YUKON PLACER SECRETARIAT

# Water Quality Monitoring Annual Report 2016

## Sixty-Mile River Watershed

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# Water Quality Objective Monitoring, Sixty Mile River Basin, 2016

## Sixty Mile River Watershed

The Sixty Mile River originates in Alaska and has a length, after crossing into Canadian territory measured along the valley, of about 110 km, and following the windings of the river, of about 201 km in total. Its fall, from the boundary to the Yukon from Alaska, amounts to 434 m, and the average grade of the valley to a little over 9.75 m to the kilometer. At the international boundary, it is a rapid winding stream averaging about 6.1 m in width and interrupted at frequent intervals by steep bars covered with only a few centimeters of water. The upper portion of the river from the boundary to California creek can hardly be considered a navigable stream even for small boats. Below California creek, the volume of water increases and the descent becomes less difficult, but bars and rapids continue almost to the mouth and no part of the river is easy to ascend. The tributary streams are small, as a rule, but two large streams, one draining the country to the west and one other to the south, come in within 6 kilometers of each other, nearly opposite Indian River, and these branches nearly double the volume of the main river. Towards its mouth, Sixty Mile has an average width of from 37–46 m.

The valley of Sixty Mile is generally flat-bottomed, the flats varying from a 180 m to nearly 1.6 km in width. The sides are usually terraced and in places, the stream for long distances has cut a secondary rock-walled channel, similar to that noticed on Indian River and Stewart River, through the bottom of its old valley. The country bordering Sixty Mile River forms part of the Yukon plateau, a highland worn into rounded hills and long zigzag ridges, but containing no well-defined and continuous mountain ranges. At several points, high hills usually of andesite, project a few hundred feet above the general level.

Miller Creek enters Sixty Mile about 110 km from its mouth. In addition to Miller Creek, Glacier, Gold, Little Gold, and Bed Rock creeks are all tributaries of Sixty Mile. Sixty Mile Butte, a prominent mountain above the headwaters of the stream, is of granite.

At the boundary and down the valley to Bedrock creek, the rocks consist principally of igneous schists of various kinds, largely granite-gneisses, with which are associated some quartzite and other clastic schists. These schists constitute the gold-bearing rocks. They are replaced below Bedrock creek by andesite, which continue down to a point 2.4 km west of the mouth of Gold creek. The andesite extends up Miller Creek nearly 4.8 km and up Gold creek over 11 km. The gross drainage area of the Sixty Mile River is 3060 $km^2$.

The Sixty Mile River basin is a heavily diverse watershed, with long tracks of active mining as well as inactive, reclaimed, and partially reclaimed, sections. This basin has been extensively monitored for the past 17 years providing us with a vast amount of information regarding the state of the water quality in a historically mined watershed.

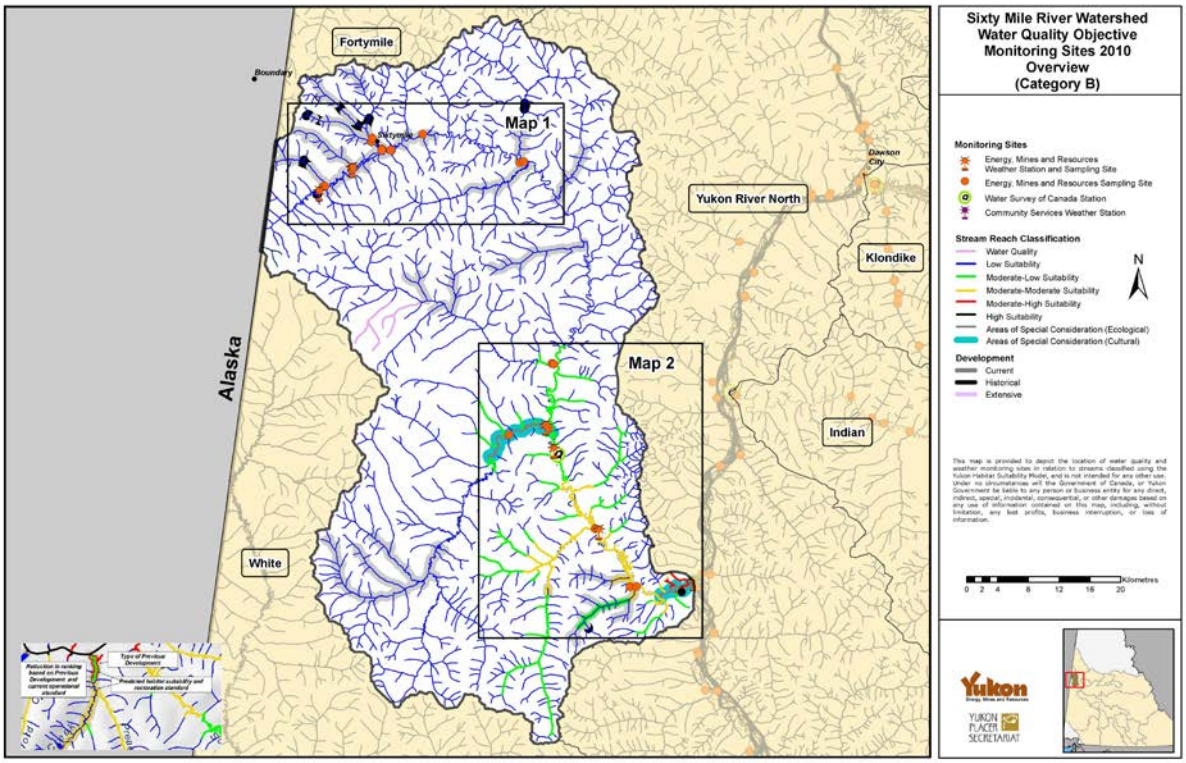
In 2016, water samples were collected at 10 different sites in the Sixty Mile River basin. Sampling commenced on May 17$^{th}$, 2016 and 553 samples were collected up until the end of the season on September 7$^{th}$ 2016. A combination of automatic composite sampling and grab sampling methods were used in the basin.

