Freshwater Creek TMDL

Electronic Newsletter

This is the second electronic newsletter for the Freshwater Creek Total Maximum Daily Load (TMDL). The recipients of this newsletter are based on an email list which was created in 2003 to streamline the process of sending updates to those people interested in the watershed and the TMDL, without going through the resource- and time-consuming process of producing and mailing numerous newsletters. We intend to send biannual updates to this list in the future. These newsletters will also be posted on the Freshwater TMDL website: http://www.waterboards.ca.gov/northcoast/programs/tmdl/freshwatercreek/freshwater.html

If you wish to subscribe or unsubscribe to this newsletter, go to the following link: http://www.waterboards.ca.gov/northcoast/email.html

In this Newsletter

Sediment Source Assessment – Phase 1

Pacific Watershed Associates (PWA) has completed their work for Phase 1 sediment source assessment for the Freshwater Creek TMDL. Phase 1 focused on conducting a landslide inventory using air photos and included field work to determine the number of landslides not detected in the air photos. Phase 1 also included road surface erosion estimates for the watershed. Some of the findings of this report include:

- A total of 190 landslides delivered 87,000 yds^3 of sediment to streams (1987-2003). Most of the landslides (65%) were in the Ryan Slough planning watershed.
- 56% of the landslides were debris landslides and delivered 67% of the sediment.
- Most of the landslides (70%) and sediment delivered (68%) occurred in Wildcat geology.
- 23% of the landslides were road-related (30% of sediment delivery). Road-related slides, on average, were 33% larger than non road-related landslides.
- 31% of the landslides were harvest related (26% of sediment delivery) and 38% of the landslides had no apparent management association (32% of sediment delivery).

- Small landslides that could not be detected on air photos delivered an average of 169 yds^3/ 1,000 ft of channel.
- Surface erosion from roads contributed an estimated 166,392 yds^3 of sediment to stream channels. Approximately 80% came from the Freshwater Creek planning watersheds.

The report can be downloaded from the Regional Water Board website. The report is on the Freshwater Creek TMDL webpage:

http://www.waterboards.ca.gov/northcoast/programs/tmdl/freshwatercreek/freshwater.html

Phase 2 – Landslide Hazard Mapping and Background Sediment Loads

Due to delays in contract approval and developing data use agreements between the contractor and the landowners, the need to meet the contract deadlines made it impossible to finish all the items needed for the Freshwater Creek TMDL. After it became clear that the contract could not be extended, we determined the best course of action was to work on the items that could be completed within the deadlines, and to develop and approve a new contract for the leftover items. However, this has led to further delays in the development of the TMDL.

The Sanborn Map Company and PWA were awarded the Phase 2 contract. This contract will focus on running slope stability models to assist in the development of a landslide hazard map for the TMDL. Bank erosion surveys will also be conducted using two different methodologies to improve our understanding and estimates for bank erosion and natural sediment loads. These surveys will be conducted in three small watersheds in the Elk River watershed to take advantage of turbidity and suspended sediment monitoring stations that will allows us to compare the bank erosion estimates with the suspended sediment loads. The work for this contract is expected to be completed by the end of this year.

Turbidity and Suspended Sediment Data Processing

We wish to thank Pacific Lumber Company, Green Diamond Resources Company and Salmon Forever for providing turbidity and suspended sediment data. This important data allows us to 1) estimate the impacts of suspend sediment to the fisheries and to 2) provide an important check on the sediment budgets being derived for the TMDL.

Turbidity is an optical measure of the amount of suspended particles in the water column, including suspended sediment, algae, organic matter and pollutants. Turbidity can be measured by a probe placed in the stream. Typically, a probe is programmed to record the turbidity every ten to fifteen minutes so we can have

"continuous" measurements. For example, Figure 1 shows how the turbidity varies throughout the "hydro-year" for a monitoring station, station 500, which is located on a tributary to South Fork Freshwater Creek. Turbidity peaks occur during storms, and for this station, it reached maximum turbidity (948 NTUs) during a storm that occurred on April, 8, 2005. Suspended sediment samples are also taken throughout the hydro-year so that suspended sediment concentrations can be correlated with turbidity.

