Cowichan Watershed Board

Total Suspended Solids

Draft Target Backgrounder for Discussion by CWB

Target Focus

"We want clean water in our watershed."

Proposed Target

TSS levels (turbidity) in the Cowichan Watershed should meet accepted water quality guidelines.

Rationale

Why is Quantifying Suspended Solids Important?

Total suspended solids is a water quality measurement usually abbreviated **TSS**. It is listed as a conventional pollutant in the U.S. Clean Water Act. This parameter was at one time called non-filterable residue (**NFR**), a term that refers to the identical measurement: the dry-weight of particles trapped by a filter, typically of a specified pore size.

The concentration of TSS is important to both river and lake ecosystems for ecological and water quality reasons. Inorganic suspended solids attenuate light, primarily through the process of scattering. High concentrations of suspended solids degrade optical water quality by reducing water clarity and decreasing light available to support photosynthesis (Fig. 1). Suspended solids have been shown to alter predator-prey relationships (for example turbid water might make it difficult for fish to see their prey (e.g., insects)). Suspended solids also influence metabolic activity and provide surface area for the sorption and transport of an array of constituents, including heavy metals and nutrients.

Deposited solids alter streambed properties and aquatic habitat for fish, macrophytes (plants) and benthic organisms. Deposited sediment may be available for resuspension and subsequent transport during periods of increased stream discharge Suspended solids in most freshwater systems originate from watershed sources, pollutant point sources, and sediment re-suspension. More rarely other sources, such as hydro-geologic (i.e., groundwater) structures can be important. High stream total suspended solids can impact water quality and deposition in downstream lakes and reservoirs.

Measuring TSS

TSS of a water sample is determined by pouring a carefully measured volume of water (typically one litre; but less if the particulate density is high, or as much as two or three litres for very clean water) through a pre-weighed filter of a specified pore size, then weighing the filter again after drying to remove all water. Filters for TSS measurements are typically composed of glass fibres. The gain in weight is a dry weight measure of the particulates present in the water sample expressed in units derived or calculated from the volume of water filtered (typically milligrams per litre or mg/l).

Current Status

Cowichan and Koksilah TSS Monitoring

As part of the BC Ministry of Environment's (MoE) mandate to manage water bodies, water quality objective reports have been created for a number of lakes, rivers and marine surface waters. These reports provide a list of objectives to protect water quality, tailored to the specific water body for which they have been created. This takes into account basin hydrology, natural water quality variability, water uses and waste discharges. While provincial water quality objectives currently have no legal standing, they can assist resource managers aiming to protect the water body in question and are used as a standard against which to measure the water quality of a particular lake or river. After objectives are developed, periodic monitoring (3-5 year interval) is undertaken to determine whether they are being met (Obee and Epps, 2011).

A recent **DRAFT** report from the Ministry of Environment (Obee and Epps; Environmental Protection Division, Nanaimo, 2011) discussed using background concentrations of Non-Filterable Residue (NFR or TSS in mg/L) within a specific water body to set actual water quality objectives. **For the Cowichan and Koksilah rivers, Ministry biologists recommended the use of Englishman River TSS water quality objectives as all three watersheds lie within the Nanaimo Lowlands Ecoregion, and the Englishman data set is more comprehensive at this time (Barlak *et al*., 2010).**

MoE staff have sampled Cowichan and Koksilah TSS concentrations and other water quality parameters at several sites on both rivers for the last decade or longer (Fig. 1). Sites are also listed in Table 1

Table 1. Cowichan and Koksilah Rivers site numbers, EMS numbers and descriptions.

Sampling Site No.	*EMS Number*	*Location Description*
C1	E206108	Cowichan River at weir
C2	0120808	Cowichan River upstream of PE 247
C3	E206107	Cowichan River downstream of PE 247
C4	0120802	Cowichan River at the Highway
C5	E206106	Cowichan River 1 km downstream of PE 1497
K1	E207425	Koksilah River at Port Renfrew Road
K2	E206976	Koksilah River at Koksilah Road
K3	E207427	Kelvin Creek at Koksilah Road
K4	E207433	Koksilah River downstream of Kelvin Road
K5	0123981	Koksilah River at the Highway

EMS refers to Environmental Monitoring System.

