VICTORIA GOLD CORP
TSX | VGCX

December 13, 2022

Mr. Todd Powell, Director
Mineral Resources Branch
Yukon Government Department of Energy, Mines and Resources
#400 - 211 Main Street, Box 2703
Whitehorse, Yukon Y1A 2C6

Dear Mr. Powell,

RE: Eagle Gold Mine QML-0011 Environmental Audit

As required by Clause 12.1 of the Quartz Mining License QML-0011 for the Eagle Gold Mine, please find enclosed an audit undertaken by Stantec Consulting Ltd. (Stantec) of the environmental protection plans and regulatory controls set out in QML-0011.

Stantec, in their capacity as the approved independent contractor for this audit, were tasked with the review of the management, operations and practices of Victoria Gold (Yukon) Corp. that are intended to ensure environmental protection during production and development of the Eagle Gold Mine. Stantec's key findings are provided within the report and Stantec, consistent with their findings for the 2020 audit, stated in the audit report:

> *"Overall, the implementation of VGC's environmental management system can be described as adequate and no immediate concerns for water quality and quantity, aquatic habitat, air quality, soils, vegetation, wildlife and wildlife habitat, stability of physical structures and waste management have been identified."*

Also enclosed is Victoria's report detailing the remedial actions that we will undertake in response to the audit.

If you have any questions, please do not hesitate to contact our office.

Sincerely,

Hugh Coyle
VP Environment
Victoria Gold Corp.

EAGLE GOLD MINE 2022
ENVIRONMENTAL AUDIT REPORT

December 12, 2022

Prepared for:
Victoria Gold Corporation

Prepared by:
Stantec Consulting Ltd.

Project Number:
123222163

The conclusions in the Report titled Eagle Gold Mine 2022 Environmental Audit Report are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from Victoria Gold Corp. (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

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Executive Summary

The Eagle Gold Mine (the Project), is owned and operated by Victoria Gold (Yukon) Corp. (VGC) and is located within the Mayo Mining District of Yukon Territory, Canada. The mine is situated approximately 85 km north of Mayo and 400 km north of Whitehorse. The Project is an open pit mine, in-valley heap leach with three stage crush and gold recovery plant.

VGC received a quartz mining license to build the open pit mine in September 2013. A Comprehensive Cooperation Benefits Agreement was signed with the First Nation of Na-Cho Nyak Dun in 2011. The Project achieved commercial production on July 1, 2020 and has an anticipated mine life of ten plus years.

Clause 12.0 of Quartz Mine License 0011 (QML-0011) requires the undertaking of an environmental audit every two years, by an independent contractor acceptable to the Director of the Mineral Resources Branch of Yukon Government Department of Energy, Mines and Resources (EMR). Stantec Consulting Ltd. (Stantec) was contracted by VGC to complete an Environmental Audit for the Project in accordance with the conditions of QML-0011. The first audit was completed by Stantec for the period July 1, 2018 to June 30, 2020, which spanned construction, commissioning and initial production phases (Stantec, 2020). This report is the second audit for the mine and the first to span only the production phase and is inclusive of monitoring and surveillance activities at the Project site from July 1, 2020, to June 30, 2022.

The audit scope involved an evaluation of consistency with requirements with the following approved plans:

- Environmental Monitoring, Surveillance and Adaptive Management Plan (EMSAMP) Version 2020-01
- Construction and Operations Water Management Plan Version 2017-01
- Water Management Plan Version 2020-01
- Solid Waste and Hazardous Materials Management Plan Version 2017-02
- Spill Response Plan Version 2017-02 and Version 2021-01
- Wildlife Protection Plan Version 2017-01

The auditors reviewed the following regulatory reporting submissions, as well as supporting documentation:

- Water License QZ14-041-01 / Quartz Mining License QML-0011 2020 Annual Report and relevant appendices
- Water License QZ14-041-01 / Quartz Mining License QML-0011 2021 Annual Report and relevant appendices

- A sample of monthly reports covering climate, air quality, hydrology, groundwater quality and quantity, surface water quality, geochemistry, soils, vegetation and physical structures monitoring; sample size varied with discipline
- Quarterly Wildlife Reports from September 2020 to June 2022.

The audit evaluated:

- Confirming the implementation of plans and associated monitoring programs, as well as associated reporting
- Confirming the monitoring (surface water quality and quantity, groundwater, and aquatics and fish and fish habitat), terrestrial environment and physical stability assessments were completed to the specifications in the approved plans and licences.

The following general steps were taken to conduct the audit:

1. Identification of documents to be reviewed to fulfill the audit objectives and requirements,
2. Comparison of monitoring activities at all sites against the execution described in the EMSAMP for frequency, methods, and results
3. Review of data quality assurance and quality control procedures
4. Confirmation that AMP thresholds are being monitored in conformance with the EMSAMP
5. Confirmation that AMP responses follow what is outlined in the EMSAMP and were reported
6. A site audit September 28 to 30, 2022
7. Provision of an audit adequacy statement regarding conformance with plans within the audit scope

Key findings of the audit are provided in section 10.0 of the report. Overall, the implementation of VGC's environmental management system can be described as adequate.

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Acronyms / Abbreviations

ADR	Adsorption Desorption Recovery
AMP	Adaptive management plan
ANCOVA	Analysis of covariance
ANOVA	Analysis of variance
AMT	Adaptive management threshold
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
CES	Critical-effect sizes
CPUE	Catch per unit effort
CWTS	Constructed wetland treatment system
dbRDA	Distance-based redundancy analysis
COA	Certificate of Analysis
EBAM	Environmental Beta-Attenuation Particulate Monitor
ECCC	Environment and Climate Change Canada
EEM	Environmental effects monitoring
EMR	Energy, Mines and Resources
EMSAMP	Environmental Monitoring, Surveillance and Adaptive Management Plan
EOM	End of Mine
EOR	Engineer of Record
EP	Eagle Pup
EQS	Effluent Quality Standard
FOS	Factor of Safety

GPS	Global positioning system
Hi-Vol	High volume
HLF	Heap Leach Facility
ISQG	Interim sediment quality guidelines
LDSP	Lower Dublin South Pond
LPL	Lowest practical level
ISQG	BC Interim Sediment Quality Guidelines I
masl	Meters above sea level
MDMER	Metal and Diamond Mining Effluent Regulations
Minnow	Minnow Environmental Inc.
MTL	Maximum tolerable levels
PASS	Passive Air Sampling System
PEL	Probably Effects Level
PG	Platinum Gulch
$PM_{2.5}$	Fine particulate matter passing a 2.5 µ sieve
PM_{10}	Coarse particulate matter passing a10 µ sieve
PTS	Passive Treatment System
QAQC	Quality Assurance / Quality Control
QA/QC	Quality assurance/quality control
QML	Quartz Mining License
RCP	Reclamation and Closure Plan
RISC	Resource Inventory Standards Committee
SD_{REF}	Standard Deviations from the Reference
SFS	Society of Freshwater Sciences
SWE	Snow-water-equivalent

TSP	Total suspended particulates
VGC	Victoria Gold (Yukon) Corp.
WMP	Water Management Plan
WPP	Wildlife Protection Plan
WQO	Water quality objective
WRSA	Waste Rock Storage Area
WUL	Water-use License
YWB	Yukon Water Board

1 Introduction

Stantec Consulting Ltd. (Stantec) was retained by Victoria Gold (Yukon) Corp. (VGC) in August 2022 to carry out an audit of the Eagle Gold Mine (the Project) in accordance with the conditions of the Quartz Mine License QML-0011 (QML). The objective of this audit was to assess whether the environmental management plans and regulatory controls set out in the QML are implemented in and about the mine and that the environmental management systems and controls are functioning as intended.

1.1 Background

The Eagle Gold Mine is owned and operated by VGC and is located within the Mayo Mining District of Yukon Territory, Canada. The Project is situated approximately 85 km north of Mayo and 400 km north of Whitehorse. The Project is an open pit mine, in-valley heap leach with a three-stage crush and gold recovery plant. Operation of the Project is governed by various regulatory approvals and non-discretionary Territorial and Federal legislation. A key regulatory approval for the Project is the Quartz Mining Licence QML-0011, issued pursuant to section 141(2)(a) of the *Quartz Mining Act* by the Department of Energy, Mines and Resources (EMR). Clause 12.0 of QML-0011 requires an environmental audit every two years, by an independent contractor acceptable to the Director of the Mineral Resources Branch of EMR.

VGC completed the environmental assessment process under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) and received Decision Documents from the Yukon Government and federal regulatory agencies in April 2013. An initial quartz mining license was received in September 2013, followed by a Water Use License in Dec 2015. Preliminary construction began in August 2017 and full construction commenced in March 2018. A Comprehensive Cooperation Benefits Agreement was signed with the First Nation of Na-Cho Nyak Dun in 2011.

In 2017, construction activities began with camp expansion, access road upgrades, site road construction, diversions and ditching, pond construction, clearing and grubbing, civil earthworks, septic system upgrade, and borrow source development. In 2018 activities included construction of Phase I of the Heap Leach Facility (HLF), Events Pond, Crushing and Screening Plants, Overland Conveying System and coarse ore transfer areas, Cement and Lime Silos, Adsorption, Desorption and Recovery Plant and Reagent Storage Buildings, Metallurgical Laboratories, Administration Office, mine offices, ANFO and Detonator Storage, Water Distribution Systems, pre-stripping of the Eagle pit and initial development of the Platinum Gulch Waste Rock Storage Area, and construction of 90-day Ore Stockpile.

Commissioning of the facilities began in Q2 2019. On February 16, 2019, VGC notified responsible authorities of their intent to enter the Production Phase (defined in the regulatory approvals as the relocation of waste rock from the Eagle Pit to a waste rock storage area) on March 17, 2019. Ore production commenced on July 1, 2019, and VGC poured its first gold in Q3 of 2019. The mine achieved commercial production on July 1, 2020, with an anticipated mine life of ten plus years.

The first environmental audit required by QML-0011 was conducted in 2020 and included both the construction phase and the initial production phase. The 2022 environmental audit is the first audit that covers only production and addresses works conducted between July 1, 2020, and June 30, 2022.

1.2 Approach

The scope and objectives of the audit were provided by VGC and are based on condition 12.0 in the Eagle Gold Mine's Quartz Mining Licence QML-0011 (YG 2016). The licence has been amended several times, most recently in June 2022, without altering the requirement for the environmental audit. The audit for 2020 was a desktop exercise without a field visit due to Covid-19 precautions. The audit scope for 2022 did include a field visit and involved an evaluation of consistency with requirements with the following approved plans:

- Environmental Monitoring, Surveillance and Adaptive Management Plan (EMSAMP) Version 2020-01
- Water Management Plan Version 2020-01
- Solid Waste and Hazardous Materials Management Plan Version 2017-02
- Spill Response Plan Version 2017-02 and Version 2021-01
- Wildlife Protection Plan Version 2017-01

The auditors reviewed the following regulatory reporting submissions:

- Water License QZ14-041-01 / Quartz Mining License QML-0011 2020 Annual Report and relevant appendices
- Water License QZ14-041-01 / Quartz Mining License QML-0011 2021 Annual Report and relevant appendices
- A sample of monthly reports from the reporting period covering climate, air quality, hydrology, groundwater quality and quantity, surface water quality, geochemistry, soils, vegetation, and physical structures monitoring; the sample differed with disciplines depending on reporting frequency and amount of data the relevant qualified professional determined was necessary to conduct a meaningful audit
- The Eagle Gold Mine 2020 Environmental Audit Report prepared by Stantec Consulting Ltd.

The audit evaluated:

- Confirming the implementation of plans and associated monitoring programs, as well as associated reporting.
- Confirming the monitoring (surface water quality and quantity, groundwater, and aquatics and fish and fish habitat), terrestrial environment and physical stability assessments were completed to the specifications in the approved plans and licences.

The following general steps were taken to conduct the audit:

1. Identification of documents to be reviewed to fulfill the audit objectives and requirements
2. Comparison of monitoring activities at all sites against the execution described in the EMSAMP for frequency, methods, and results
3. Review of data quality assurance and quality control procedures
4. Confirmation that adaptive management plan (AMP) thresholds are being monitored in conformance with the Environmental Monitoring, Surveillance, and Adaptive Management Plan (EMSAMP)
5. Confirmation that AMP responses follow what is outlined in the EMSAMP and were reported
6. Conduct a site audit September 28 to 30, 2022
7. Provision of an audit adequacy statement regarding conformance with plans within the audit scope
8. Provision of a summary table of identified gaps and/or recommendations for the monitoring programs

The evaluated disciplines included in this audit were meteorological and atmospheric environment, water resources (which included surface quantity and quality, groundwater quantity and quality, geochemistry, and the aquatic environment), the terrestrial environment (which included reclamation, vegetation, soils, and wildlife) and geotechnical stability (which included permafrost monitoring, open pits, material storage and stockpiles and the heap leach and process facilities). The audit also included a review of the solid waste and hazardous materials handling and spill response. Discipline-specific audit findings are included below.

2 Atmospheric Environment

2.1 Meteorology

2.1.1 Documents Reviewed

The documents in Table 1 were reviewed as part of the meteorology section of the audit.