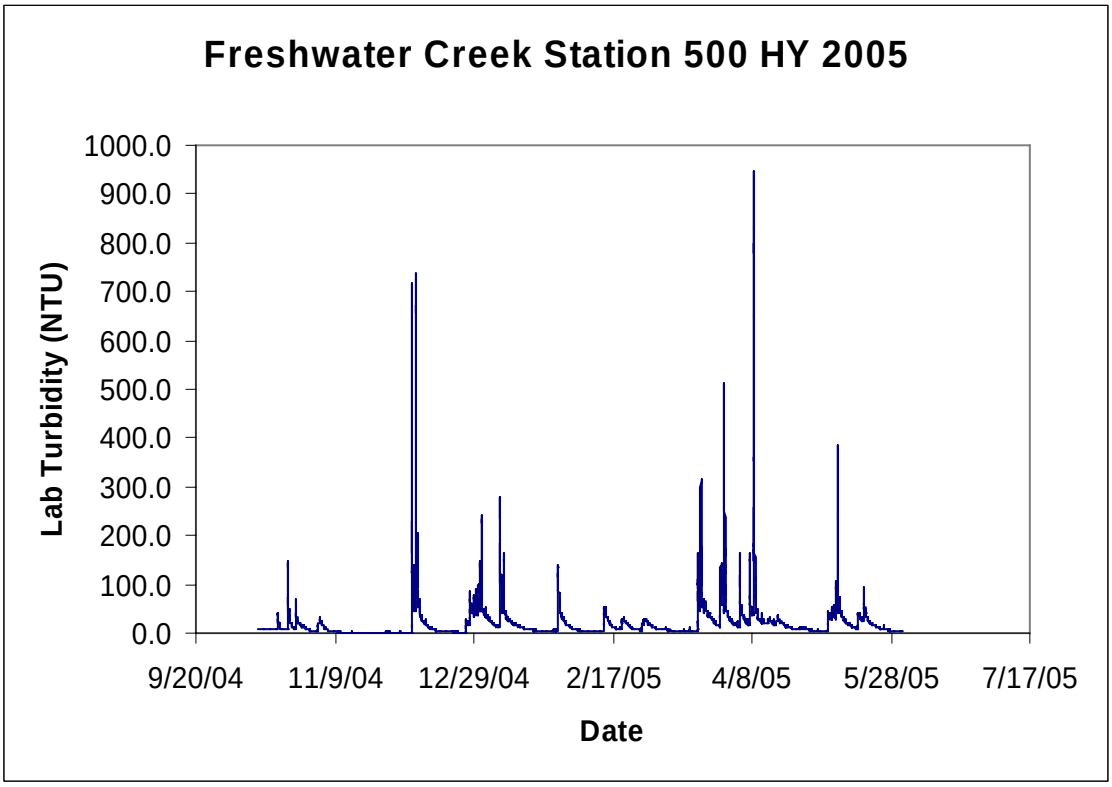


Figure 1. Turbidigraph for a monitoring station that is a tributary to South Fork Freshwater Creek.

We are using this monitoring data to analyze the potential impacts to the salmonids in Freshwater Creek as part of our TMDL analysis. Newcombe and Jensen (1996) performed an analysis of eighty published articles and reports that documented fish response to suspended sediment. They developed a "severity index" to describe the different effects associated with suspended sediment on the fish (Table 1). Newcombe and Jensen also created six models that relate the different species and life stages to the suspended sediment dose (suspended sediment concentration and exposure time).

We are analyzing the turbidity and suspended sediment using a modified model 1 and model 4 from Newcombe and Jensen. Model 1 covers all juvenile and adult salmonids, while model 4 is for eggs and larvae of salmonids and non-

