Hydrologic and Geomorphic Characteristics of the Big Creek Drainage Basin

Big Creek, a major tributary to the Yukon River, drains an area of approximately 1750 square kilometers and has an overall channel length of approximately 77 km. The drainage basin is located west-south-west of Minto and north-west of Carmacks.

Big Creek has its headwaters in the Dawson Range and eventually drains into the Yukon River below the old town site of Minto. There are several areas of exposed bedrock forming high rock bluffs along the creek. Above the WSC gauging station, the creek is entrenched within a narrow valley, while below the gauging station the creek flows through a low flat area before entering the Yukon River. The creek banks are generally lined with spruce, willows and poplars. Most of the creek flows over a bed of course gravel, underlain by shallow bedrock. There has been very little channel migration evident along the lower portion of the creek, below the confluence with Seymour Creek, but above this point, Big Creek has been prone to heavy flooding and substantial migration has occurred.

The Water Survey of Canada (WSC) gauging station (09AH003) is located 9.7 km from the confluence of Big Creek with the Yukon River.

Topographical drainage Basin	1750 Sq. Kilometers
Area of Lakes	0%
Area of Forest	98%
Channel Length	77 Kilometers
Terrain	75% non-glaciated / 25% glaciated

In 2008, water samples were collected at 17 different sites in the Big Creek basin. Sampling commenced on June 10th, 2008 and a total of 448 samples were collected up until the end of the season on August 21st, 2008. A combination of automatic composite sampling and grab sampling methods were used in the basin.

Atmospheric data was collected using four portable weather stations; one located near the mouth of Big Creek, the second on upper Big Creek, another above all mining on Mechanic Creek and the last at the mouth of Seymour Creek

Basin total flow data was provided to us by the Water Survey of Canada station located near the mouth of Big Creek. Flow data for the individual tributaries to Big Creek was collected at the time of sampling by the staff of E.M.R CS&I using the methodology outlined in the Yukon Placer Secretariats, Water Quality Monitoring Protocol.

In 2008, the effluent discharge standards for the Big Creek Basin were those set under the existing *Yukon Placer Authorization*. Beginning in 2009, the effluent standards for all 19 separate watersheds in the Yukon, including Big Creek, will be set under the *Fish Habitat Management System*. The *Fish Habitat Management System* replaces the YPA with approximately 19 separate watershed authorizations, each of which are class authorizations under Section 35(2), governing placer mining in specific drainage basins.

Site Codes and Global Position of Water Quality Sampling Locations in the Big Creek Watershed

SITE CODE	LOCATION	LAT_Y	LONG_X
BC 01	Big Creek mouth	62.59901	-137.01318
BC 02	Big Creek u/s of Seymour Creek	62.35579	-137.17790
BC 02A	Big Creek u/s Happy Creek and d/s Boliden Creek	62.34543	-137.25592
BC 03	Big Creek d/s of Mechanic Creek and bridge	62.35129	-137.29741
BC 04	Upper Big Creek u/s Mechanic Creek	62.34840	-137.30298
BC 05	Upper Big Creek	62.37486	-137.38141
BC BOL 01	Boliden Creek mouth	62.34525	-137.25809
BC BOW 01	Bow Creek mouth	62.30600	-137.21629
BC HAP 01	Happy Creek mouth	62.34672	-137.23535
BC MEC 01	Mechanic Creek mouth	62.34764	-137.30185
BC MEC 02	Mechanic Creek above Gow's mining	62.34085	-137.31169
BC MEC 03	Mechanic Creek at road crossing to Hank Farr camp	62.33065	-137.31941
BC MEC 04	Mechanic Creek Above All Mining (AAM)	62.32771	-137.32123
BC REV 01	Revenue Creek mouth	62.34504	-137.27414
BC REV 02	Revenue Creek above Whirlwind Creek	62.33569	-137.27481
BC SEY 01	Seymour Creek mouth	62.35560	-137.17700
BC SEY 02	Seymour at road crossing	62.30057	-137.21416
BC SEY 03	Seymour Creek Above All Mining (AAM)	62.27880	-137.17442
BC WHI 01	Whirlwind Creek mouth	62.33558	-137.27507
BC WHI 02	Whirlwind Creek Above All Mining (AAM)	62.33235	-137.28101

Water Quality Objective monitoring, Big Creek Watershed – Summary

Between 1998 and 2000, this basin was extensively monitored, providing us with a vast amount of baseline information at the time. Placer activates in this watershed have recently increased. Due to the greater interest in the area, and recent changes in mining locations and levels of activity, the Big Creek Watershed was designated a '*major*' watershed for monitoring in 2008. This meant that a major proportion of our monitoring efforts were spent in the basin, that more than one third of our monitoring equipment inventory was deployed in the Big Creek area, and that our seasonal monitoring schedule included many repeat visits throughout the season.

A total of eight, automatic water sampling stations were set up and maintained from June 10th until shutdown on August 21st as well as four portable weather monitoring stations. From the data obtained by these instruments and through on site visits and sampling conducted by CS&I staff, the following observations regarding the water quality in the basin can be made:

On average, the water quality in the basin, met the minimum objectives set under the *Fish Habitat Management System* throughout the monitoring season. On those occasions when the WQO were not met and the Total Suspended Solids levels were greater than the objectives, a direct correlation between environmental conditions and the volume of solids in the water was observed.

In all cases, rain fall, either as localised events or basin wide occurrences, increased the amount of surface run off and subsequent soil erosion from the land, increasing the input of sediment into the receiving waters. These increases occurred simultaneously at the time of the rain event or immediately in a period of one or two days after the rain event, as surface water continued draining from the land and ground water infiltrated the water course.

Increases in the volume of sediment laden ground and surface water entering the system add to the amount of sediment in the water course. The ability of the receiving water to dilute these inputs of sediment is negated by the re-suspension of stream bed material and by the further erosion of the streams banks that occurs along with the increased flows that are generated by the aftermath of these rain events.

All of these factors; precipitation leading to increased sediment input and increased flows from these rain events re-suspending and further eroding material, lead to an increase in suspended solids concentrations and a decrease in water quality.