Table 1 Climate Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
Eagle Gold Project Environmental Monitoring, Surveillance and Adaptive Management Plan - Version 2020-01	27-Feb-20	10 Climate
Quartz Mining License QML-0011 - Effective March 24, 2016 to September 20, 2040	29-Jun-22	Part VI - Audits and Reporting Schedule B - Plans to be submitted for approval as approved plans Schedule C - Approved Plans and Authorized Activities Schedule D - Annual Reporting Requirements
Yukon Water Board - QZ14-041-1 (Water License)	22-Aug-19	General references to EMSAMP
Eagle Gold Project Water License QZ14-041-01 Quartz Mining License QML-0011 2020 Annual Report	12-Apr-21	3.8 Meteorology and Air Quality Monitoring 3.8.1 Climate Monitoring Appendix K
Eagle Gold Project Water License QZ14-041-01 Quartz Mining License QML-0011 2021 Annual Report	11-Apr-22	3.8 Meteorology and Air Quality Monitoring 3.8.1 Climate Monitoring Appendix K
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - August 2020	05-Oct-20	6.1 Meteorological Stations Appendix D
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - November 2020	31-Dec-20	6.1 Meteorological Stations Appendix C
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - February 2021	03-Apr-21	6.1 Meteorological Stations Appendix D
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - April 2021	01-Jun-21	6.1 Meteorological Stations Appendix D
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - July 2021	31-Aug-21	6.1 Meteorological Stations Appendix D

Table 1 Climate Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - November 2021	02-Jan-22	6.1 Meteorological Stations Appendix C
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - December 2021	30-Jan-22	6.1 Meteorological Stations Appendix D
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report – January 2022	02-Mar-22	6.1 Meteorological Stations Appendix D
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report -April 2022	02-Jun-22	6.1 Meteorological Stations Appendix C

In addition, the following references were used as part of the Audit:

- British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) British Columbia Field Sampling Manual – Part A: Quality Control and Quality Assurance and Part B: Air and Air Emission Testing (2013, 2020b)
- World Meteorological Organization (WMO) Guide to Instruments and Methods of Observations Volumes I, III, and V (2018)
- Environment and Climate Change Canada (ECCC) Manual of Surface Weather Observation Standards (2021)
- United States Environmental Protection Agency (U.S. EPA) Meteorological Monitoring Guidance for Regulatory Modeling Applications (2000)
- Canadian Council of Ministers of the Environment (CCME) Ambient Air Monitoring and Quality Assurance/Quality Control Guidelines (2019a)
- BC ENV Snow Survey Sampling Guide (2018)

2.1.2 Monitoring Program Implementations and Data Quality Assurance and Quality Control

2.1.2.1 Meteorology Stations

Two solar powered automated meteorology stations are currently operating in the Project area. The Potato Hills station (elevation 1,420 m) was installed in 2007 and the Camp station (elevation 782 m) in 2009. The meteorology stations continuously collect data for the following parameters:

- Ambient air temperature
- Precipitation
- Wind speed
- Wind direction
- Barometric pressure
- Solar radiation
- Snow depth
- Relative humidity

In October 2019, the original ONSET Hobo Potato Hills meteorology station was decommissioned due to repeated equipment failures. Air temperature and barometric pressure were measured by a stand-alone Hobo station during January and February 2020. The station was replaced in March 2020 with a Campbell Scientific solar powered meteorology station with data collected by a CR1000X datalogger. The updated station measures:

- Ambient air temperature
- Precipitation
- Wind speed
- Wind direction
- Barometric pressure
- Snow depth
- Solar radiation
- Relative humidity.

During this deployment, the Camp meteorology station underwent a service and calibration of the instrumentation. The tipping bucket rain gauges in both stations were replaced by the all-weather Geonor total precipitation gauge to better capture both rain and snow-water-equivalent (SWE) precipitation amounts.

The Potato Hills station experienced several data losses in 2020, including ongoing malfunctioning of the barometric pressure sensor. The barometric pressure The barometric pressure sensor was replaced in

January 2021 and operated continuously except for September, October, and December 2021. In 2021, the Potato Hills station experienced a data loss for all sensors from January 22 to February 27.

The Camp station had no data loss from July 01, 2020 through all of 2021. Both stations underwent another calibration and service in September 2021.

The EMSAMP details the requirements for the climate stations and reporting. It should be noted that the 2020 and 2021 annual reports have location coordinates (Table 2) that differ from those in the EMSAMP document. In addition, there have been changes to the equipment located at each site. As such the EMSAMP should be updated to reflect the changes at the meteorology stations.

Table 2 Locations of the Climate Stations and Snow Course Surveys Reported in the 2020 and 2021 Annual Reports

Type	Name	Elevation	NAD83 UTM Coordinates[2]			2020	2021
		m ASL[1]	m East	m North	Zone		
Meteorology Stations	Camp	782	458,164	7,101,036	8V	✓	✓
	Potato Hills	1,420	463,544	7,100,833	8V	✓	✓
Manual Snow Survey	Camp	782	458,164	7,101,036	8V	✓	✓
	Potato Hills	1,420	463,290	7,100,568	8V	✓	✓
	Ann Gulch Snow Survey	875	458,945	7,101,185	8V	2012-2017	
	Stewart (Snow Survey #2)	995	460,570	7,101,490	8V	2012	
	HLF Snow Survey[3]	1,078	459,859	7,102,319	8V	✓	
	PG WRSA 1370 Bench[4]	1,370	460,581	7,099,188	8V		✓
	HLF 3b (Bench and Slope)[3]	1,066	459,295	7,102,063	8V		✓
	HLF 4b (Bench and Slope)[3]	1,049	459,602	7,102,212	8V		✓
	HLF 5b (Bench and Slope)[3]	1,048	459,580	7,102,207	8V		✓

NOTES:

1 ASL – above sea level elevations reported in 2020 and 2021 annual reports

2 Universal Transverse Mercator (UTM), North American Datum 1983 (NAD83) coordinates reported in the 2020 and 2021 annual reports.

3 HLF – Heap Leach Facility

4 WRSA – Waste Rock Storage Area

The EMSAMP or the annual reports do not mention quality assurance and control methods that would be typically adopted to ensure the representativeness and reliability of the climate data being collected and reported. There is not enough information available in the EMSAMP or annual reports to verify that the 1-hour, 24-hour, monthly, and annual averages for the meteorology data were calculated based on standard methodologies.

2.1.2.2 Snow Depth Surveys

Snow depth information is also collected during winter with monthly manual snow course surveys near both meteorology stations and the additional locations shown in Table 2. As documented in the EMSAMP the manual snow surveys follow the Yukon Environment guidance and the BC ENV Snow Survey Sampling Guide (2016) using a standard federal snow sampler. The EMSAMP indicated that manual snow sampling would occur at or near the meteorology stations and west of lower Ann Gulch and typically start around April until the snow is melted each year. These locations may change based on changing conditions at the mine site as per the adaptive management framework.

The 2020 manual snow survey were conducted at similar sites as previous assessments and used 10 discrete sampling locations along a transect. The locations were sampled for depth and SWE, and the results averaged for the 10 discrete locations at the three sites. In 2021 four additional manual snow surveys were included and were conducted near the dates that the Yukon Water Resources Branch conducted their monthly surveys which includes the annual maximum snowpack. Data was not available for 2021

2.1.2.3 Reporting

The meteorology stations automatically collect data on an ongoing basis and store the results as 15-minute averages on the dataloggers. The data is downloaded during monthly station visits during the open water season, and in the winter concurrent with collection of the manual snow course surveys. This meteorology data is analyzed and summarized in an annual report during each collection year. The following data is summarized in the annual report:

- Monthly and annual recorded mean, minimum and maximum air temperature
- Total monthly and annual precipitation, as well as rainfall and snowfall amounts
- Maximum 24-hour precipitation total for each month
- Monthly snowpack depth as well as monthly snowmelt distribution
- Monthly average barometric pressure and relative humidity
- Monthly and annual recorded mean, minimum and maximum wind speed and direction
- Monthly and annual recorded mean, minimum and maximum net solar radiation
- Estimates of monthly sublimation and evaporation/evapotranspiration

The annual report is submitted to Yukon Government and the Yukon Water Board as part of the compliance with the EMSAMP, QML-0011 and QZ14-041-1. The submission includes a Microsoft Excel spreadsheet with the collected data and analyses used in the annual report. Meteorology monitoring parameters, frequencies and reporting requirements have remained the same throughout construction and operations phases of the Project.

Some monthly and quarterly reports were generated by VGC during the audit period. These were reviewed for information for the audit but are not evaluated as they are not specifically part of the requirements in the EMSAMP or QML-0011.

2.1.3 Reporting Adequacy, Consistency with Requirements, and Recommendations

The meteorology data for 2020 and 2021 are summarized in appendices to the Annual Reports. These appendices have the required summaries identified in the EMSAMP and provide previous years data for comparison. There is minimal information on the quality assurance and quality control methods used on the data referenced in the report and insufficient information available to determine what processing was done. There are letter codes within the data tables and footnotes indicating that the threshold for missing data are periods in which less than 25 days of data per month was not available. So, some quality assurance and control methods are being used.

In the 2021 annual report an additional appendix was provided which showed annual maintenance report from Campbell Scientific for the meteorology stations. This shows that adequate due diligence with respect to regular scheduled maintenance is being implemented for the meteorology stations.

It was indicated that due to the COVID-19 Pandemic that servicing the meteorological equipment was delayed which did impact the collection of some of the data. As mentioned in the previous audit (2020) it is recommended that VGC consider maintaining spare meteorology station sensors on site that may be easily deployed should sensors fail or when gaps are noted during monthly review of data records.

In addition, it is recommended that VGC should have ongoing site documentation for each of the meteorology monitoring sites. This would include:

- Description of the monitoring site
- Location in Latitude and Longitude as well as UTM coordinates and elevation
- List of instrumentation deployed on the site
- Indication of the height of the various meteorology instruments above the ground surface
- Description of the ground cover and surrounding conditions like distance to buildings and trees, heights of nearby structures and trees
- Description of potential biases to the collection of the meteorology data
- Pictures of the meteorology station and surrounding area in each of the four cardinal directions.

This documentation should be updated at least annually or when anything changes at the meteorology stations. During site visits there should be a log kept of the activities conducted at the stations included pictures of the state of the meteorology station during the site visit. Similar logs should be used for the manual snow surveys if they are not already used. Table 3 summarizes consistency with requirements gaps and/or deficiencies for the meteorology monitoring program and provides recommendations for improvements.

Table 3 Meteorology Monitoring Program Consistency with requirements and Recommendations

Consistency with requirements Gaps and/or Deficiencies	Recommendations
The meteorology data quality management process is unclear. Spare parts for the meteorology station should be readily available at the Eagle Gold site. The site documentation for each meteorology monitoring site should be collected and documented. Records of maintenance activities.	• Reference industry standards followed for data quality management in the next annual report. • Keep spare climate station sensors on-site for rapid deployment should sensors/equipment begin to fail, or data gaps are noted. • For each meteorology station, information should be compiled for its location, list of instrumentation, sensor height above ground, description of surrounding ground cover, description of potential biases, photos in each of the four cardinal directions. • Each station should have a logbook in which the various maintenance activities can be recorded.

2.2 Air Quality

2.2.1 Documents Reviewed

The documents in Table 4 were reviewed as part of the air quality section of the audit.

Table 4 Air Quality Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
Eagle Gold Project Environmental Monitoring, Surveillance and Adaptive Management Plan - Version 2020-01	27-Feb-20	11 Air Quality
Quartz Mining License QML-0011 - Effective March 24, 2016 to September 20, 2040	29-Jun-22	Part VI - Audits and Reporting Schedule B - Plans to be submitted for approval as approved plans Schedule C - Approved Plans and Authorized Activities Schedule D - Annual Reporting Requirements
Yukon Water Board - QZ14-041-1 (Water License)	22-Aug-19	General references to EMSAMP
Eagle Gold Project Water License QZ14-041-01 Quartz Mining License QML-0011 2020 Annual Report	12-Apr-21	3.8 Meteorology and Air Quality Monitoring 3.8.2 Air Quality Monitoring Appendix L
Eagle Gold Project Water License QZ14-041-01 Quartz Mining License QML-0011 2021 Annual Report	11-Apr-22	3.8 Meteorology and Air Quality Monitoring 3.8.2 Air Quality Monitoring
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - August 2020	05-Oct-20	6.2 Air Quality Data Collection Appendix E

Table 4 Air Quality Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - November 2020	31-Dec-20	6.2 Air Quality Data Collection Appendix D
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - February 2021	03-Apr-21	6.2 Air Quality Data Collection Appendix E
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - April 2021	01-Jun-21	6.2 Air Quality Data Collection Appendix E
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - July 2021	31-Aug-21	6.2 Air Quality Data Collection Appendix D
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - November 2021	02-Jan-22	6.2 Air Quality Data Collection Appendix D
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - December 2021	30-Jan-22	6.2 Air Quality Data Collection Appendix D
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report – January 2022	02-Mar-22	6.2 Air Quality Data Collection Appendix E
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report -April 2022	02-Jun-22	6.2 Air Quality Data Collection Appendix D

In addition, the following references were used as part of the Audit:

- British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) British Columbia Field Sampling Manual – Part A: Quality Control and Quality Assurance and Part B: Air and Air Emission Testing (2013, 2020a)
- Canadian Council of Ministers of the Environment (CCME) Ambient Air Monitoring and Quality Assurance/Quality Control Guidelines (2019a)

2.2.2 Monitoring Program Implementations and Data QA/QC

Table 5 shows the locations of the air monitoring equipment deployed in the Project site as documented in the EMSAMP, 2020 annual report, and 2021 annual report.

Table 5 Locations of the Air Quality Monitoring Stations Reported in the 2020 and 2021 Annual Reports

Type	Name		NAD83 UTM Coordinates[1]			2020	2021
			m East	m North	Zone		
Continuous	EBAM (TSP, PM_{10}, $PM_{2.5}$)[2]		458,237	7,101,021	8V	✓	✓
	Hi-Vol/Partisol[3]					✓	✓
Dustfall and Passive Air Sampling System (PASS)[4]	Dustfall	PASS					
	D1	AQ1	463,559	7,100,818	8V	✓	✓
	D2	AQ2	—	—	8V	Pre-2020	
	D2B	AQ2B	458,254	7,100,976	8V	✓	✓
	D3	AQ3	460,583	7,099,088	8V	✓	✓
	D4	AQ4	458,436	7,097,951	8V	Pre-2020	
	D4B	AQ4B	458,290	7,097,734	8V	✓	✓
	D5	AQ5	458,290	7,097,734	8V	Pre-2020	
	D5B	AQ5B	457,864	7,095,942	8V	✓	✓

NOTES:

1 Universal Transverse Mercator (UTM), North American Datum 1983 (NAD83) coordinates reported in the 2020 and 2021 annual reports.

2 Environmental Beta-Attenuation Particulate Monitor (EBAM) stations measuring the ambient air for concentrations of total suspended particulates (TSP), coarse particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$)

3 High volume (Hi-Vol) station to collect 24-hour samples of TSP. Replaced by Partisol 2000i Air Sampler in May 2020.

4 Certain stations were relocated/renamed (denoted as a "B" station) as the monitoring program evolved. Station AQ4/D4 was decommissioned July 1, 2020. Station AQ5/D5 was renamed to AQ4B/D4B July 1, 2020. Station AQ5B/D5B was commissioned July 1, 2020.