Atmospheric data was collected using three portable weather stations, one located near the mouth of the Sixty Mile River, another at along the Sixty Mile River downstream of Five Mile Creek and a last at an Upper Sixty Mile River background site.

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

**Site Codes and Global Position of Water Quality Sampling Locations in the Sixty Mile River Watershed**

| SITE_CODE | SITE_DESCRIPTION | LATITUDE_DD | LONGITUDE_DD |
|---|---|---|---|
| SI01 | Sixty Mile River mouth | 63.55929 | -139.76578 |
| SI02 | Sixty Mile River upstream Ten Mile Creek | 63.54676 | -139.92938 |
| SI03 | Sixty Mile River downstream Twenty Mile Creek | 63.68945 | -140.15981 |
| SI04 | Sixty Mile River upstream of Water Survey of Canada Site | 63.69286 | -140.16948 |
| SI05 | Sixty Mile River upstream of confluence with Matson Creek | 63.71880 | -140.19047 |
| SI06 | Sixty Mile River upstream of Fifty Mile Creek | 63.79314 | -140.19731 |
| SI07 | Sixty Mile River downstream of California Creek | 64.02219 | -140.34203 |
| SI08 | Sixty Mile River downstream of Five Mile Creek | 64.03903 | -140.61754 |
| SI09 | Sixty Mile River downstream of Big Gold Creek | 64.01590 | -140.69438 |
| SI10 | Sixty Mile River upstream of Big Gold Creek | 64.01591 | -140.69672 |
| SI11 | Sixty Mile River downstream of Miller Creek | 63.98712 | -140.78941 |
| SI12 | Sixty Mile River upstream of Miller Creek | 63.98732 | -140.79236 |
| SI13 | Sixty Mile River downstream of Bedrock Creek | 63.96442 | -140.85784 |
| SI14 | Sixty Mile River above all mining | 63.95505 | -140.86928 |
| SI_BE01 | Bedrock Creek mouth | 63.96371 | -140.86111 |
| SI_BI01 | Big Gold Creek mouth | 64.01590 | -140.72046 |
| SI_BI02 | Big Gold Creek upstream of confluence with Glacier Creek | 64.02708 | -140.74985 |
| SI_CA01 | California Creek mouth | 64.02017 | -140.35150 |
| SI_FI01 | Fifty Mile Creek mouth | 63.79349 | -140.20274 |
| SI_GL01 | Glacier Creek mouth | 64.01418 | -140.72046 |
| SI_GL02 | Glacier Creek at road crossing | 64.02293 | -140.74994 |
| SI_MA01 | Matson Creek mouth | 63.71862 | -140.19824 |
| SI_MA02 | Upper Matson Creek | 63.70507 | -140.29218 |
| SI_MI01 | Miller Creek mouth | 63.98732 | -140.79236 |
| SI_TE01 | Ten Mile Creek mouth | 63.54799 | -139.91335 |
| SI_TWEL01 | Twelve Mile Creek mouth | 63.21667 | -139.85000 |
| SI_TWEN01 | Twenty Mile Creek mouth | 63.60909 | -140.03815 |