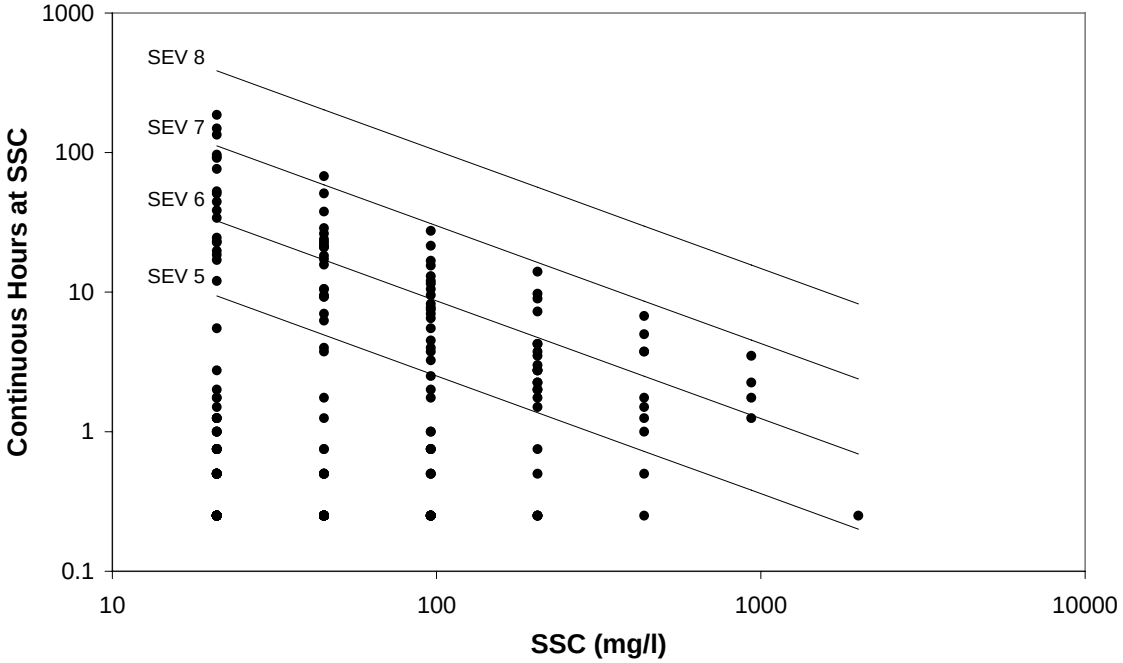
salmonids. Model 1 was modified by excluding species which evolved under conditions different than those of this watershed (e.g. Arctic Grayling).

Table 1.

Severity Index from Newcombe & Jensen 1996	
Rank	**Description of Effect Associated w/ Excess Turbidity or Suspended Sediment**
0	No Effect
1	Alarm Reaction
2	Abandonment of Cover
3	Avoidance Response
4	Short-term Reduction in Feeding Rates and/or Feeding Success
5	Minor Physiological Stress, Increased Coughing Rate, and/or Increased Respiration Rate
6	Moderate Physiological Stress
7	Moderate Habitat Degradation and/or Impaired Homing
8	Major Physiological Stress, Poor Condition, and/or Long-term Reduction in Feeding Rates and/or Feeding Success
9	Reduced Growth Rate, Delayed Hatching, and/or Reduced Fish Density
10	0 to 20% Mortality, Increased Predation, and/or Moderate to Severe Habitat Degradation
11	>20 to 40% Mortality
12	>40 to 60% Mortality
13	>60 to 80% Mortality
14	>80 to 100% Mortality

An example of our analysis is shown in Figure 2. This figure shows that suspended sediment doses reached levels that would create moderate habitat degradation and/or impaired homing (SEV level 7) for this monitoring station during the 2005 hydro-year.

Freshwater Creek Station 500 HY 2005 Model 1 (Modified)



Another part of our analysis of the turbidity and suspended sediment data is to estimate the suspended sediment loads. For example, Table 2 shows the estimated suspended sediment loads for monitoring station 500.

Table 2. Suspended sediment estimates for Station 500, a tributary to South Fork Freshwater Creek.

Freshwater Creek Station 500	**2003**	**2004**	**2005**
Suspended Sediment Load (metric tons)	432	160	194

There are approximately eleven turbidity and suspended sediment stations in the Freshwater Creek TMDL watersheds, one of which has been operating since the winter of 1999. Although it takes time to analyze all this data, it will be very helpful in developing the TMDL for this watershed.

Reference

Newcombe, Charles P., and Jorgen O. T. Jensen. 1996. Channel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk Impact. *North American Journal of Fisheries Management* **16**:693-726.

The next issue of this newsletter will be produced around November 2007. Please contact Matthew (707 576-2499 or mbuffleben@waterboards.ca.gov) or Mark (707 576-2689 or mneely@waterboards.ca.gov) for questions or input on this project.