2.2.2.1 Continuous Particulate Monitoring

There are three Environmental Beta-Attenuation Particulate Monitor (EBAM) stations measuring the ambient air for concentrations of total suspended particulates (TSP), coarse particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$) near the Camp meteorology station. These stations were established in 2018 and collect concentration data and uploads it to a cloud-based server and is accessed remotely for analyses of the results.

A high volume (Hi-Vol) ambient air quality monitoring station was installed with the EBAM station on May 21, 2020 to collect a 24-hour sample of TSP every six days. The samples were sent for laboratory analyses to measure the mass of TSP and the concentration of metals in the particulates on the filter

media. Specifically, the laboratory reports the 24-hour concentration of total arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), Zinc (Zn), and acid extractible mercury (Hg).

It is unclear between the EMSAMP and the annual reports if the Hi-Vol station was replaced by a Partisol 2000i Air Sampler or if the terminology is interchangeable. It is recommended to provide a clear indication of the history of this type of sampling with what equipment was deployed and when as well as the current equipment deployed at the site in the EMSAMP.

2.2.2.2 Dustfall Stations

Five dustfall stations were distributed within the Project area. These samples passively collect the particulates in the air using an open top container with a known surface area which is collected after approximately 30 days of exposure to the ambient air. These samples are sent to laboratory to determine the deposition of particulates at the sampling site. Once each quarter (approximately every 91 days) the dust fall sample is sent to the laboratory to measure the amounts of metals in the particulate.

The original D2 dustfall site was relocated due to construction activities at the D2B site. The original D4 station was not installed in the best location, so it was decommissioned in June 2020 and replaced by the D5 station, which was then renamed to D4B as of June 2020. A new dustfall station D5B was subsequently installed in July 2020. These relocations (to make five total locations) were done to better meet the intent of the EMSAMP and the Project Air Emissions Permit 60-600.

2.2.2.3 Passive Monitoring

Passive Air Sampling System (PASS) stations were co-located with the dustfall stations. Samplers are deployed with a diffusive barrier and a reactive media to collect ambient air for sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and ammonia (NH_3). The samplers are exposed for a nominal 30-day period and sent to the laboratory for analyses. This provides 30-day average concentrations of SO_2, NO_2, and NH_3 at the monitoring locations. This type of sampling technology is a cost-efficient method to determine the presence of these chemical species at different areas of the Project and the exposure amounts. The technology is not necessarily precise enough to be used to determine regulatory compliance but can indicate if more refined monitoring technology is required.

2.2.2.4 Reporting

The EBAM stations are continuously collecting data which is uploaded to a cloud-based server and is accessible by authorized VGC personnel to view the data in real time. Two web cameras are used at the site to provide a qualitative record of the current ambient air quality at the EBAM stations. Designated VGC personnel automatically receive a daily report showing the monitoring data for the last 24-hour period.

The results from the Hi-Vol station, dustfall samples, and PASS samples are processed monthly through the laboratory and the results are available to designated VGC personnel. These data are summarized with the EBAM data every quarter (three months) and a quarterly report is sent internally to designated VGC staff.

An annual report is produced to summarize the EBAM, Hi-Vol, dustfall, and PASS data from the calendar year. These data are compared to the Yukon Ambient Air Quality Standards (Yukon DoE 2019) or other relevant criteria.

2.2.3 Reporting Adequacy, Consistency with Requirements, and Recommendations

The air quality data are summarized in the 2020 and 2021 annual reports for each of the air quality monitoring technologies used at the Project. For the EBAM stations and Hi-Vol sampler there is minimal information available to validate the methodologies to verify that the 1-hour, 24-hour, and annual averages are processed according to acceptable quality standards like the British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) British Columbia Field Sampling Manual – Part A: Quality Control and Quality Assurance and Part B: Air and Air Emission Testing (2013, 2020a) and the Canadian Council of Ministers of the Environment (CCME) Ambient Air Monitoring and Quality Assurance/Quality Control Guidelines (2019a). Information regarding the maintenance and calibrations completed and how often that they are completed was not reviewed as part of this audit. Like the meteorology stations, the site documentation and documented quality management for the air quality stations should be referenced within the annual report and EMSAMP and routinely updated with changes to equipment or locations. There should also be a contingency plan in place to have spare parts or a stand-by EBAM sampler should one of the three stations experiences damage or require unanticipated maintenance to maintain continuous monitoring.

Unlike the meteorology annual reporting the air quality sampling results are all summarized within the body of the report. The 2020 annual report has a separate appendix which essentially echoes the tables from the report and does not provide any additional analyses, such as trends and relationship between results and wind conditions or mining activities; thus there was no need for an appendix for the 2021 report.

The data analyses includes some negative values which according to the CCME Ambient Air Monitoring and Quality Assurance/Quality Control Guidelines (2019a) should not be used for averaging periods greater than 1-hour. If the 1-hour average is negative it should be recorded as zero for the 24-hour and annual averaging as per this guidance. The CCME Guidance Document on Achievement Determination for the Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone (CCME 2012) also provide some guidance on the calculation and data verification of particulate matter data that could be implemented. Although the Canadian Ambient Air Quality Standards (CAAQS) are only intended for air shed management and not for regulatory compliance they can be a useful tool in the management of the regional air shed (CCME 2019b). Many jurisdictions in Canada are either adopting the CAAQS as part of their provincial or territorial air quality criteria or are aligning them to be like the CAAQS (BC ENV 2020b, 2021; NWT ENR 2014; ON MoE 2020; Yukon DoE 2019).

Based on the material reviewed for the audit, it is unclear for the PASS and dustfall monitoring that common quality assurance and control methods are in place like deploying duplicate PASS sample media or dustfall containers at the sites and using trip blanks during the sample deployment and retrieval. These sites should be similarly documented with heights to the PASS samplers and top of the dustfall containers in addition to the typical site information common to the meteorology stations with pictures at the site.

Every quarter the dustfall samples are analyzed by the laboratory for metals content in the particulate matter collected but there is no associated summary of those results in the annual reports. In addition, the annual report did not have the laboratory reports attached as an appendix to the report. The monthly reports that were reviewed contained the laboratory reports.

The monthly reports reviewed were similar in content to the data summaries in the annual report, and they were just specific to the monthly monitoring period. The monthly reports mainly summarized the monitoring data for that period and identified any potential high concentrations and other issues that may have occurred during the monitoring period. No daily reports were supplied or reviewed as part of this audit. Table 6 summarizes consistency with requirements gaps and/or deficiencies for the air quality monitoring program and provides recommendations for improvement.

Table 6 Air Quality Monitoring Program Consistency with requirements and Recommendations

Consistency with requirements Gaps and/or Deficiencies	Recommendations
The air quality data quality management process is unclear	• Reference industry standards followed for data quality management in the next annual report and the EMSAMP.
Spare parts for the air quality stations should be readily available at the Eagle Gold site	• Keep spare parts for the air quality monitoring stations on-site for rapid deployment should sensors/equipment begin to fail, or data gaps are noted.
The site documentation for each air quality monitoring site should be collected and documented.	• For each air quality monitoring station, information should be compiled for its location, list of instrumentation, sensor height above ground, description of surrounding ground over, description of potential biases, photos in each of the four cardinal directions.
Records of maintenance activities	
Annual report was missing the results from the particulate matter metals analyses	• Include a summary of the quarterly results for the particulate matter metals analyses in the subsequent annual reports.
Annual report did not include the laboratory reports	• Include the air quality laboratory reports as appendices to the subsequent annual reports.

3 Water Resources

3.1 Surface Water Hydrology

3.1.1 Documents Reviewed

Documents shown in Table 7 were reviewed for the surface water hydrology section of the audit:

Table 7 Documents Reviewed – Surface Water Hydrology

Document	Version Reviewed	Sections Applicable to Operations Phase
Environmental Monitoring, Surveillance, and Adaptive Management Plan (EMSAMP)	2020-01	2.0 – Surface Water Hydrology
Water Licence QZ14-041-01 Quartz Mining License QML-0011 2020 Annual Report	N/A	2.1.1 – Summary of Construction Activities 3.1 – Surface Water Hydrology Appendix E – Streamflow Monitoring Report – 2020 Update
Water Licence QZ14-041-01 Quartz Mining License QML-0011 2021 Annual Report	N/A	2.1.1 – Summary of Construction Activities 3.1 – Surface Water Hydrology Appendix C – Eagle Gold Project – 2021 Streamflow Monitoring Report
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - August 2020	05-Oct-20	2.0 Surface Water Hydrology
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - November 2020	31-Dec-20	2.0 Surface Water Hydrology
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - February 2021	03-Apr-21	2.0 Surface Water Hydrology
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - April 2021	01-Jun-21	2.0 Surface Water Hydrology
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - July 2021	31-Aug-21	2.0 Surface Water Hydrology
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - November 2021	02-Jan-22	2.0 Surface Water Hydrology
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - December 2021	30-Jan-22	2.0 Surface Water Hydrology
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report – January 2022	02-Mar-22	2.0 Surface Water Hydrology
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report -April 2022	02-Jun-22	2.0 Surface Water Hydrology
Eagle Gold Project Water Management Plan (WMP)	2020-01	All

3.1.2 Monitoring Program Implementation and Data QA/QC

Table 8 summarizes the consistency with monitoring requirements for surface water hydrology during the operations phase as outlined in the EMSAMP. Table 9 summarizes the consistency with requirements performed at each EMSAMP (version 2020-01) monitoring site.

Table 8 Surface Water Hydrology Consistency with EMSAMP (version 2020-01) Requirements

Category	Consistency Criteria	Criteria Description
1. Field Program	1A: Frequency	Monitoring was performed at the prescribed frequency (station-specific).
	1B: Tasks	Required tasks were completed at each site visit (e.g., collect data, perform routine maintenance, obtain discharge measurement)
2. Analysis	2A: Rating Curve	For automated stations, a rating curve has been (or is being) developed in accordance with standard industry practices and EMSAMP.
	2B: Streamflow Record	For automated stations, a continuous streamflow record has been generated using continuous stage record and rating curve or other methods. For manual stations, discharges and/or water levels have been summarized.
	2C: QA/QC	QA/QC has been performed in accordance with standard industry practices and EMSAMP.
3. Reporting and Adaptive Management	3A: Reporting	Reporting covering/discussing the station was submitted at the prescribed frequency.
	3B: Exceedance Check/Comment	The results were compared to the applicable exceedance thresholds and an evaluation was formally made.
	3C: Response to Exceedance(s)	If an exceedance occurred, the appropriate adaptive management response was performed.

Table 9 Surface Water Hydrology Consistency with Requirements – EMSAMP 2020-01

Station	Location Description	Consistency Criteria							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Exceedance	3C: Response to Exceedance(s)
W1[a]	Dublin Gulch above Stewart	Compliant. Monthly and automated monitoring documented during applicable periods.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station. VGC communication outside of reporting (personal communication, November 21, 2022) indicated these tasks are documented in field notes (not provided for review).	Compliant. Rating curve developed.	Compliant. Continuous flow record documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
W4[a]	Haggart Creek below Dublin	Compliant. Monthly and automated monitoring documented during applicable periods.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	Compliant. Rating curve developed.	Compliant. Continuous flow record documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	Compliant. Exceedance check formally documented.	Compliant. Appropriate responses formally documented.
W5[a]	Haggart Creek above Lynx Creek	Compliant. Monthly and automated monitoring documented during applicable periods.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	Compliant. Rating curve developed.	Compliant. Continuous flow record documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
W6[a]	Lynx Creek above Haggart Creek	Compliant. Monthly and automated monitoring documented during applicable periods.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	Compliant. Rating curve developed.	Compliant. Continuous flow record documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
W20[b]	Bawn Boy Gulch	Compliant. Monthly manual monitoring documented.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Rating curve not required for monthly manual measurement stations.	Compliant. Manual measurements have been summarized.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
W21[a]	Dublin Gulch at Mouth	Compliant. Monthly and automated monitoring documented during applicable periods.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	Compliant. Rating curve developed.	Compliant. Continuous flow record documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.

Table 9 Surface Water Hydrology Consistency with Requirements – EMSAMP 2020-01

Station	Location Description	Consistency Criteria							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Exceedance	3C: Response to Exceedance(s)
W22[a]	Haggart Creek above Project Influence	Compliant. Monthly and automated monitoring documented during applicable periods.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	Compliant. Rating curve developed.	Compliant. Continuous flow record documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
W23[b]	Haggart Creek below Lynx Creek	Compliant. Monthly manual monitoring documented.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Rating curve not required for monthly manual measurement stations.	Compliant. Manual measurements have been summarized.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
W26[a]	Stewart Gulch	Compliant. Monthly and automated monitoring documented during applicable periods.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Parshall flume installed.	Compliant. Continuous flow record documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
W27[a]	Eagle Creek near Camp below Eagle Creek Pond	Compliant. Monthly and automated monitoring documented during applicable periods.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Parshall flume installed.	Compliant. Continuous flow record documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
W29[b]	Haggart Creek below Eagle Creek and Platinum Gulch	Compliant. Monthly manual monitoring documented.	N/A. Channel instabilities have led to decommissioning of the station; use of W99 as a surrogate.	N/A. Rating curve not required for monthly manual measurement stations.	Compliant. Manual measurements have been summarized.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	Compliant. Exceedance check formally documented (through W99).	Compliant. Appropriate responses formally documented (through W99).
W39[c]	Haggart Creek above South McQuesten River	Partial consistency with requirements. Quarterly manual monitoring documented except for Q3 2021.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Rating curve not required for quarterly manual measurement stations.	Partial consistency with requirements. Quarterly manual flows documented except for Q3 2021.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
W45[a]	Eagle Creek above Haggart Creek	Compliant. Monthly manual monitoring documented.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	Partial Consistency with requirements. Range in flow measurements to date not sufficient for production of rating curve.	Not Compliant. Continuous flow record has not been documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.

