

**Adaptive Management  
Report 2020**

**Fish Habitat Management System for Yukon Placer  
Mining**

May 11 2021



# Acronyms

AHM	Aquatic Health Monitoring
AMF	Adaptive Management Framework
CSAS	Canadian Science Advisory Secretariat
DFO	Fisheries and Oceans Canada
EHM	Economic Health Monitoring
% EPT	percent ephemeroptera, plecoptera and trichoptera
FHMS	Fish Habitat Management System
IMG	Intergovernmental Management Group
NTU	nephelometric turbidity units
RCA	Reference Condition Approach
TSS	total suspended solids
WQO	Water Quality Objective
WQOM	Water Quality Objective Monitoring
YPS	Yukon Placer Secretariat
AMF	Adaptive Management Framework
CSAS	Canadian Science Advisory Secretariat
DFO	Fisheries and Oceans Canada
EHM	Economic Health Monitoring
FHMS	Fish Habitat Management System
IMG	Intergovernmental Management Group
JPIC	Joint Placer Implementation Committee
RCA	Reference Condition Approach
TSS	total suspended solids
WQO	Water Quality Objective
WQOM	Water Quality Objective Monitoring
YPS	Yukon Placer Secretariat

# Table of Contents

Executive Summary .....	1
Introduction.....	1
Summary of Monitoring Results.....	2
Evaluation and Adjustment Results .....	7
Literature Cited.....	9
Appendix A: 2020 Water Quality Objective Monitoring and Aquatic Health Monitoring Report	
Appendix B: 2020 Economic Health Monitoring Report	



# Executive Summary

## Introduction

Placer mining, which recovers gold from gravel, takes place in and around creeks and streams. Some aspects of placer mining works can result in the harmful alteration, disruption or destruction of fish habitat. The system for managing the effects of placer mining on fish and fish habitat under the *Fisheries Act* is the Fish Habitat Management System for Yukon Placer Mining (the FHMS). The FHMS is administered by Fisheries and Oceans Canada (DFO) and the Government of Yukon.

The FHMS includes operational requirements and standards for placer mining which are based on watershed sensitivity to placer mining activity and fish habitat suitability. The requirements are designed to support the management system in achieving the dual objectives of the conservation and protection of fish and fish habitat supporting fisheries alongside a sustainable placer mining industry (YPISC and YPWC, 2005; YPS 2008a). Adaptive management is required to support the FHMS as there is uncertainty whether the operational requirements will balance the two objectives, or whether they will shift the system towards one objective over the other. Adaptive management involves monitoring, assessing, and evaluating the outcomes of the operational requirements to determine if they need to be adjusted to better balance the management objectives.

The Adaptive Management Framework (AMF) has supported the FHMS since 2008 (YSA 2008a). The AMF identifies how information gathered through the three effects monitoring programs and Traditional Knowledge will be used to guide decisions about potential adjustments to the FHMS. This information is collected and analyzed on an annual basis. The three effects monitoring protocols include Water Quality Objective Monitoring (WQOM), Aquatic Health Monitoring (AHM), and Economic Health Monitoring (EHM). This Adaptive Management Report communicates the results of the 2020 monitoring programs.

Recently, several reviews have been done to examine the design and implementation of the AMF. This work includes the Implementation Status Review for the FHMS (YPS, 2018), the Evaluation of the Reference Condition Approach for the AHM program (CSAS, 2019), and the Review and Evaluation of Adaptive Management in the FHMS (ESSA, 2020). These reviews found that the initial design and implementation of the AMF included many of the key components necessary for successful adaptive management and many insights have been gained through adaptive management about the FHMS (ESSA, 2020). However, changes can be made to the AMF to improve its effectiveness, which will in turn improve how placer mining is managed in Yukon. Some recommendations from the reviews focused on improving the monitoring protocols and so this work began in 2019 and was continued in 2020. The outcomes of this work has been reported in the monitoring reports where applicable. Work on the AMF will continue in 2021.

## Summary of 2020 Monitoring Results

In 2020, Hemmera Envirochem Inc. (Hemmera) conducted and reported on the WQOM and AHM programs. Government of Yukon conducted and reported on the EHM, with contribution from Vector Research. Below is a summary of the monitoring that was conducted and the results of each program, the comprehensive monitoring reports can be found in Appendix A and B.

### Water Quality Objective Monitoring Program

Water Quality Objective monitoring (WQOM) for the AMF follows the WQOM Protocol (YPS, 2008b). The purpose of the WQOM Protocol is to monitor and assess whether the Water Quality Objectives (WQO) established under the FHMS are being achieved and whether exceedances are due to placer mining activity or other causes. The WQO performance measure that is used, is total suspended solids (TSS) in mg/L. Monitoring involves measuring TSS in the watercourses and compares the result to the WQO for TSS that is established for the watercourse (YPS, 2008a and 2008b).