The Englishman River NFR objectives, which are based on background conditions in the upper watershed, are **33.0 mg/L (maximum) and 13.0 mg/L (mean – based on 5 weekly samples in 30 days) for October to December, and 26.0 mg/L (maximum) and 6.0 mg/L (mean) for January to September.** The Cowichan and Koksilah attainment monitoring results were compared to these objectives to determine their applicability (Table 2).

Table 2. NFR concentrations (mg/L) for the Cowichan and Koksilah rivers. Greyed values exceed the maximum and mean objectives proposed for nearby Englishman River.

		2002					**2003**						**2008**	
	Summer		**Fall**			**Summer**		**Fall**			**Summer**		**Fall**	
SITE	Max	Mean	Max	Mean		Max	Mean	Max	Mean		Max	Mean	Max	Mean
C1	6	3	16	6		3	2	7	3		1	1	3	1
C2	4	2	2	1		2	1	6	3		2	1	2	1
C3	1	1	2	1		2	1	5	2		7	3	1	1
C4	3	2	80	25		9	3	166	60		8	4	12	5
C5	2	2	123	30		51	11	90	39		3	2	22	6
K1	2	1	4	2		8	2	12	3		1	1	2	1
K2	3	2	6	2		1	1	41	10		15	4	4	2
K3	8	3	18	6		36	11	13	5		4	3	3	1
K4	1	1	7	4		10	3	16	7		7	2	6	3
K5	4	2	18	7		7	2	34	13		23	9	11	5

North Island Laboratories' (Courtenay) minimum detection limit for TSS is 5mg/L.

In addition to MoE's TSS sampling program, Catalyst Paper Corp., DFO and the BC Conservation Foundation have undertaken both TSS and turbidity[i] sampling in the Cowichan River to assess water quality in relation to specific needs and objectives, including the Crofton pulp mill's "raw" water supply and as a measure of progress in controlling point sources of fine sediment on the mainstem river (e.g., Stoltz Bluff remediation in 2006/07).

A new project supported by the Pacific Salmon Commission, Natural Resources Canada and Living Rivers – Georgia Basin/Vancouver Island is now underway (2010 – 2012) to assess water quality and fish habitat improvements following Stoltz Bluff remediation. This includes TSS and turbidity sampling from early November through March, coincident with the basin's natural flood hydrograph and peak sediment loading events. This information and previous sampling results from a baseline period (pre-Stoltz construction; 2004-2006) can be added to MoE's NFR/TSS data base for the Cowichan River, and compared with the water quality objectives specified above.

This may also potentially allow for a more rigorous evaluation of annual sediment loads to the river, before and after Stoltz Bluff remediation.

Proposed Actions

1. Collect and correlate data from the Fed/Provincial data system to identify times during the year when there are issues.
2. Install continuous turbidity meters two sites including the lower Cowichan River and explore linking to SCADA system.
3. Establish a monitoring program to identify sources, trends, tendencies, key time periods, storm-event driven issues and hotspots
4. Specific projects e.g. Broadway (possibly requiring Stoltz like project)
5. Various other point/ and non point source remediation projects.

Resource Requirements

Continuously recording turbidity meters are expected to cost approximately $20,000 plus$4,000 ($2,000 per) to maintain & calibrate.

It is anticipated that development of the monitoring program can be accomplished by staff. If the Watershed Board receives its $370K Gas Tax Request monitoring costs can be provided for up to the summer of 2013 when less frequent monitoring would be required. Ongoing monitoring costs are not know at this time.

Preliminary estimates for Broadway rehabilitation projects are estimated at $800,000. Funding sources for that project (should it be feasible) would be similar to those for the Stoltz project e.g. Conservation partners -possibly. Living Rivers, HCTF, Catalyst, Salmon Commission, various levels of governments including Cowichan Tribes etc.)

Other costs are yet to be determined but depending on the findings of monitoring a number of other projects may be required to be undertaken by TSS generators.

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[i] Turbidity is the amount of particulate matter that is suspended in water. Turbidity measures the scattering effect that suspended solids have on light: the higher the intensity of scattered light, the higher the turbidity. Turbidity is measured by shining a light through the water and is reported in nephelometric turbidity units (NTU).