Table 9 Surface Water Hydrology Consistency with Requirements – EMSAMP 2020-01

Station	Location Description	Consistency Criteria							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Exceedance	3C: Response to Exceedance(s)
W49[c]	South McQuesten River below Haggart Creek	Partial consistency with requirements. Quarterly manual monitoring documented except for Q1, Q3, Q4 in 2021.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Rating curve not required for quarterly manual measurement stations.	Partial consistency with requirements. Quarterly manual flows documented except for Q1, Q3, Q4 in 2021.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
W99[a]	Haggart Creek above 15 Pup	Compliant. Monthly and automated monitoring documented during applicable periods.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	Compliant. Rating curve developed.	Compliant. Continuous flow record documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	Compliant. Exceedance check formally documented.	Compliant. Appropriate responses formally documented.
ADR Pad Ditch[f]	ADR Pad Ditch Outlet	Compliant. Documented as having no flow in monthly reports.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Rating curve not required for manual measurement stations.	Compliant. Documented as having no flow in monthly reports.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Partial Consistency with requirements. Not included in annual reports; sometimes included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
CS-07[e]	Sediment Basin - below Ice Rich Storage Area	Reports reviewed do not consistently address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, November 21, 2022), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
EPS[b]	Eagle Pup WRSA Seepage	Reports reviewed do not consistently address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, November 21, 2022), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
FT[e]	Mine Water Treatment Plant Finishing Tank	Reports reviewed do not consistently address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, November 21, 2022), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
HLFUMV[a]	Heap Leach Facility Underdrain Monitoring Vault	Partial Consistency with requirements. Manual measurements not documented in all months; automated data not documented in reviewed reports.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Rating curve for not applicable to piped system.	Not Compliant. Continuous flow record has not been documented. VGC communication outside of reporting (personal communication, November 21, 2022) indicated a continuous record exists (not provided for review).	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Partial Consistency with requirements. Not included in annual reports; sometimes included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.

Table 9 Surface Water Hydrology Consistency with Requirements – EMSAMP 2020-01

Station	Location Description	Consistency Criteria							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Exceedance	3C: Response to Exceedance(s)
LDSPI[e]	Lower Dublin South Pond Inflow	Partial Consistency with requirements. Appendix E in 2020 and Appendix C in 2021 note that PDI + PGS + EPS = LDSPI, but LDSPI not reported directly and flow measurements at PDI, PGS, and EPS obtained at different times (complicating calculation).	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	Not Compliant. Rating curve for automated monitoring not documented.	Not Compliant. Continuous flow record has not been documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Partial Consistency with requirements. Included in annual reports; not included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
LDSP[e]	Lower Dublin South Pond Outflow	Partial Consistency with requirements. Spot flow measurements provided; continuous/automated data not documented.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	Not Compliant. Rating curve for automated monitoring not documented.	Not Compliant. Continuous flow record has not been documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Partial Consistency with requirements. Not included in annual reports; sometimes included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
LDSP-UND[b]	LDSP Underdrain Outflow	Compliant. Monthly manual monitoring documented.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Rating curve not required for manual measurement stations.	Compliant. Monthly manual monitoring documented.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Partial Consistency with requirements. Not always included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
MWTP[e]	Mine Water Treatment Plant	Reports reviewed do not consistently address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, November 21, 2022), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
OPP[h]	Open Pit Pond	Reports reviewed do not consistently address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, November 21, 2022), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
OPPO[b]	Open Pit Pond Overflow	Reports reviewed do not consistently address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, November 21, 2022), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
PGS[b]	Platinum Gulch WRSA Seepage	Partial Consistency with requirements. Sometimes documented in monthly reports.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Rating curve not required for manual measurement stations.	Partial Consistency with requirements. Sometimes documented in monthly reports.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.
PDI & PG PTS[b,g]	Platinum Gulch Ditch into Lower Dublin South Pond (Ditch/Pipe A; PG Passive Treatment System)	Partial Consistency with requirements. Sometimes documented in monthly reports.	Partial Consistency with requirements. Monitoring visit tasks outlined in EMSAMP Section 2.3.1 not specifically documented for the station.	N/A. Rating curve not required for manual measurement stations.	Partial Consistency with requirements. Sometimes documented in monthly reports.	Partial Consistency with requirements. General QA/QC procedures outlined; not documented on a site-specific basis.	Compliant. Included in both annual and monthly reports	N/A. Not listed as requiring adaptive management check in EMSAMP.	N/A. Not listed as requiring adaptive management check in EMSAMP.

Table 9 Surface Water Hydrology Consistency with Requirements – EMSAMP 2020-01

Station	Location Description	Consistency Criteria							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Exceedance	3C: Response to Exceedance(s)
PS[d]	Open Pit Sump	Reports reviewed do not consistently address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, November 21, 2022), indicated the site was not active, suggesting EMSAMP requirements not applicable.							

NOTES:

[1] Consistency with requirements for analysis and reporting requirements could not be checked for consistency with requirements for 2022, as the monthly reports (all that is available for 2022) do not provide rating curves, flow records, QA/QC, monitoring summaries, or adaptive management checks

[a] Automated monitoring. Manual monitoring weekly during freshet until loggers installed and monthly during winter.

[b] Manual monitoring on a monthly basis.

[c] Manual monitoring on a quarterly basis.

[d] Automated monitoring when dewatering.

[e] Automated monitoring when discharging.

[f] Manual monitoring on a daily basis when discharging.

[g] Platinum ditch intake converted to Platinum Gulch PTS when PG WRSA is progressively reclaimed.

[h] Quarterly manual water level measurement during active closure.

3.1.3 Water Management Plan

The Licensee's consistency with requirements of the WMP was evaluated. The WMP is an approved plan with design drawings sealed by a professional engineer licensed to practice in the Yukon.

The consistency with requirements evaluation for the WMP checked for completion, and for effectiveness. Consistency with completion requirements occurred if the water management infrastructure item was documented as installed by the required time (e.g., prior to operation). Consistency with requirements with effectiveness occurred if water quality did not exceed the Effluent Quality Standards during operations (Table 6.1-1 in WMP), and if regular inspection (as required) was documented for water management infrastructure/measures. Table 10 summarizes the main water management infrastructure and provides an evaluation of consistency with requirements based on the reviewed reporting.
Water quality implications (for effectiveness consistency with requirements) are discussed in Section 3.2 (Surface Water Quality).

Table 10 Water Management Plan Implementation

Water Management Infrastructure	Consistency with Requirements
LDSP	Compliant. Previous VGC communication outside of reviewed reporting (personal communication, 29 October 2020) indicated as-built report submitted in 2017 annual report (prior to this audit period). The 2017 completion date was not documented in reviewed reports, although maintenance and minor modifications during this audit period are documented in reviewed reports.
Ditch A	Compliant. VGC communication outside of reviewed reporting (personal communication, 29 October 2020) indicated ditch as-built report provided to EMR as appendix to 2019 Annual Report (prior to this audit period). Ditch A maintenance and improvement activities during this audit period documented in reviewed reports.
Ditch B	Compliant. VGC communication outside of reporting (personal communication, October 29, 2020) indicated ditch as-built report provided to EMR as appendix to 2019 Annual Report (prior to this audit period). Ditch B maintenance and improvement activities during this audit period documented in reviewed reports.
Ditch C	Compliant. Excavation, rip rap armoring completed in April 2019, prior to beginning of operation (August 31, 2020).
Culverts	Partial consistency with requirements. In reviewed reporting, installation of culverts has been documented, however it is unclear whether the installed culverts include the nine named culverts in the WMP, and/or and which additional culverts have been installed. Inventory of culvert locations, characteristics, and completion dates not provided in reviewed reports.
Unnamed Ditches	Compliant. Unnamed ditches (roadside, collector) documented as part of the erosion and sediment control BMP implementations in reviewed reporting.
WRSA Rock Drains	Compliant. Ongoing construction of PG WRSA rock drain and EP WRSA rock drain documented in reviewed reporting.
Events Pond	Compliant. VGC communication outside of reporting (personal communication, October 29, 2020) indicated as-built documents provided to YWB as appendix to 2019 Annual Report (prior to this audit period). Events pond water transfers documented in reviewed reporting.

Table 10 Water Management Plan Implementation

Water Management Infrastructure	Consistency with Requirements
MWTP	Compliant. Initiation of MWTP construction documented in reviewed reports.
Erosion and Sediment Control BMP's	Compliant. Erosion and sediment control BMP implementations documented in reviewed reporting.

3.1.4 Reporting Adequacy, Consistency with Requirements and Recommendations

Overall, consistency with requirements results were a mix of compliant, partial consistency with requirements, and not consistent (see Table 9 and Table 10,). We note that the surface water hydrology consistency with requirements levels were notably improved from the previous environmental audit (Stantec 2020).

Several non-consistency with requirements or partial consistency with requirements themes were observed throughout the current audit period. Table 11 summarizes the \consistency, partial consistency, or non-consistency with requirements, and provides recommendations.

Table 11 Surface Water Hydrology Consistency with Requirements and Recommendations

Consistency with requirements Gap and/or Deficiency	Recommendations
EMSAMPs reference RISC (2009) as the document which was used to develop hydrology data collection. This document is out of date; Version 2.0 of that document was published in 2018.	The EMSAMP surface water hydrology program should be updated to reflect Version 2 of the hydrometric standards (RISC 2018).
The annual reports and the monthly reports do not consistently document the monitoring activities or status of each of the 29 surface water hydrology stations. Consistency with requirements can not always be determined.	Recommend including the full list of 29 sites from the EMSAMP in each of the annual and monthly reports, and summarizing the current status of each (e.g., automated monitoring ongoing, not active, not discharging, manual flow measurement collected this month). Consistency with requirements can not be determined if status is not documented.
For automated stations, winter and freshet time periods were not clearly delineated as to allow for demonstration of consistency with requirements as outlined in the EMSAMPs.	Recommend one of two changes: 1 Document approximate dates of freshet start and logger deployment each year in the monthly and annual reports to delineate winter, freshet, and open water periods (each of which have different monitoring requirements), or 2 Update the EMSAMP requirements for the freshet period to better acknowledge i) the subjectivity of determining freshet period and/or ii) the difficulty of obtaining flow measurements during freshet flows.

Table 11 Surface Water Hydrology Consistency with Requirements and Recommendations

Consistency with requirements Gap and/or Deficiency	Recommendations
The EMSAMPs list general tasks to be completed at each field visit and during QA/QC (Section 2.3.1). Completion of these tasks, including grading of each hydrometric station, was discussed in general in annual reports but documentation was not provided for audit review, for each station per requirements of RISC (2018).	Provide summary information regarding the completion of the tasks and QA/QC steps associated with each field visit in the annual reports, and/or indicate (in reporting) that these data have been documented internally and are available upon request. This could be done through "station datasheets" for each of the stations, with a full station history log. Formal grading of each station (per RISC 2018) would be a good addition demonstrating QA/QC completion.
QA/QC related to field and analytical tasks (e.g., benchmark surveys, station condition, field processes, photos, equipment calibration) were not documented.	Recommend that QA/QC processes in accordance with Section 2.3.1 in EMSAMP 2020-01, EC 2001, RISC 2018 are documented and provided in reporting.

3.2 Surface Water Quality

3.2.1 Documents Reviewed

Documents shown in Table 12 were reviewed for the surface water quality monitoring section of the audit. In addition, the monitoring program was reviewed with respect to procedures outlined in the British Columbia Field Sampling Manual as per the EMSAMP (BC ENV 2013), and the Guidance Document for the Sampling and Analysis of Metal Mining Effluents (EC 2001).

Table 12 Surface Water Quality Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
Environmental Monitoring, Surveillance, and Adaptive Management Plan (EMSAMP)	2020-01	3.0 – Surface Water Quality
Eagle Gold Project Water Management Plan (WMP)	2020-01	3.4.2 – Surface Water Quality 4.3 – Discharge Protocols 6.0 – Water Management Implementation
Water Licence QZ14-041-01 (Amendment 1, August 22, 2019)	22-Aug-19	Part F – EQS
Water Licence QZ14-041-01 Quartz Mining License QML-0011 2020 Annual Report	N/A	3.2 – Surface Water Quality
Water Licence QZ14-041-01 Quartz Mining License QML-0011 2021 Annual Report	N/A	3.2 – Surface Water Quality
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - August 2020	05-Oct-20	3.0 – Surface Water Quality
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - November 2020	31-Dec-20	3.0 – Surface Water Quality

Table 12 Surface Water Quality Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - February 2021	03-Apr-21	3.0 – Surface Water Quality
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - April 2021	01-Jun-21	3.0 – Surface Water Quality
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - July 2021	31-Aug-21	3.0 – Surface Water Quality
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - November 2021	02-Jan-22	3.0 – Surface Water Quality
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - December 2021	30-Jan-22	3.0 – Surface Water Quality
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report – January 2022	02-Mar-22	3.0 – Surface Water Quality
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report -April 2022	02-Jun-22	3.0 – Surface Water Quality

3.2.2 Monitoring Program Implementation

The surface water quality monitoring program was designed to meet the following objectives during operations as described in EMSAMP:

- *Continue to collect water quality data in the receiving environment at stations upstream and downstream of Project influences.*
- *Collect water quality data to verify compliance with the Effluent Quality Standards (EQSs) and monitor receiving environment Water Quality Objectives (WQOs) specified in QZ14-041-1.*
- *Provide a continuous water quality database to support adaptive management strategies to meet water quality compliance criteria and protect aquatic life.*

The following are key watersheds of the surface water monitoring program:

- Haggart Creek from below the confluence of Fisher Gulch to immediately downstream of the confluence with Lynx Creek;
- Dublin Gulch from Bawn Boy Gulch to the confluence with Haggart Creek;
- Eagle Creek;
- Lynx Creek; and
- Lower Haggart Creek and the South McQuesten River at the confluence with Haggart Creek

The surface water quality monitoring program is implemented according to the objectives stated in the EMSAMP. A review comparing reported parameters measured and detection limits to those listed in the EMSAMP was completed on each year (2020, 2021, and 2022). As ALS reports are not included in the annual report, one monthly report from each year for 2020, 2021, and 2022 were selected as a sample to represent the year. Results are listed in Table 13.