The objective of the 2020 WQOM program was to conduct annual monitoring and reporting with some slight changes from previous years. Only grab (discrete) water

samples were collected in 2020, and no automated, time integrate sampling was conducted. The WQOM sites were sampled from July 28th to 30th 2020 in conjunction with the AHM sampling program and sampled again in the period from September 22nd to 25th to try to capture low-flow conditions. Twenty-five WQOM stations were sampled in 2020. This included fourteen established WQOM sites and eleven newly established sites. Sampling occurred in the Klondike River Watershed (Adams Creek, Hunker Creek and All Gold Creek), Stewart River Watershed (Clear Creek), and Yukon River North Watershed (Swede Creek and Ok Creek). Monitoring sites were located in Category A and B Watersheds; in habitat classifications including Low, Moderate-Low, Moderate-Moderate, Moderate-High, and an Area of Special Consideration; and in disturbed and undisturbed locations.

The WQO were met at the majority of monitoring sites sampled as part of the 2020 WQOM program. In the Klondike River watershed, observed TSS concentrations in 20% of samples collected were higher than their respective WQO (in 8 of 41 samples). In Hunker Creek, TSS samples taken in low habitat suitability areas typically fell below the WQO. The highest TSS exceedances were observed in the lower reaches in the stream, at stations where habitat suitability classification changes from low to moderate-low and is associated with a more stringent WQO. In 2019, the site with the most frequent and high magnitude exceedances was KL\_HU06, in 2020 no exceedances were observed at this location. In Adams Creek, samples were taken in low habitat suitability areas. Samples for TSS fell below the WQO however some sites were re-sampled in the afternoon at locations that appeared more turbid and the WQO were exceeded. These observations will inform the scheduling of future sampling events. All sampling in Adams Creek occurred in low fish habitat suitability areas. In All Gold Creek, sampling occurred in low and moderate-low fish habitat suitability areas and all TSS samples were below the WQO.

In the Yukon River North Watershed, TSS concentrations were very low, and none of the samples were above their respective WQO. Swede Creek was sampled at an Area of Special Consideration. Samples were taken at OK Creek which is a moderate-high habitat suitability area.

In the Stewart River Watershed, Clear Creek was sampled in September 2020 at a moderate-moderate habitat suitability area. TSS was very low, and below the WQO.

The comprehensive 2020 WQOM report can be found in Appendix A.

## Aquatic Health Monitoring Program

The AHM program is intended to assess how effective the FHMS is in maintaining aquatic health in placer mined watersheds. The AHM Protocol (YPS, 2008c) uses the benthic invertebrate community as a monitoring tool, and employs the Reference Condition Approach (RCA) for the analysis to determine if aquatic health is being maintained in reference condition, and if improvements are occurring over time in historically mined streams. In 2018, the Implementation Status Review recommended that the AHM protocol be reviewed (YPS, 2018). As a result the protocol was evaluated and several challenges were identified by DFO's Canadian Science Advisory Secretariat (CSAS, 2019).

Recommendations from CSAS informed focal studies that are being undertaken to answer key questions necessary to update the AMF approach to monitoring aquatic health. The focal studies began in 2019 and were continued in 2020, the results have been included in this report when appropriate. Focal studies include an *in-situ* sediment analysis to understand the relationship between *in-situ* sediment characteristics and benthic invertebrate community metrics; and a study of within-site variation in invertebrate community composition to evaluate the need to incorporate site replication into the study design. This report also includes an interim assessment approach of the AHM data. The assessment relies on a quantitative description of the benthic invertebrate community and habitat, an evaluation of several invertebrate community metrics, a qualitative characterization of the degree of placer mining development.

The AHM stations that were sampled in 2020 included eleven established AHM sites and five newly established sites. Sampling occurred in the Klondike River watershed (Hunker Creek and Adams Creek) and Yukon River North watershed (Swede Creek).

The AHM stations were sampled from July 28th to 30<sup>th</sup>, 2020.

In Hunker Creek, the benthic community composition was often dominated by Chironomidae (non-biting midges), and the Orthocladius complex was usually the dominant taxon. For the percent ephemeroptera, plecoptera and trichoptera (% EPT), the presence of Ephemeroptera (mayflies) is generally higher than Plecoptera (stoneflies) and Trichoptera (caddisflies). Monitoring at the same ten sites took place in 2019 and 2020 and provided insights into the comparability of data between subsequent years of monitoring. We observed a reasonable agreement in overall benthic invertebrate abundance estimates per kick-net sample between 2020 and 2019. However, there was little consistency in the other benthic invertebrate metrics including Family Richness, % EPT, and percent chironomids. There was no statistically significant relationship ( $\alpha = 0.05$ ) across the ten Hunker Creek sites between the 2019 and 2020 data for these indicators. Differences in the two years of data at the Hunker Creek sites demonstrates that inter-annual variability is possible, and further study of this variation is required. An evaluation of turbidity and discharge relationship with benthic invertebrate community metrics did not reveal any significant relationships, though these studies will be continued with a larger data set. The abundance of stream invertebrates significantly co-varied with the fines content of sediment samples in 2019, however this was not observed in 2020. However, a positive relationship between taxon richness and the ratio of pebbles to cobbles in the streambed substrate was observed in 2020. Hunker Creek is historically and currently placer mined, and this was evident at all sites sampled. Turbidity was highest at the most downstream site and lowest at the most upstream site. Very little periphyton was observed at the sites.

