<b>2016-2017</b> <b>Asset risks.</b>
<b>PRIORITY 2</b>  Dove - <b>extreme</b> <b>D6/D5 – 25 pts</b>	Enhancement of fish habitat and spawning, channel stabilization.	Juvenile and adult salmonids	Removal of bedload by means of a bedload trap (or 2) should be considered, before this long slug of material moves further downstream. <b>(Priority before D3/D1)</b>	<b>2016-2017.</b>
<b>PRIORITY 3</b>  Tsolum - <b>extreme</b> <b>T10/T9 – 18 pts</b>	Stabilizing of mobile bedload.	All Species	Planting on the extensive high gravel bars of mobile bedload by live staking with cottonwood and an excavator. <b>(Priority over any following mainstem projects)</b>	<b>2018.</b>
<b>PRIORITY 4</b>  Tsolum <b>T4 – 24 pts</b>	Live stake planting - stabilization of gravel bar and bank stabilization.	All Species	Willow staking to stabilize mobile bars.  Ongoing source of bedload and siltation to lower reaches along eroding fields.	<b>2019.</b> August salmon window.
<b>PRIORITY 5</b>  Dove <b>D3 – 27 pts</b>	Rehabilitation of channel and enhancement of LWD fish cover habitat: restore channel and floodplain path, open damming gravel bar and stabilize existing debris jam.	Juvenile and adult salmonids	Right bank (2.0m ht.) two erosion sites (8-10m long) between placed riprap require armour and LWD. Place logs in the floodplain to protect overland short cuts and help cut through the bar. Stabilize existing jam with wood and rock and tie it to the bank. This jam requires logs along with rock ballast. Bar to be scalped along thalweg to train first flows to assist cutting through the bar.	<b>Defer until bedload slug mitigation is determined; revert to high priority if mitigated. 2019.</b> August salmon window.
<b>PRIORITY 6</b>  Portuguese <b>P1 – 25 pts</b> *Combine with P2 project	Rehabilitate spawning gravel conditions. Secure perennial winter flood refuge pools. Enhancement of fish habitat / cover and riparian areas.	Juvenile and adult salmonids	611m from Headquarters Rd downstream to the Tsolum. Spawning gravel imported to pool tail out areas. Removal of considerable sediment material prior. Installing 3-5 LWD pieces per pool (2 pool sites) buried into the banks with rock ballast would be an improvement. Planting shrubs & trees to improve bank stability and cover.	<b>2020.</b> August salmon window. September riparian planting.

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Ranked Priority / Stream / Reach	Recovery Objective	Target Species	Activity – Project Description	Anticipated Timing
<b>PRIORITY 7</b> Portuguese <b>P2 – 26 pts</b> *Combine with P1 project	Bank stabilization – offers high benefits to pools and spawning gravel.	Juvenile and spawning salmonids	300m towards Carwithen Rd. Re-sloping the steep cut banks with an excavator where accessible and plant staking/wattles where no machine access is possible. The re-sloped banks can also receive LWD where it can fit in the confined area.	<b>2020.</b> August salmon window.
<b>PRIORITY 8</b> Dove <b>D1 – 25 pts</b> *D6/D5 bedload slug needs to be addressed before proceeding	Bank stabilization – offers high benefits to pools and spawning gravel. Enhancement of fish habitat / cover and riparian areas.	Juvenile and adult salmonids	At Day pool, 40-50m of left bank erosion requires rock and buried LWD and bank needs to be dug back from its vertical angle. Downstream in the next pool several cross logs require anchoring before they wash away. Downstream on left bank is a slump, stabilize with 15m by 3m of willow wattles. Upslope riparian planting is required after restoration on each site along approximately 100m of stream bank. Adding rock crests to increase the spawning gravel anchoring has potential.	<b>Defer until bedload slug mitigation is determined. 2019.</b>  August salmon window. September riparian planting.
<b>PRIORITY 9</b> Tsolum (2 sites) <b>T3 – 21 pts</b>	Bank and tree root wads stabilization, and enhancement of fish habitat.	Juvenile and adult salmonids	Dove Creek Rd site: Place Rip Rap to stabilize 2 banks existing LWD. Work with CVRD in 2015/16 to protect road bed. Formosa property: 50-75m rip rap at toe of slope with added LWD to anchor.	CVRD – <b>2017</b> , Formosa – <b>2021</b> . August salmon window.
<b>PRIORITY 10</b> Tsolum <b>T9 – 20 pts</b>	Riparian planting and LWD replacement to enhance fish habitat.	Juvenile and adult salmonids	Diversify the riparian species diversity with an emphasis on cedar plantings. Improve existing LWD locations until new ones develop. This will improve spawning habitats.	<b>2021.</b> and as part of riparian prescription.
<b>RIPARIAN PRESCRIPTION</b> Tsolum - T13, T10, T9, T8, T7, T4, T3 Murex – M3, M2, M1, etc.	Bank stabilization & future LWD and fish cover enhancement.	Juvenile and adult salmonids	Riparian planting in all reaches, not necessarily linked to any specific assessed priority activity – <b>volunteer, school and community based</b> . Plant a variety of Doug Fir & Red cedar, willow, red osier dogwood, ninebark & salmonberry.	Opportunistically <b>2016 through 2019.</b>

The top three priority projects (dark green fill) have only a single activity and the single activity scored EXTREME while having an overall higher point score. Priority projects 4 through 8 (moderate green fill) and 9 – 10 (light green fill) were ranked based on their overall score *less the riparian point value* in an effort to equalize them. The riparian activities will be included in all projects and prioritized in a separate riparian prescription (Teal green fill). *Priority 3 Project, Tsolum T10/T9, should have the specific T10 and T9 Riparian and LWD Placement activity work done at the same time as the gravel bar live staking priority project.*