Table 13 Comparison of Surface Water Quality Parameters and Detection Limits to EMSAMP

Parameter		Unit	EMSAMP Detection Limit	2020 Annual Report[1] (ALS reported detection limit)	2021 Annual Report[2] (ALS reported detection limit)	2022 Monthly Report[3] (ALS reported detection limit)
Physical Parameters	Specific Conductance	µS/cm	2.0	✓✓	✓✓	✓✓
	Hardness (as $CaCO_3$)	mg/L	0.5	✓✗(0.6)	✓✗(0.6)	✓✗(0.6)
	pH	pH unit	0.1	✓✓	✓✓	✓✓
	TSS	mg/L	3.0	✓✓	✓✓	✓✓
	TDS	mg/L	10	✓✓	✓✓	✓✓
	Turbidity	NTU	0.1	✓✓	✓✓	✓✓
Organic/ Inorganic Carbon	DOC	mg/L	0.5	✓✓	✓✓	✓✓
	TOC	mg/L	0.5	✓✓	✓✓	✓✓
Major Anions and Nutrients	Alkalinity, Total (as $CaCO_3$)	mg/L	2	✓✓	✓✓	✓✓
	Ammonia as N	mg/L	0.005	✓✓	✓✓	✓✓
	Bromide	mg/L	0.05	✓✓	✓✓	✓✓
	Chloride	mg/L	0.5	✓✓	✓✓	✓✓
	Fluoride	mg/L	0.02	✓✓	✓✓	✓✓
	Nitrate (as N)	mg/L	0.005	✓✓	✓✓	✓✓
	Nitrite (as N)	mg/L	0.001	✓✓	✓✓	✓✓
	TKN	mg/L	0.05	✓✓	✓✓	✓✓
	Total Nitrogen	mg/L	0.0025	✓✓	✓✓	✓✓
	Ortho Phosphate as P	mg/L	0.001	✓✓	✓✓	✓✓
	Total Dissolved Phosphate as P	mg/L	0.002	✓✓	✓✓	✓✓
	Total Phosphate as P	mg/L	0.002	✓✓	✓✓	✓✓
	Sulphate	mg/L	0.5	✓✓	✓✓	✓✓

Table 13 Comparison of Surface Water Quality Parameters and Detection Limits to EMSAMP

Parameter		Unit	EMSAMP Detection Limit	2020 Annual Report[1] (ALS reported detection limit)	2021 Annual Report[2] (ALS reported detection limit)	2022 Monthly Report[3] (ALS reported detection limit)
Cyanide	Cyanide, Weak Acid Dissociable	mg/L	0.005	✓✓	✓✓	✓✓
	Cyanide, Total	mg/L	0.005	✓✓	✓✓	✓✓
	Cyanate	mg/L	0.2	✓✓	✓✓	✓✓
	Thiocyanate	mg/L	0.5	✓✓	✓✓	✓✓
Field Parameters	pH	pH unit	0.01	✓✓	✓✓	✓✓
	Temperature	°C	0.1	✓✓	✓✓	✓✓
	Conductivity	µS/cm	1	✓✓	✓✓	✓✓
	Dissolved Oxygen	mg/L	0.01	✓✓	✓✓	✓✓
Total and Dissolved Metals	Aluminum	mg/L	0.003	✓✓	✓✓	✓✓
	Antimony	mg/L	0.0001	✓✓	✓✓	✓✓
	Arsenic	mg/L	0.0001	✓✓	✓✓	✓✓
	Barium	mg/L	0.00005	✓×(0.00010)	✓×(0.00010)	✓×(0.00010)
	Beryllium	mg/L	0.0005	✓✓	✓✓	✓✓
	Bismuth	mg/L	0.0005	✓✓	✓✓	✓✓
	Boron	mg/L	0.01	✓✓	✓✓	✓✓
	Cadmium	mg/L	0.000017	✓✓	✓✓	✓✓
	Calcium	mg/L	0.05	✓✓	✓✓	✓✓
	Chromium	mg/L	0.0005	✓✓	✓✓	✓✓
	Cobalt	mg/L	0.0001	✓✓	✓✓	✓✓
	Copper	mg/L	0.0005	✓✓	✓✓	✓✓
	Iron	mg/L	0.03	✓✓	✓✓	✓✓
	Lead	mg/L	0.00005	✓✓	✓✓	✓✓
	Lithium	mg/L	0.005	✓✓	✓✓	✓✓
	Magnesium	mg/L	0.1	✓✓	✓✓	✓✓
	Manganese	mg/L	0.00005	✓×(0.00010)	✓×(0.00010)	✓×(0.00010)
	Mercury	mg/L	0.00001	✓✓	✓✓	✓✓
	Molybdenum	mg/L	0.00005	✓✓	✓✓	✓✓
	Nickel	mg/L	0.0005	✓✓	✓✓	✓✓
	Phosphorus – Total	mg/L	0.3	✓✓	✓✓	✓✓
	Potassium	mg/L	2	✓✓	✓✓	✓✓

Table 13 Comparison of Surface Water Quality Parameters and Detection Limits to EMSAMP

Parameter		Unit	EMSAMP Detection Limit	2020 Annual Report[1] (ALS reported detection limit)	2021 Annual Report[2] (ALS reported detection limit)	2022 Monthly Report[3] (ALS reported detection limit)
	Selenium	mg/L	0.001	✓✓	✓✓	✓✓
	Silicon	mg/L	0.05	✓✓	✓✓	✓✓
	Silver	mg/L	0.00001	✓✓	✓✓	✓✓
	Sodium	mg/L	2	✓✓	✓✓	✓✓
	Sulphur	mg/L	0.50	✓✓	✓✓	✓✓
	Strontium	mg/L	0.0001	✓×(0.0002)	✓×(0.0002)	✓×(0.0002)
	Thallium	mg/L	0.0001	✓✓	✓✓	✓✓
	Tin	mg/L	0.0001	✓✓	✓✓	✓✓
	Titanium	mg/L	0.01	✓✓	✓✓	✓✓
	Uranium	mg/L	0.00001	✓✓	✓✓	✓✓
	Vanadium	mg/L	0.001	✓✓	✓✓	✓✓
	Zinc	mg/L	0.003	✓✓	✓✓	✓✓

NOTES:
✓✓ Parameter sampled; detection limit is at or below applicable EMSAMP limit
✓× Parameter sampled; detection limit is above applicable EMSAMP limit
1 QZ14-041-1 Monthly Report - August 2020 was reviewed for this task as a spot check
2 QZ14-041-1 Monthly Report - April 2021 was reviewed for this task as a spot check
3 QZ14-041-1 Monthly Report - April 2022 was reviewed for this task as a spot check

3.2.3 Consistency with Requirements of the EMSAMP

The Water Management Plan 2020-01 was reviewed for alignment with the EMSAMP. Discharge protocols relating to WQOs, adaptive management thresholds (AMTs), and EQS were compared to the EMSAMP and Water Licence QZ14-041-01.

The 2020 Annual Report, 2021 Annual Report, and provided 2020, 2021 and 2022 Monthly Reports were reviewed for consistency with requirements of the EMSAMP. As described in Section 1.2 of this report, the scope of the audit including the audit of one monthly report per quarter. In this review, monitoring stations, sampling frequency, parameters analyzed, and rationale for missing data from selected monthly reports were evaluated for consistency with the EMSAMP. The results of this task are listed in Table 14. Effluent compliance points, EQS, and WQOs were described in the EMSAMP as per the Water License QZ14-041-01. Table 15 lists the threshold trigger events for surface water quality monitoring sites during operations while Table 16 describes the responses and follow up actions completed with auditor's comments on any discrepancies.

Table 14 Surface Water Quality Monitoring Program Consistency with Requirements of the EMSAMP for Selected Monthly Reports*

Site	Location Description	Sampling Frequency			Consistency Check (Y/N) with Rationale for Missing Data for Provided Monthly Reports							
		Field Measurements	Laboratory Analysis									
		pH, Temperature, Dissolved Oxygen and Specific Conductance	Analytical Suite[1]	48-Hour and 96-Hour LT50	Aug-20	Nov-20	Feb-21	Apr-21	Jul-21	Nov-21	Jan-22	Apr-22
					Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022
W1	Dublin Gulch above Stewart	M	M	-	Y	Y	Y	Y	Y	Y	Y	Y
W21	Dublin Gulch below Event Ponds	M	M	-	Y	Y	Y	Y	Y	Y	Y	Y
W4	Haggart Creek below Dublin	D, M	D[2], M[2]	-	Y	Y	Y	Y	Y	Y	Y	Y
W22	Haggart Creek above Project Influence	M	M[3]	-	Y	Y	Y	Y	Y	Y	Y	Y
W5	Haggart Creek above Lynx Creek	M	M[3]	-	Y	Y	Y	Y	Y	Y	Y	Y
W6	Lynx Creek above Haggart Creek	M	M[3]	-	Y	Y	Y	Y	Y	Y	Y	Y
W20	Bawn Boy Gulch	M	M	-	Y	Y - No Sample	Y	Y	Y	Y	Y	Y
W23	Haggart Creek below Lynx Creek	M	M[3]	-	Y	Y	Y	Y	Y	Y	Y	Y
W27	Eagle Creek near Camp below LDSP	M	M	-	Y	Y	Y - No Sample	Y	Y	Y	Y - No Sample	Y
W26	Stewart Gulch	M	M	-	Y	Y - No Sample	Y	Y	Y	Y	Y - No Sample	Y - No Sample
W29	Haggart Creek below Eagle Creek & Platinum Gulch	D, M	D[2], M[3]	-	Y	Y	Y	Y	Y	Y	Y	Y
W39	Haggart Creek above South McQuesten River	Q	Q[3]	-	Y – No Sample	Y	Y	Y	Y	Y - No Sample	Y	Y - No Sample
W45	Eagle Creek above Haggart Creek	M	M	-	Y	Y	Y	Y	Y	Y	Y	Y
W49	South McQuesten River below Haggart Creek	Q	Q[3]	-	Y - No Sample	Y	Y - No Sample	Y	Y	Y - No Sample	Y	Y - No Sample
W99	Haggart Creek above 15 Pup	M	Q[3]	-	Y	Y	Y	Y	Y	Y	Y	Y
EPS	Eagle Pup WRSA Seepage	M	M	-	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
PDI & PG_PTS[5]	Platinum Gulch Ditch into Lower Dublin South Pond	M	M	-	Y	Y - No Sample	Y - No Sample	Y	Y	Y - No Sample	Y - No Sample	Y - No Sample
PGS	Platinum Gulch WRSA Seepage	M	M	-	Y	Y - No Sample	Y	Y	Y	Y - No Sample	Y - No Sample	Y - No Sample
PS	Open Pit Sump	M	M	-	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
MWTP	Mine Water Treatment Plant	D	D[3]	-	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
FT	Mine Water Treatment Plant Finishing Tank	D	D[3]	-	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
LDSPI	Lower Dublin South Pond Inflow	D, M	D[3], M	M	Y	Y	Y	Y	Y	Y	Y	Y
LDSP	Lower Dublin South Pond Outflow	D, W	D[3], W[3,4]	Md	Y	Y - No Sample	Y - No Sample	Y - No Sample	Y	Y	Y - No Sample	Y – No Sample
CS-07	SG-G4 below Ice Rich Overburden Storage Area	Md	Md	-	N - ?	Y – No Sample	Y – No Sample	Y – No Sample	Y – No Sample	Y – No Sample	Y – No Sample	Y – No Sample
LDSP-UND	LDSP Underdrain Outflow	M	M[2]	-	Y	Y	Y	Y	Y	Y	Y	Y
HLFUMV	Heap Leach Facility Underdrain Monitoring Vault	C, D, W	D[5], M[3,4]	M	Y	Y	Y	Y	Y	Y	Y	Y
ADR Pad Ditch	ADR Pad Ditch Outlet	D, M	D[3], W[3,4]		Y – No Sample	Y – No Sample	Y – No Sample	Y – No Sample	Y – No Sample	Y – No Sample	Y – No Sample	Y – No Sample

Table 14 Surface Water Quality Monitoring Program Consistency with Requirements of the EMSAMP for Selected Monthly Reports*

NOTES:

1 Laboratory analysis includes physical parameters: pH, Specific Conductance, turbidity, TSS, TDS and hardness as well as total and dissolved organic carbon; cyanide species, major anions and nutrients (alkalinity, total nitrogen, total Kjeldahl nitrogen (TKN), ammonia-N, nitrate-N, nitrite-N, total dissolved phosphate-P, ortho-phosphate-P, sulphate, bromide, chloride, fluoride); and, total and dissolved metals (Al, Sb, As, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Hg, Ni, K, Se, Ag, Na, Sr, Tl, S U, Zn).

2 Laboratory analysis includes WAD, Total CN, Thiocyanate and Cyanate.

3 Laboratory analysis includes WAD and Total CN.

4 Calculation of un-ionized ammonia

5 Laboratory analysis only includes WAD and Total CN – no other parameters required.

C Continuous monitoring for specific conductance; D – Daily when discharging; W – Weekly when discharging; M – Monthly; Md – Monthly when discharging; Q – Quarterly

Y = Consistent with requirements

N - ? = No sample and no rationale provided in the monthly or annual reports

Y- No Sample = Consistent with reporting requirements; however, quarterly sample collected in another month, no flow, no discharge, dry conditions, frozen, not active, heavy sediment, or no safe access

* Selected Monthly Reports include August 2020, November 2020, February 2021, April 2021, July 2021, November 2021, January 2022, and April 2022

Table 15 Surface Water Quality Monitoring Program WQO Exceedance Table for Selected Monthly Reports*

Site	Site Description	Parameter in Exceedance	Thresholds/Objectives				Thresholds/Objectives Exceeded for Selected Monthly Reports							
			WQO (mg/L)	AMT T1 (mg/L)	AMT T2 (mg/L)	AMT T3 (mg/L)	Aug-20	Nov-20	Feb-21	Apr-21	Jul-21	Nov-21	Jan-22	Apr-22
							Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022
W1**	Dublin Gulch above Stewart	As (total)	0.0085	0.0064	0.0072	0.0085	WQO, AMT T3							
W21**	Dublin Gulch below Event Ponds	As (total)	0.0085	0.0064	0.0072	0.0085	WQO, AMT T3							
W4	Haggart Creek below Dublin	As (total)	0.0085	0.0064	0.0072	0.0085	WQO, AMT T3				WQO, AMT T3	WQO, AMT T3		
		Fe (total)	1.00	0.75	0.85	1.00	WQO, AMT T3				WQO, AMT T2			
W23	Haggart Creek below Lynx Creek	As (total)	0.0085	0.0064	0.0072	0.0085	WQO, AMT T1				WQO, AMT T3			
W29	Haggart Creek below Eagle Creek & Platinum Gulch	As (total)	0.0085	0.0064	0.0072	0.0085	WQO, AMT T3							
W99	Haggart Creek above 15 Pup	As (total)	0.0085	0.0064	0.0072	0.0085	WQO, AMT T2							

NOTES:
WQO = Water Quality Objective (QZ14-041-01)
AMT = Adaptive Management Threshold, T1 = Tier 1, T2 = Tier 2, T3 = Tier 3
There were no exceedances of MDMER standards or WUL EQSs.
*Selected Monthly Reports include August 2020, November 2020, February 2021, April 2021, July 2021, November 2021, January 2022, and April 2022
**AMT are not applicable to Dublin Gulch sites W1 and W21 but are included to show influence of Dublin Gulch on Haggart Creek.