In Adams Creek, low % EPT was observed at all sites, with very low Trichoptera (caddisflies) representation. Chironomidae (non-biting midges) dominated the community composition at all sites. The high presence of chironomids combined with the low Simpson's Evenness Index (SEI) values suggest that there is a high degree of dominance by one or a few organisms within this family. An increasing trend of total abundance and family richness (apart from YPS-624) was observed as you move from the most downstream site to the most upstream site. Adams Creek showed evidence of current or historic placer mining at most sites. Low turbidity was observed at all sites,



and there was little evidence of fine sediment accumulation in the riffle areas. Placer mines were moving dirt but did not appear to be sluicing at time of sampling.

In Swede Creek, only one site (YPS-386) was sampled, at the mouth near the Yukon River. The results were generally consistent with 2009 and 2016. Based on this small data set, there appears to be a decreasing trend in percent Chironomidae and increasing trend in % EPT and total abundance. Similar to Adams Creek there was a lack of Trichoptera (caddisflies) taxa represented in the sample. There was little to no recent or historic placer development at the site, though mining is known to occur further upstream. Swede Creek was one of the few sites monitored in 2020 with the presence of periphyton; it has low turbidity (1.8 NTU) and little evidence of sediment accumulation within riffle substrates.

Overall, the benthic invertebrate data for both Hunker Creek and Adams Creek show that the numerically dominant families include especially dipteran insects, with very low abundance of ephemeroptera (mayflies) and very low abundances of plecoptera (stoneflies) and trichopteran (caddisflies). A better understanding of community compositional differences across watersheds, and along natural gradients from headwater areas to valley bottom confluences with mainstem flows will be useful for re-evaluation of AHM metrics and approaches that reflect ecological responses to anthropogenically increased suspended sediment loads and inventories. Focal studies will continue as they are necessary to update the approach to monitoring aquatic health. Hemmera posed four recommendations for the AHM monitoring protocol including: improve in the in-situ sediment sampling methodology, refine methods for quantifying TSS input from placer mining, investigate proliferation of certain Chironomidae taxa, and add the collection of periphyton to AHM Program.

The comprehensive 2020 AHM report can be found in Appendix A.

## Economic Health Monitoring Program

The EHM program collects economic health indicator data and evaluates where there are changes in the industries viability year to year and whether these changes are attributed to the FHMS. The program is guided by the EHM Protocol (YPS, 2008d).

In 2020, the FHMS did not adversely affected the viability of Yukon's placer mining industry. However, non-significant adverse changes were observed in the number of active licenses, the number of person days of employment, the level of non-compliance, and the total placer claims staked during the reporting period. Two of the indicators positively changed, including the gold royalty collected and the number of claims in good standing. Data for two of the indicators was not available including total fuel consumption and number of water licenses. Because the FHMS did not adversely affect the viability of the industry, the placer miner panel was not triggered and was not completed. In addition to the EHM viability analysis, a placer industry snapshot was done to describe the economic backdrop for the Yukon placer mining industry during COVID-19 pandemic in 2020. The results of EHM in 2020 and the industry snapshot can be found in Appendix B.

## Traditional Knowledge

Traditional Knowledge is an essential part of the FHMS. The AMF considers Traditional Knowledge during adaptive management in its assessments (YPS, 2008a). In the past, each year First Nation governments were invited to share Traditional Knowledge that may be important to the management of placer mining activity in their traditional territories. However, Traditional Knowledge was not shared in response to the annual invitations for reasons related to the collection process, ownership, storage, and use of this information (YPS, 2018). These reasons were described in the Implementation Status Review along with recommendations to revise how Traditional Knowledge is included in the AMF (YPS, 2018). Because of this, a formal invitation to share Traditional Knowledge was not sent out in 2020. However, First Nation governments can still contribute Traditional Knowledge to the adaptive management process voluntarily. How Traditional Knowledge is collected and considered by the AMF will be reviewed and improved with input with First Nations.

## Evaluation and Adjustment Results

Through the annual adaptive management process, the results of the AHM, WQOM, EHM, and Traditional Knowledge are evaluated together to determine if the management objectives of conserving and protecting fish and fish habitat and

maintaining a viable placer mining industry are being achieved for the FHMS. However, due to obstacles hindering the monitoring protocols, the Intergovernmental Management Group (IMG) for the FHMS is reviewing the adaptive management process determining how to make improvements to the program. This work was initiated in 2019, occurred in 2020, and will continue in 2021. Effects monitoring has continued on an annual basis in order to detect and address environmental and economic health concerns, and management decisions may be made using alternative approaches. Compliance monitoring has not been impacted.

## Literature Cited

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2020 Adaptive Management Report for the Fish Habitat  
Management System for Yukon Placer Mining

# Appendix A: 2020 Water Quality Objective Monitoring and Aquatic Health Monitoring Report



2020 Adaptive Management Report for the Fish Habitat  
Management System for Yukon Placer Mining

# Appendix B: 2020 Economic Health Monitoring Report