## Water Quality Objective monitoring, Sixty Mile River Watershed – Summary

Due to the intensified interest in the area, and recent changes in mining locations and levels of activity, the Sixty Mile River Watershed was once again designated an important watershed for monitoring in 2016. This meant that a major proportion of our monitoring efforts were spent in the basin, and that our monitoring schedule included many repeat visits throughout the season. Five automatic water sampling station and three weather stations were set up and maintained from May17th until shutdown on September 7th 2016.

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 average 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 most cases, rainfall, as either 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 watercourse.

**The Fish Habitat Management System - Sixty Mile River Watershed (Category B)**

**Sample Results that Exceed Water Quality Objectives for 2016**

| Sampling Station | SI01 | SI04 | SI_MA01 | SI_FI01 | SI06 | SI08 | SI10 | SI_BI01 | SI_MI01 | SI14 |
|---|---|---|---|---|---|---|---|---|---|---|
| Location Description | Mouth | lower 60M u/s WSC station | Matson Ck Mouth | Fifty Mile Ck mouth | u/s Fifty Mile Creek | d/s Eldorado Placers | u/s SI_BI01 | Big Gold Ck mouth | Miller Ck mouth | AAM |
| Sample Type | Auto | Auto/Grab | Grab | | | Auto/Grab | Auto | Grab | Grab | Auto |
| Lat Y | 63.54735 | 63.69286 | 63.71928 | 63.79349 | 63.79314 | 64.03903 | 64.01576 | 64.02708 | 63.98746 | 63.96247 |
| Long X | -139.79333 | -140.16948 | -140.19861 | -140.20274 | -140.19731 | -140.61754 | -140.69718 | -140.74985 | -140.79268 | -140.86173 |
| Habitat Classification | Area of special consideration | Moderate-L | Area of special consideration | Moderate-L | Moderate-L | Low | Low | Low | Low | Low |
| Water Quality Objective (mg/L) | 100 | 200 | 200 | 200 | 200 | 300 | 300 | 300 | 300 | 300 |
| Date of Sampling | | | | | | | | | | |
| 2-Jun-16 | 406.3 | 11.2 | | | | 5.6 | 4.2 | | | 4.4 |
| 5-Jul-16 | 58.4 | 156.0 | 93.2 | | | 415.6 | 288.8 | 106.0 | 189.2 | 65.2 |
| 6-Jul-16 | 172.8 | 96.0 | | | | 208.0 | 67.6 | | | 26.4 |
| 7-Jul-16 | 152.8 | 243.2 | | | | 96.8 | 73.2 | | | 38.4 |
| 8-Jul-16 | 91.6 | 177.2 | | | | 345.6 | 98.8 | | | 66.0 |
| 15-Jul-16 | 80.4 | 108.4 | | | | 428.0 | 48.0 | | | 61.6 |
| 16-Jul-16 | 132.4 | 40.0 | | | | 1304.0 | 312.4 | | | 209.6 |
| 17-Jul-16 | 202.0 | 248.4 | | | | 439.2 | 349.2 | | | 470.4 |
| 22-Jul-16 | 193.2 | 52.3 | | | | 60.8 | 66.0 | | | 34.0 |
| 29-Jul-16 | 40.8 | 244.4 | | | | 71.2 | 48.8 | | | 63.2 |
| 30-Jul-16 | 244.0 | | | | | 41.6 | 21.6 | | | 15.6 |
| 16-Aug-16 | 358.4 | | | | | 452.4 | 101.2 | | | 134.4 |
| 17-Aug-16 | 348.8 | 130.4 | 8.0 | | | 39.2 | 43.2 | 12.0 | 32.0 | 54.8 |
| 27-Aug-16 | 103.2 | 89.2 | | | | 48.8 | 8.4 | | | 29.2 |
| | | | | | | | | | | |
| Total Seasonal Average TSS (mg/L) by site | 47.9 | 46.4 | 40.5 | NA | NA | 66.2 | 28.9 | 42.9 | 66.9 | 25.0 |
| Number of days sampled | 102 | 83 | 4 | 0 | 0 | 101 | 107 | 4 | 4 | 109 |

Legend: Not continuously monitored

Water Samples that are: Above / Below the Water Quality Objective