Table 16 Selected Monthly Reports Surface Water Quality WQO Exceedances, Responses, and Consistency with Requirements of the EMSAMP

Date	Stations	WQOs and AMTs Exceeded	Response(s) by VGC	Follow Up Reporting by VGC	Auditor's Comments on Consistency with Requirements of the EMSAMP
August 2020	W4, W29, W99, W23	WQO and AMT T1, T2 and T3	• Additional samples were collected daily at W4 between August 3 and 18, 2020 • Additional samples were collected weekly from LDSP, W1, and W21 between August 3 and 17, 2020 • Acute lethality testing was performed on the discharged water on August 3, 2020 and yielded results that were non-acutely lethal to Rainbow Trout or *Daphnia magna.*	• A comparison trial was performed in September 2020 and included in the subsequent monthly reports. • A monthly water quality trend analysis was conducted by Lorax for the August 2020 data at Haggart Creek Stations and attached to the August 2020 Monthly Report. • A WQO Notification was sent to the Government of Yukon following this event and included notification, evaluation, and action.	• As per Section 3.6 of the EMSAMP 2020-01 notification, review, evaluation, and action for exceeding an AMT was not clear in the provided reports; however, the AMT response was provided by VGC as part of the audit review and is therefore consistent with the requirements.
July 2021	W4, W23	WQO and AMT T2 and T3	• Additional samples were collected daily at W4 between July 12 and 23, 2021. • Subsequent investigation sampling occurred in August 2021 as laboratory results were delayed. • Acute lethality testing was performed on the discharged water on July 12, 2021 and yielded results that were non-acutely lethal to Rainbow Trout or *Daphnia magna.*	• A WQO Notification was sent to the Government of Yukon following this event and included notification, evaluation, and action.	• As per Section 3.6 of the EMSAMP 2020-01 notification, review, evaluation, and action for exceeding an AMT was not clear in the provided reports; however, the AMT response was provided by VGC as part of the audit review and is therefore consistent with the requirements. • The audit included one monthly report per quarter; therefore, August 2021 Monthly Report was not reviewed.
November 2021	W4	WQO and AMT T3	• Additional sampled were collected daily at W4, W4 Mix and W99 between November 12 and 20, 2021 • Acute lethality testing was performed on the discharged water on November 3, and 12, 2021 and yielded results that were non-acutely lethal to Rainbow Trout or *Daphnia magna.*	• A WQO Notification was sent to the Government of Yukon following this event and included notification, evaluation, and action.	• As per Section 3.6 of the EMSAMP 2020-01 notification, review, evaluation, and action for exceeding an AMT was not clear in the provided reports; however, the AMT response was provided by VGC as part of the audit review and is therefore consistent with the requirements.

NOTE:
*Selected Monthly Reports include August 2020, November 2020, February 2021, April 2021, July 2021, November 2021, January 2022, and April 2022

3.2.4 Data Quality Assurance/Quality Control

2020 Annual Report

The methods and result and discussion sections of the quality assurance/quality control (QA/QC) program were adequately described and listed in the 2020 Annual Report with the exception of:

- A total of 9% of total water quality samples were QA/QC samples, which is below recommendations (>10%) as per BC ENV (2013). The 2020 Annual Report reported 28 QA/QC samples per 321 water quality samples; however, the auditor identified 30 QA/QC Samples (5 field blanks, 21 field duplicates, and 4 travel blanks) and 348 water quality samples, which also equates to 9%.
- QA/QC sample ID descriptions from Section 3.2.2 of the 2020 Annual Report and in subsequent tables and appendices are contradicting. Section 3.2.2 of the 2020 Annual Report describes QA/QC sample IDs as station number followed by "SampleID"01 for field replicates, "SampleID"02 for field (it is unclear whether *field* means field replicate or field blank; however, this was confirmed to be field blank by VGC), and "SampleID"03 for travel blanks. A fourth category, either field replicate or field blank should be included. These categories contradict with Table 3.2-2 of the 2020 Annual Report, as field blanks are represented with an "02"; in Appendix F1 field duplicates are represented as "01"; and travel blanks are not listed (Table 3.2-3 of the 2020 Annual Report).

2021 Annual Report

The methods and result and discussion sections of the QA/QC program were adequately described and listed in the 2021 Annual Report. A total of 22% of QA/QC samples were reported as collected in the 2021 Annual Report Section 3.2.4.3 (65 QA/QC samples per 303 water quality samples) which is above recommendations (>10%) as per BC ENV (2013). The auditor identified 71 QA/QC samples from Appendix D (19 field blanks, 3 travel blanks, and 49 field duplicates as opposed to 65 as reported). Appendix D mentions 46 field duplicates and Section 3.2.4.3 reports 48 field duplicates.

2020 to 2022 Monthly Reports

For all audited 2020 to 2022 monthly reports, in the report body or Appendix A, QA/QC samples are not explicitly identified, but are described in the 2020 and 2021 Annual Reports. Section 3.3.5 of the EMSAMP states QA/QC results will be reported on for each month of the sampling program.

3.2.5 Reporting Adequacy, Consistency with Requirements, and Recommendations

The 2020 Annual Report, the 2021 Annual Report, and the selected audited 2020, 2021 and 2022 Monthly Reports were reviewed for adequacy and consistency with requirements. Overall, the reporting and summarization of data collected for the surface water quality monitoring program is complete and adequate with deviations described below.

2020 Annual Report

The 2020 Annual Report adequately described and reported the operational monitoring program as described in the EMSAMP; however, some deviations and omissions were noted:

- In Tables 3.2-3 and 3.2-4, Sample IDs should be included so the reader can compare/link to laboratory certificates of analysis.
- Detection limits did not align with EMSAMP for hardness (0.6 mg/L reported and 0.5 mg/L in EMSAMP), total and dissolved barium (0.00010 mg/L reported and 0.00005 mg/L in EMSAMP), and total and dissolved strontium (0.0002 mg/L reported and 0.0001 mg/L in EMSAMP).

2021 Annual Report

The 2021 Annual Report adequately described and reported the operational monitoring program as described in the EMSAMP; however, some deviations and omissions were noted:

- In Appendix D Tables 2-2, 2-4, 2-6, 2-7, 2-8, 2-9, 2-10, and 2-11, Sample IDs should be included so the reader can compare/link to laboratory certificates of analysis.
- Detection limits did not align with EMSAMP for hardness (0.6 mg/L reported and 0.5 mg/L in EMSAMP), total and dissolved barium (0.00010 mg/L reported and 0.00005 mg/L in EMSAMP), and total and dissolved strontium (0.0002 mg/L reported and 0.0001 mg/L in EMSAMP).

2020, 2021, 2022 Selected Monthly Reports

- As per Section 3.6 of the EMSAMP 2020-01 notification, review, evaluation, and action for exceeding an AMT were partially completed. Missing:
    - Detailed AMT response following the EMSAMP methods was not clear in the reviewed Monthly Reports with AMT exceedances.
- Detection limits did not align with EMSAMP for hardness (0.6 mg/L reported and 0.5 mg/L in EMSAMP), total and dissolved barium (0.00010 mg/L reported and 0.00005 mg/L in EMSAMP), and total and dissolved strontium (0.0002 mg/L reported and 0.0001 mg/L in EMSAMP).
- Tabulated surface water quality data is recommended to be included in the monthly reports and identify the QA/QC sample types and Sample ID.
- August 2020 Monthly Report was missing COA for sample CS-07. Field parameters and flow were reported, but laboratory COA was not attached. Surface water quality data was not in provided database. Rationale for missing sample was not provided.

Recommendations to correct gaps and/or deficiencies for the surface water monitoring program are summarized in Table 17.

Table 17 Surface Water Quality Gaps Consistency with requirements and Recommendations

Consistency with Requirements Gap and/or Deficiency	Recommendations
2020 Annual Report – Section 3.2.2 QA/QC Program Sample IDs.	This was corrected in the 2021 Annual Report. Continue corrective action in future reports.
Reported surface water quality detection limits did not align with the EMSAMP for hardness (0.6 mg/L reported and 0.5 mg/L in EMSAMP), total and dissolved barium (0.00010 mg/L reported and 0.00005 mg/L in EMSAMP), and total and dissolved strontium (0.0002 mg/L reported and 0.0001 mg/L in EMSAMP).	Discuss with laboratory (e.g., ALS) to reduce detection limit for the listed parameters. If the upper detection limit is not achievable a description/rationale should be included in the report and the EMSAMP be updated. I
2021 Annual Report – QA/QC total samples not consistent in report body, tables, and appendices	Review database inputs/outputs and quality review procedures and reports.
Selected Monthly Reports – Describe QA/QC data as Section 3.3.5 of the EMSAMP states QA/QC results will be reported on for each month of the sampling program.	Include tabulated results of surface water quality samples including identifying which samples are QA/QC in monthly reports.

3.3 Groundwater Quantity and Quality

3.3.1 Documents Reviewed

Documents in Table 18 were reviewed for the groundwater quantity and quality section of the audit:

Table 18 Groundwater Quantity and Quality Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
Environmental Monitoring Surveillance and Adaptive Management Plan (EMSAMP)	2020-01	4.0 Groundwater Quantity 5.0 Groundwater Quality
Type A Water Use License QZ14-041-1 Monthly Reports, Reporting Period: August 2020 to April 2022	N/A	4.0 Groundwater Quantity and Quality; Appendix B Lab Results: Groundwater

The groundwater monitoring program audit period (August 2020 to April 2022) includes the mine's operations phase. The approved groundwater monitoring program (e.g., well locations, data collection frequency) are presented in the EMSAMP. The relevant version of the EMSAMP and groundwater monitoring programs used as the basis for the audit are presented in Table 18.

3.3.2 Monitoring Program Implementation and Data QA/QC

3.3.2.1 Groundwater Quantity

The objective of the groundwater quantity monitoring program, as presented in the EMSAMP, is to provide groundwater level measurement to monitor potential project effects on the occurrence and quantity of groundwater during mine operations and closure. The main components of the groundwater quantity program, as presented in the EMSAMP, are:

- Field program to install and maintain a network of groundwater monitoring wells at strategic locations and perform continuous and/or manual groundwater level measurement at selected wells in accordance with the monitoring schedule proposed in the EMSAMP
- Desktop assessment to compile and calibrate field groundwater level data, plot hydrographs versus time, precipitation, and temperature, and compare the hydrographs to existing baseline data
- Preparation of data summary report at the completion of construction, annually during operation, and for specific reporting periods as identified in the Reclamation and Closure Plan

As a part of the audit's effort to evaluate the implementation of the groundwater quantity monitoring program, the groundwater level records presented in the monthly reports from Q3 2020 to Q2 2022 were reviewed and compared with the applicable groundwater quantity monitoring requirements in the EMSAMP. A summary of the groundwater level monitoring program is provided in Table 20. Recommendations on the implementation of the groundwater quantity monitoring program are presented in Section 3.3.3.

Table 19 Groundwater Quantity Monitoring Program Implementation – Operations Phase

Well ID	Facility	Datalogger[1]	Groundwater Level Monitoring Frequency[2]	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Notes
BH-BGC11-73a	Open Pit	Yes	Quarterly									Decommissioned 2020
BH-BGC11-73b	Open Pit	Yes	Quarterly									Decommissioned 2020
BH-BGC11-73c	Open Pit	Yes	Quarterly									Decommissioned 2020
PZXX-OP1a/b	Open Pit	Yes	Quarterly									Installed after 2021, To be addressed in 2022 Annual Report
PZXX-OP2a/b	Open Pit	Yes	Quarterly									Installed after June 2021, To be addressed in 2022 Annual Report
PW-BGC11-02	Open Pit	No	Quarterly									Decommissioned 2020
MWXX-OP1a/b	Suttles Gulch	No	Quarterly									To be addressed in 2022 Annual Report
MW19-PGW1a	PG WRSA	Yes	Quarterly		M	M	M	M	M	M	M	
MW19-PGW1b	PG WRSA	Yes	Quarterly									Well reported damaged in Q4 2020; to be addressed in 2022 Annual Report
MW10-PG1	PG WRSA and Open Pit	Yes	Quarterly		M	M	M	M	M	M	M	
MW96-13A	EP WRSA	Yes	Quarterly		M	M	M					Decommissioned Apr. 30 2021
MW96-13B	EP WRSA	Yes	Quarterly		M	M	M					Decommissioned Apr. 30 2021
MW96-14A	EP WRSA	No	Quarterly									Decommissioned
MW96-14B	EP WRSA	No	Quarterly		M	M	M					Decommissioned Apr. 30 2021
MW96-15(B)	EP WRSA	No	Quarterly		M	M	M	M	M	M	M	
MWXX-15aR	EP WRSA	No	Quarterly									To be installed
MW19-EPW1a	EP WRSA	Yes	Quarterly		M		M	M	M	M	M	Reported frozen in Q1 2021
MW19-EPW1b	EP WRSA	Yes	Quarterly		M			M	M		M	Reported frozen in Q1 2021, Q2 2021
MW10-AG3a	HLF	Yes	Quarterly									Decommissioned
MW19-HLF1a	HLF	Yes	Quarterly			M	M	M	M	M	M	
MW19-HLF1b	HLF	No	Quarterly		M	M	M	M	M	M	M	
MWXX-AG6R	HLF	No	Quarterly									To be installed
MW19-DG6Ra	HLF	Yes	Quarterly				M					
MW19-DG6Rb	HLF	Yes	Quarterly				M					
MWXX-HLF2a/b	HLF	Yes	Quarterly									To be installed
MWXX-HLF3a/b	HLF	Yes	Quarterly									To be installed
MWXX-HLF4a/b	HLF	Yes	Quarterly									To be installed
MW19-EVP1a	Events Pond	No	Quarterly		M	M	M	M	M	M	M	
MW19-EVP1b	Events Pond	No	Quarterly		M	M	M	M	M	M	M	
MW19-EVP2a	Events Pond	No	Quarterly		M	M	M	M	M	M	M	
MW19-EVP2b	Events Pond	No	Quarterly		M	M	M	M	M	M	M	
MW18-DG2R	Lower Dublin South Pond	Yes	Quarterly									

Table 19 Groundwater Quantity Monitoring Program Implementation – Operations Phase

Well ID	Facility	Datalogger[1]	Groundwater Level Monitoring Frequency[2]	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Notes
MW18-LDSP1	Lower Dublin South Pond	Yes	Quarterly		M	M	M	M	M	M	M	
MW19-LDSP2a	Lower Dublin South Pond	Yes	Quarterly		M	M	M	M	M	M	M	
MW19-LDSP2b	Lower Dublin South Pond	Yes	Quarterly		M	M	M	M	M	M	M	
BH-BGC11-72	Lower Dublin Gulch	Yes	Quarterly			M	M	M	M	M	M	
BH-BGC11-74	Lower Dublin Gulch	No	Quarterly			M	M	M	M		M	
MWXX-LPH1	Low pH treatment solids storage cell	No	Quarterly									To be installed
MWXX-LPH2	Low pH treatment solids storage cell	No	Quarterly									To be installed
MW96-9b	N/A	Yes	Quarterly			M	M	M	M	M	M	

NOTES:

IM Groundwater level measured.
Q3 2020 data not presented in monthly report.

