

Hydrologic and Geomorphic Characteristics of the Klondike River Drainage Basin

The Klondike River, a major tributary to the Yukon River, drains an area of approximately 7800 square kilometers and has an overall channel length, including the North Klondike River, of approximately 160 Km.

The North Klondike River, a tributary of the Klondike River, drains an area of approximately 1100 square kilometers. From its headwaters in the Ogilvie Mountains, the North Klondike flows in a southerly direction for approximately 75 kilometers until its confluence with the Klondike. It then flows west, down the valley as the Klondike for approximately 42 kilometers until it joins the Yukon River near Dawson.

The North Klondike, for its first 58 kilometers, flows through a narrow valley entrenched between high mountains. The remaining length of the river, all the way to the mouth of the Klondike, flows south through relatively flat topography. The banks of the river are stable with relatively little erosion except during flood periods.

Water Survey of Canada's gauging stations are located near the mouth of the north Klondike (09EA004, Km 9.5 Dempster Highway), and at the mouth of the Klondike River (09EA003) near Dawson.

North Klondike

Topographical drainage Basin	1100 Sq. Kilometers
Area of Lakes	<2%
Area of Forest	<44%
Channel Length	76.5 Kilometers
Terrain	glaciated

Klondike

Topographical drainage Basin	7800 Sq. Kilometers
Area of Lakes	<1%
Area of Forest	<30%
Channel Length	160 Kilometers
Terrain	Left Limit: non-glaciated Right Limit: glaciated

In 2008, water samples were collected at 37 different sites in the Klondike River basin. Sampling commenced on May 13th, 2008 and a total of 363 samples were collected up until the end of the season on August 26th, 2008. A combination of automatic composite sampling and grab sampling methods were used in the basin.

Atmospheric data was collected using two portable weather stations, one located near the mouth of Bonanza Creek, the other above all mining near the headwaters of Hunker Creek. Additional information was provided through the Yukon Government Community Services weather station at the Klondike Fire Center, located at the Dawson City Airport.

Basin total flow data was provided to us by the Water Survey of Canada station located near the mouth of the Klondike River. Flow data for the individual tributaries to the Klondike River 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 Klondike River 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 the Klondike, 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 Klondike River Watershed

SITE CODE	LOCATION	LAT_Y	LONG_X
K 01	Klondike River at mouth	64.05348	-139.43961
K 02	Klondike River at bridge u/s of Bonanza Creek	64.08163	-139.40922
K 03	Klondike River at Marcel's Sauna	64.04693	-139.12772
K 04	Klondike River d/s of Goring Ck and u/s of Hunker Creek	64.05810	-139.03092
K 05	Klondike River at Dempster hwy	63.99030	-138.74612
K 06	Klondike River d/s of Too Much Gold Ck bridge	63.95778	-138.69030
K 07	Klondike River u/s of Too Much Gold Creek	63.95131	-138.66690
K 08	Klondike River at highway washout d/s of Flat Creek	63.95782	-138.69005
K ADAM 01	Adams Gulch Creek mouth	63.93412	-139.33099
K ALLG 01	All Gold Creek Below All Mining (BAM)	63.94263	-138.61734
K ELDO 01	Eldorado Creek mouth	63.91909	-139.31386
K ELDO 01A	Eldorado Creek Left Fork	63.86261	-139.24573
K ELDO 01B	Eldorado Creek Right Fork	63.86261	-139.24573
K ELDO 02	Eldorado Creek d/s of French Gulch	63.91267	-139.31483
K ELDO 03	Eldorado Creek u/s of French Creek	63.90855	-139.31382
K ELDO 04	Upper Eldorado Creek background	63.86187	-139.24578
K FLAT 01	Flat Creek Below All Mining (BAM)	64.02940	-139.17860
K FREN 01	French Gulch mouth	63.90865	-139.31442
K GOLDB 01	Gold bottom Creek mouth	63.96247	-138.96675
K LAST 01	Last Chance Creek mouth	64.01028	-139.09018
K TOO 01	Too Much Gold Creek mouth	63.95132	-138.66708
K VICT 01	Victoria Creek mouth	63.91262	-139.20933
KB 01	Bonanza Creek Below All Mining (BAM)	64.04054	-139.40814
KB 02	Lower Bonanza Creek (DFO site)	64.01295	-139.37022
KB 03	Lower Bonanza Creek d/s of bridge	63.97027	-139.35472
KB 04	Bonanza Creek d/s of Adams Gulch	63.93550	-139.32798

KB 05	Bonanza Creek u/s of Adams Gulch	63.93415	-139.32977
KB 07	Bonanza Creek d/s of Eldorado Creek	63.92047	-139.31600
KB 08	Upper Bonanza Creek u/s of Eldorado Creek	63.91963	-139.31329
KB 09	Upper Bonanza Creek u/s of Victoria Creek	63.91282	-139.20921
KH 01	Hunker Creek Below All Mining (BAM)	64.02943	-139.17859
KH 02	Hunker Creek d/s of Henry Gulch	64.02838	-139.17522
KH 04	Hunker Creek d/s of Last Chance Creek	64.01103	-139.08967
KH 05	Hunker Creek u/s of Last Chance Creek	64.01015	-139.09148
KH 06	Hunker Creek d/s of Gold bottom Creek	63.96833	-138.97324
KH 08	Hunker Creek u/s of Gold bottom Creek	63.96833	-138.97324
KH 09	Hunker Creek Above All Mining (AAM) left fork	63.91105	-138.88522
KH 10	Hunker Creek Above All Mining (AAM) right fork	63.89025	-138.92522
KH 11	Hunker Creek Above All Mining (AAM), d/s of forks	63.91319	-138.88727

Water Quality Objective monitoring, Klondike River Watershed – Summary

Because of extensive monitoring activities conducted in this watershed between 2004 and 2007 which provided vast amounts of data for comparative purposes, and due to large number of both active and historic mines in the drainage area, the Klondike River Watershed was once again designated a ‘major’ watershed for monitoring in 2008.

Two automatic water sampling stations were set up and maintained from May 13th until shutdown on August 26th as well as two portable weather monitoring stations. Water sampling sites in the Klondike received multiple visits during the monitoring season due to their close proximity to Dawson and their location along the access route to the Indian River Watershed.

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:

The water quality objectives, set under the *Fish Habitat Management System*, were not met at all sites throughout the 2008 monitoring season. On those occasions when the WQO were not met and the Total Suspended Solids levels were greater than the objectives, there is a direct correlation to environmental conditions influencing the amount of solids concentrations in the water.

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 sediment laden ground and surface water entering the system add to the amount of sediment in the water. 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.