3.3.2.2 Groundwater Quality

The objective of the groundwater quality monitoring program is to monitor project effects on the quality of groundwater over the life of the project.

The key components of the groundwater quantity program, as presented in the EMSAMP, are:

- Field program to install and maintain a network of groundwater monitoring wells at strategic locations and collect groundwater samples from selected wells in accordance with the monitoring schedule, and sampling and transportation protocols presented in the EMSAMP. The groundwater quality monitoring is integrated with the groundwater quantity monitoring program such that groundwater samples are collected from a subset of wells that are monitored for groundwater levels.
- Field QA/QC program including collection of trip blanks, field blanks, and field duplicates samples
- Field and lab analysis of groundwater samples for the following groundwater quality parameters:
  - Field parameters: temperature, pH, conductivity, turbidity
  - Lab physical parameters: conductivity, turbidity, TDS, TSS, pH
  - Anion: Cl, SO_4, NO_3, NO, Total CN, WAD CN1, Total Alkalinity/hardness, F, Br
  - Nutrients: Total-PO4
  - Carbon: Dissolved Organic Carbon, Total Organic Carbon
  - Dissolved metals: ICPOES/MS + mercury, trace metals (Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, P, K, Se, Si, Ag, Na, Sr, Tl, V, U, Zn)
- Desktop analysis of analytical results and compilation of groundwater quality data, review data against baseline groundwater quality and QA/QC criteria to identify and eliminate false positives and negatives, compare results to monitoring criteria, and plot concentration of regulated constituents and key indicator parameters versus time and applicable standards and baseline concentrations
- Submission of groundwater quality data for regulatory review

As a part of this audit's effort to evaluate the implementation of the groundwater quality monitoring program, the groundwater quality data presented in the Q3 2020 to Q2 2022 monthly reports were reviewed and compared to applicable groundwater quality monitoring requirements in the relevant EMSAMP. The mine was in the operations phase during throughout this time period.

The audit results are presented separately in Table 20.

Table 20 Groundwater Quality Monitoring Program Implementation – Operations Phase

Well ID[1]	Facility	GW Quality Sample Frequency[2]	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q3 2022	Note
MW19-PGW1a	PG WRSA	Quarterly		S		S	S	S	S	S	Q3 2020 sampling not provided in quarterly reports, frozen Q1 2021
MW19-PGW1b	PG WRSA	Quarterly									Well reported damaged in Q4 2020
MW10-PG1	PG WRSA and Open Pit	Quarterly		S	S	S	S	S	S	S	
MW96-13A	EP WRSA	Quarterly		S	S	S					decommissioned
MW96-13B	EP WRSA	Quarterly									Well reported dry in Q4 2020, Q1 2021, Q2 2021; decommissioned
MW96-15(B)	EP WRSA	Quarterly		S	S	S	S	S	S	S	
MWXX-15aR	EPWRSA	Quarterly									To be installed
MW19-EPW1a	EP WRSA	Quarterly		S		S	S	S	S	S	Well frozen in Q1 2021
MW19-EPW1b	EP WRSA	Quarterly					S	S			Well reported frozen in Q4 2020, Q1 2021, Q2 2021
MW10-AG3A	HLF	Quarterly									
MW19-HLF1a	HLF	Quarterly			S	S	S	S	S		
MW19-HLF1b	HLF	Quarterly								S	Well reported dry in Q4 2020, Q1 2021, Q2 2021
MW19-DG6Ra	HLF	Quarterly				S					
MW19-DG6Rb	HLF	Quarterly									Frozen Q2 2021
MWXX-HLF2a/b	HLF	Quarterly									To be installed
MWXX-HLF3a/b	HLF	Quarterly									To be installed
MWXX-HLF4a/b	HLF	Quarterly									To be installed
MW19-EVP1a	Events Pond	Quarterly									Well reported dry in Q4 2020, Q1 2021, Q2 2021
MW19-EVP1b	Events Pond	Quarterly									Well reported dry in Q4 2020, Q1 2021, Q2 2021
MW19-EVP2a	Events Pond	Quarterly									Well reported dry in Q4 2020, Q1 2021, Q2 2021
MW19-EVP2b	Events Pond	Quarterly		S		S	S	S	S	S	Duplicate Q4 2020, frozen in Q1 2021
MW18-DG2R	Lower Dublin South Pond	Quarterly									
MW18-LDSP1	Lower Dublin South Pond	Quarterly					S	S			Well reported dry in Q4 2020, Q1 2021, Q2 2021
MW19-LDSP2a	Lower Dublin South Pond	Quarterly		S			S	S			Well reported dry in Q1 2021, Q1 2021, Q2 2021
MW19-LDSP2b	Lower Dublin South Pond	Quarterly		S	S	S	S	S	S	S	
BH-BGC11-72	Lower Dublin Gulch	Quarterly			S	S	S	S	S	S	
BH-BGC11-74	Lower Dublin Gulch	Quarterly			S	S	S	S		S	

Table 20 Groundwater Quality Monitoring Program Implementation – Operations Phase

Well ID[1]	Facility	GW Quality Sample Frequency[2]	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q3 2022	Note
MWXX-LPH1	Low pH treatment solids storage cells	Quarterly									To be installed
MWXX-LPH2	Low pH treatment solids storage cells	Quarterly									To be installed

NOTES:

S Groundwater sample collected.
Q3 2020 data not presented in monthly reports.

3.3.3 Reporting Adequacy, Consistency with Requirements and Monitoring

Table 21 summarizes consistency with requirement gaps and/or deficiencies for the groundwater quantity and quality monitoring program and provides recommendations.

Table 21 Groundwater Quantity and Quality Consistency with requirements and Recommendations

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Some wells included in the monthly report are not part of the EMSAMP.	• Reporting should only include the wells listed in the EMSAMP.
Groundwater quantity and quality monitoring from some wells was performed less frequently than the schedule prescribed in EMSAMP.	• A number of factors, including those beyond the control of VGC may result in a scheduled monitoring not being performed (e.g. frozen conditions, weather, equipment malfunction, unsafe condition, construction). The monthly reporting needs to consistently provide the rationale for missed monitoring in tabular format and if any corrective action will be or has been taken. Corrective actions could include monitoring well repair, replacement, improved accessibility, etc. and should be relevant to the specific well concern.
The Q3 2020 data was not provided in the monthly reports.	• Include the Q3 2020 groundwater quantity and quality data in the monthly report.
No continuous water level data provided in monthly reports.	• VGC should consider including the continuous water level data hydrographs in the monthly reports. This would enable an ongoing analysis of groundwater levels which might identify changes which could lead to a circumstance of noncompliance with the permit. • If the continuous water level data will not be included in the monthly reports, a statement should be included indicating that the continuous water level data will be included and reviewed as part of the annual report.
EMSAMP (S. 5.2) presents groundwater quality parameters to be analyzed in the monitoring program. It is not clear in the monthly reports if all parameters are being analyzed.	• Review water license conditions and laboratory records to confirm if required parameters were analyzed and provide in monthly reports. • Include all analyzed parameters and laboratory reports in monthly reporting.

Table 21 Groundwater Quantity and Quality Consistency with requirements and Recommendations

Consistency with requirements Gaps and/or Deficiencies	Recommendations
No data interpretation is provided in the monthly reports.	• VGC should consider completing ongoing data analysis and interpretation in their monthly reports. This will enable the early identification of any trends which could lead to a circumstance of noncompliance with the permit. • If data interpretation is not planned to be included in the monthly reports, a statement should be included indicating that data review and interpretation consistent with the requirements of the EMSAMP will be provided in the annual reports.
EMSAMP (S. 5.3.2 and 5.3.3) describes the field QA/QC program for groundwater quality monitoring, which includes collection and analysis of trip blanks, field blanks and duplicates. The field QA/QC program is not included in the monthly reports.	• A statement should be included in the monthly reports that the field QA/QC program was implemented consistent with EMSAMP and a complete analysis of the QA/QC will be provided in the annual reports.

3.4 Geochemical Monitoring

3.4.1 Documents Reviewed

Documents listed in were reviewed for the geochemical monitoring section of the audit:

Table 22 Geochemical Monitoring Program Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
EMSAMP	2020-01	6.0 – Geochemical Monitoring
Water Licence QZ14-041-01 (Amendment 1, August 22, 2019)	22-Aug-19	Part F – EQS
Water Licence QZ14-041-01 Quartz Mining License QML-0011 2019 Annual Report	N/A	2.2.1 – Ore, Waste and Gold Production
Water Licence QZ14-041-01 Quartz Mining License QML-0011 2020 Annual Report	N/A	3.5 – Geochemical Monitoring
Water Licence QZ14-041-01 Quartz Mining License QML-0011 2021 Annual Report	N/A	3.5 – Geochemical Monitoring
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - August 2020	05-Oct-20	5.0 – Geochemical Monitoring
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - November 2020	31-Dec-20	5.0 – Geochemical Monitoring

Table 22 Geochemical Monitoring Program Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - February 2021	03-Apr-21	5.0 – Geochemical Monitoring
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - April 2021	01-Jun-21	5.0 – Geochemical Monitoring
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - July 2021	31-Aug-21	5.0 – Geochemical Monitoring
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - November 2021	02-Jan-22	5.0 – Geochemical Monitoring
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report - December 2021	30-Jan-22	5.0 – Geochemical Monitoring
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report – January 2022	02-Mar-22	5.0 – Geochemical Monitoring
Eagle Gold Project Type A Water Use Licence QZ14-041-1 Monthly Report -April 2022	02-Jun-22	5.0 – Geochemical Monitoring
Quartz Mining Licence QML-0011	N/A	9.3 and 9.4

3.4.2 Monitoring Program Implementation

The waste rock contact water monitoring program, as described in EMSAMP, includes:

- *[Monthly] seepage water quality monitoring program includes monitoring of seeps, if detected, at the toe of both waste facilities, in addition to the expected seepage where surface water flow currently exists in Eagle Pup and Platinum Gulch drainages (included as part of the surface water quality audit in Section 3.2)*
- *Field barrel monitoring is currently being conducted at least four times per year (during ice-free periods), and will continue through initial operations to expand the time trends until actual seepage database is adequate and can be related to the barrel data.*
- *Analysis to include hardness, pH, anions and nutrients (acidity, alkalinity, chloride, fluoride, nitrate, nitrite, and sulfate), and dissolved metals.*
- *Replicate analyses are completed on one sample for each sampling campaign.*
- *Monthly survey of waste facilities during ice-free months to observe developments of new seeps (as per Section 6.3.3 of the EMSAMP*

- *On-site analysis, when available, will consist of the following:*
  - *Blast-hole chip composites of waste rock and ore from each blast round in the open pit. Each composite sample will represent a maximum of 20% of the total blast holes be blast round.*
  - *Geological logging of blast hole composites.*
  - *Analysis for carbon, sulphur and arsenic.*
  - *Results will be geospatially linked to the sample location from the pit, and if possible, to the area within the waste storage facilities and the HLF pad that it is placed.*
- *Off-site analysis (accredited analytical lab) will consist of the following:*
  - *Grab samples collected quarterly representing blasted waste, reduced to 1-2 kg in size using a riffle splitter prior to shipping to an accredited analytical laboratory for testing of the following methods as recommended in MEND, 2009.*
  - *Rinse pH and EC*
  - *Modified Acid Base Accounting (ABA) including a total sulphur, sulphate sulphur, fizz rating, modified Sobek neutralization potential and total inorganic carbon*
  - *Metal analysis by ICP-MS following aqua regia digestion*

The geochemical monitoring program was implemented according to the objectives stated in the EMSAMP; consistency with requirements of the EMSAMP is included in the following section.

3.4.3 Consistency with Requirements of the EMSAMP

The 2020 Annual Report, the 2021 Annual Report, and the 2022 Monthly Reports were reviewed for consistency with requirements of the EMSAMP.

The following field and laboratory methods and consistency with requirements with sampling frequencies per the EMSAMP were reviewed for Operations:

- Blast-hole static testing
- Waste rock static testing
- Field barrel kinetic testing
- Waste rock contact water (seep) monitoring

The results of this task are listed in Table 23.

Table 23 Geochemical Monitoring Program Audit Table

Program	Analysis Location	Methods (EMSAMP and QML-0011)	Required		Conducted		Sample Consistency Check (Y/N) with Rationale	Methods Check (Y/N) with Rationale
			Sampling Quantity	Sampling Frequency	Sampling Quantity	Sampling Frequency		
Surficial Material Static Testing for Construction Material	Off-Site Analysis	• *The geochemical monitoring of surficial materials consists of the following:* - *Visual inspection of the blasted rock to ensure that anomalously high concentrations of sulphide are not present.* - *Grab samples representing each major excavation, with a separate bulk sample collected in each distinct geological formation encountered and/or from every 200,000 m^3 material moved.* • *The geochemical monitoring of bedrock materials consists of the following:* - *Grab samples representing each major excavation, with a separate sample collected in each distinct geological formation encountered and/or from every 100,000 m^3 material moved. An exception is proposed for bedrock excavated from the open pit, (…) [if used] in construction will be sampled at a rate of one per every 250,000 m^3 of material moved.* - *Samples will be sieved to obtain subsamples representing specific grain size distributions as follows:* - *Bulk sample* - *<2 mm fraction* • *The samples will be reduced to 1-2 kg in size using a riffle splitter prior to shipping to an accredited analytical laboratory for testing.* • *Depending on the use or disposition of the material, test methods may include the following as recommended in MEND (2009) (…)* - *Rinse pH and electrical conductivity (EC) on the <2 mm fr*action - *Modified Acid Base* Accounting on the bulk sample and the <2 mm fraction - *Metal analysis by ICP-MS following aqua regia digestion on the bulk sample and the* <2 mm fraction - *Leach extraction tests will be completed on every 5th sample using a 3:1 water to solid ratio on the <1 cm sample fraction* (EMSAMP) • Waste rock used for construction or fill purposes must have a pH of at least 5.0, a NP:AP ratio of at least 3:1, and a total sulphide sulphur content of no greater than 0.3% (QML-0011)	Varies	Each major excavation or every 200,000 m^3 material moved	**2020 Annual Report** • 6 Samples **2021 Annual Report** • 4 Samples **2022 Monthly Reports** • January 2022: None • April 2022: 3 samples	**2020 Annual Report –** N/A (as required based on excavated tonnes)) **2021 Annual Report –** N/A (as required based on excavated tonnes) **2022 Monthly Reports –** N/A (as required based on excavated tonnes)	**2020 Annual Report –** Y **2021 Annual Report** – Y **2022 Monthly Reports** – Y	**2020 and 2021 Annual Reports, and 2020, 2021 and 2022 Monthly Reports** – N Visual inspection not described. Description of volume of material moved was not provided or if samples were selected per distinct geological formation. All other methods were implemented.

Table 23 Geochemical Monitoring Program Audit Table

Program	Analysis Location	Methods (EMSAMP and QML-0011)	Required		Conducted		Sample Consistency Check (Y/N) with Rationale	Methods Check (Y/N) with Rationale
			Sampling Quantity	Sampling Frequency	Sampling Quantity	Sampling Frequency		
Field Barrel Kinetic Testing	Off-Site Analysis	• *Field barrel monitoring is currently being conducted at least four times per year (during ice-free periods), and will continue through initial operations to expand the time trends until actual seepage database is adequate and can be related to the barrel data.* • *Analysis to include hardness, pH, anions and nutrients (acidity, alkalinity, chloride, fluoride, nitrate, nitrite, and sulfate), and dissolved metals.* • *Replicate analyses are completed on one sample for each sampling campaign.* (EMSAMP).	Four	Per Year (during ice-free period)	**2020 Annual Report** - 10 samples collected from two new (in 2020) field barrels **2021 Annual Report** – 7 samples from two field barrels **2022 Monthly Reports** January 2022: n/a as field barrels were decommissioned for the winter. April 2022: not enough water to sample.	**2020 Annual Report** – Y **2021 Annual Report** – Y **2022 Monthly Reports** - Y	**2020 Annual Report –** Y **2021 Annual Report** – Y **2022 Monthly Reports** - Y	**2020 Annual Report –** N Replicate samples were not described in annual report or 2020 monthly reports. **2021 Annual Report –** N Replicate samples were not described in annual report or 2021 monthly reports. **2022 Monthly Reports** – n/a
Blast-hole Static Testing	On-Site Analysis	• *Blast-hole chip composites of waste rock and ore from each blast round in the open pit. Each composite sample will represent a maximum of 20% of the total blast holes per blast round.* • *Geological logging of blast hole composites.* • *Analysis for carbon, sulphur* and arsenic. • *Results will be geospatially linked to the sample location from the pit, and if possible, to the area within the waste storage facilities and the HLF pad that it is placed.* (EMSAMP).	Less than 20% of total blast hole	Each blast round	**2020 Annual Report** – 21 samples **2021 Annual Report** – 3502 samples **2022 Monthly Reports** January 2022: 45 samples April 2022: 8 samples	**2020 Annual Report** - Not described **2021 Annual Report** - Not described **2022 Monthly Reports** - Not described	**2020, 2021 Annual Report and 2022 Monthly Reports** – N Details of total blast holes were not included in the annual report Section 3.5; therefore, sample consistency with requirements could not be completed.	**2020 Annual Report** – N Geological logs were not included in the annual report. All other methods were implemented. **2021 Annual Report** – N Geological logs were not included in the annual report. All other methods compliant. **2022 Monthly Report** – N Results of onsite analysis were not included in provided monthly reports. Geological logs were not included in the annual report. All other methods were implemented.

Table 23 Geochemical Monitoring Program Audit Table

Program	Analysis Location	Methods (EMSAMP and QML-0011)	Required		Conducted		Sample Consistency Check (Y/N) with Rationale	Methods Check (Y/N) with Rationale
			Sampling Quantity	Sampling Frequency	Sampling Quantity	Sampling Frequency		
Quarterly Blasted Waste Rock Static Testing	Off-Site Analysis	• *Grab samples* collected quarterly representing blasted waste, reduced to 1–2 kg in size using a riffle splitter prior to shipping to an accredited analytical laboratory for testing of the following methods as recommended in MEND (2009). - *Rinse pH and EC* - *Modified Acid Bas*e Accounting (ABA) including a total sulphur, sulphate sulphur, fizz rating, modified Sobek neutralization potential and total inorganic carbon - *Metal analysis by ICP-MS following aqua regia digestion* (EMSAMP).	Less than 20% of total blast hole	Quarterly	**2020 Annual Report** – 4 samples **2021 Annual Report** – 4 samples **2022 Monthly Reports** January 2022: Not described April 2022: Not described	**2020 Annual Report –** 1/quarter **2021 Annual Report –** 1/quarter **2022 Monthly Reports** – Not described	**2020 Annual Report –** N A total of four samples were collected; however, two were collected in Q1, one in Q3, and one in Q4, and none in Q2. **2021 Annual Report** – N A total of four samples were collected: one from Q4 2020, one from Q1 2021, two from Q3 2021. **2022 Monthly Reports** – N For each monthly report, three samples were collected from waste rock; however, they are described as annual waste rock testing (see next row below)	**2020 Annual Report** – N Laboratory COAs or data tables were not included in the annual report. These are often provided in monthly reports; however, sampling did not occur in the provided monthly reports (included in this audit). **2021 Annual Report** – N Laboratory COAs or data tables were not included in the annual report. **2022 Monthly Report** – n/a
Annual Waste Rock Static Testing	Off-Site Analysis	*Annual waste sampling from placed waste rock in the storage facilities (Eagle Pup and Platinum Gulch) consisting of collection of grab samples from waste produced in the previous calendar year. The number of samples will vary depending on production. One sample per million tonnes of waste produced be collected.* (EMSAMP).	Varies. 1 sample / million tonnes of waste rock in previous year	Annual	**2020 Annual Report** – 12 samples **2021 Annual Report** – 11 samples **2022 Monthly Reports** January 2022: 3 samples April 2022: 3 samples	**2020 Annual Report –** Total mined tonnages in 2019 were not reported in the 2019 or 2020 Annual Report; however, were provided in the 2019 Annual Report (4.9 million tonnes). **2021 Annual Report –** As per Table 3.5-4 in 2020 Annual Report, 17 million tonnes were mined in 2020. **2022 Monthly Reports –** tonnages not provided	**2020 Annual Report** – Y 12 samples were collected for 4.9 million tonnes of rock mined. **2021 Annual Report** – N 11 samples were collected for 17 million tonnes of rock mined (required 17 to be consistent with requirements) **2022 Monthly Reports** – N Tonnages not provided; likely summarized in annual reports	**2020 Annual Report** – Y **2021 Annual Report** – Y **2022 Monthly Reports** – Y

Table 23 Geochemical Monitoring Program Audit Table

Program	Analysis Location	Methods (EMSAMP and QML-0011)	Required		Conducted		Sample Consistency Check (Y/N) with Rationale	Methods Check (Y/N) with Rationale
			Sampling Quantity	Sampling Frequency	Sampling Quantity	Sampling Frequency		
All Static Testing	Off-Site Analysis	*Samples will be sieved to collect samples representing specific grain size distributions as follows:* • *Bulk sample* • *<2 mm fraction* • *<1 cm fraction (including the < 2 mm fraction)* • *The samples will be reduced to 1-2 kg in size using a riffle splitter pr*ior to shipping to an accredited analytical laboratory for testing. *Test methods will include the following as recommended in MEND (2009) and summarized in Table 6.3-1:* • *Rinse pH and EC on the <2 mm size fraction* • *Modified Acid Base Accounting including a t*otal sulphur, sulphate sulphur, fizz rating, modified Sobek neutralization potential and total inorganic carbon on all three size fractions • *Metal analysis by ICP-MS following aqua regia digestion on all four size fractions* • *Leach extraction analyses using a 3:1 water to solid ratio on the <1 cm sample fraction* (EMSAMP).	N/A	N/A	N/A	N/A	N/A	**2020, 2021 Annual Report and 2022 Monthly Reports** – N All analyses are correct with the exception of conducting the SFE tests on < 1 cm and <2 mm fractions. These details are not included in Appendix I ALS Reports. ALS states a 0.50 g sample is prepared but does not include size fractions completed in that preparation - only refers to MEND 1.20.1 Predication Manual. The MEND 1.20.1 Prediction Manual methods describe 100 g samples of minus 6.35 mm size fraction.
Waste Rock Contact Water (Seep) Monitoring	Off-Site Analysis	• [Monthly] *seepage water quality monitoring program includes monitoring of seeps, if detected, at the toe of both waste facilities, in addition to the expected seepage where surface water flow currently exists in Eagle Pup and Platinum Gulch drainages (included as part of the surface water quality audit in Section 3.2)* • *Monthly survey of waste facilities during ice-free months to monitor for development of new seeps*. (EMSAMP).	As needed	Monthly Survey	N/A	N/A	N/A	**2020 Annual Report** – N Monthly seepage survey not described. **2021 Annual Report** – Y Weekly inspection including seep survey described in Section 4.2.2.

3.4.4 Data QA/QC

2020 Annual Report

- Details of the geochemical QA/QC program were not included in the 2020 Annual Report; however, review of provided datasheets showed two of twelve field barrel samples (17%) submitted to ALS were field replicates. The percentage of QA/QC samples per total samples above 10% is consistent with the EMSAMP.

2020 Monthly Reports

- Details of the geochemical QA/QC program were not included in the provided 2020 Monthly Reports (August 2020 and November 2020).

2021 Annual Report

- Details of the geochemical QA/QC program were not included in the 2021 Annual Report; however, a review of provided datasheets showed four of eighteen field barrel samples (22%) submitted to ALS were QA/QC samples, one field blank and three field replicates. The percentage of QA/QC samples per total samples above 10% is consistent with the EMSAMP.

2021 Monthly Reports

- Details of the geochemical QA/QC program were not included in the provided 2021 Monthly Reports (February 2021, April 2021, July 2021, November 2021, and December 2021).

2022 Monthly Reports

- Details of the QA/QC program were not included in the provided 2022 Monthly Reports (January 2022 and April 2022).

3.4.5 Reporting Adequacy, Consistency with requirements, and Recommendations

The 2020 Annual Report, the 2021 Annual Report, and the 2022 Monthly Reports were reviewed for adequacy and consistency with requirements of the EMSAMP. Overall, the reporting and summarization of data collected for the geochemical monitoring program is complete and adequate with deviations and recommendations listed in Table 24**.**

Table 24 Geochemical Monitoring Consistency with Requirements of the EMSAMP and Recommendations

Consistency Gaps and/or Deficiencies	Recommendations
2020 and 2021 Annual Report – Sample type description of surficial material static testing for construction use	Include details on the material sample collected (i.e., surficial, or bedrock) and why these samples were collected (i.e., 1 per 100,000 m^3 material moved or distinct geological unit).
2020 and 2021 Annual Report – Appended analytical data	Include all analytical data in appendices.
2020 and 2021 Annual Report – QA/QC samples	Collect field replicate samples of operational monitoring samples, include discussion of result (including relative percent differences) in report body, and append dataset.
2020 and 2021 Annual Report – Details of blast rounds	Include details of blast rounds to demonstrate consistency with EMSAMP. Include geological logs of blast holes.
2020 Annual Report – Reported mined tonnage of previous year	Annual waste rock samples are collected based on the tonnage mined from the previous year. Recommend including previous year tonnage when describing annual waste rock samples.
2020 Annual Report – Monthly seep sample survey	Include details of monthly seep sample survey in report.
2020 and 2021 Annual Report – Shake flask extraction size fraction	Check with off-site laboratory (ALS) if shake flask extraction is conducted on <2 mm and <1 cm size fraction.
2020, 2021, and 2022 Monthly Reports – QA/QC samples	Collect field replicate samples, include relative percent differences, and discuss results in the report body. Explicitly describe which samples are duplicates of respective parent sample.

3.5 Aquatic Environment

In April 2019, the Mine became subject to the Metal and Diamond Mining Effluent Regulations (MDMER) under the federal *Fisheries Act.* This occurred when the daily effluent discharge was greater than 50 m^3 per day from the Lower Dublin South Pond (LDSP). Schedule 5 of the MDMER describes requirements associated with the Aquatic Environment for Environmental Effects Monitoring (EEM) Studies which include effluent characterization, sub-lethal toxicity testing, water quality monitoring, and, if required, biological monitoring studies (e.g., fish population, benthic invertebrate community, and fish tissue studies).

Following the Mine being subject to the MDMER, an EEM study design was required within 12 months of triggering the MDMER, and at least six months prior to conducting the required biological monitoring field studies. These requirements were met with preparation by Minnow Environmental Inc. (Minnow) of a Phase 1 EEM Study Design in April of 2020, and field studies in 2021. An addendum to address ECCC questions about the Phase 1 EEM Study Design was prepared by Minnow in December 2020. The EEM

Study Design by Minnow was approved by ECCC on December 11, 2020. This study design has since replaced the 2020 EMSAMP for the monitoring of aquatics (sediment, benthics and fish).

3.5.1 Stream Sediment

3.5.1.1 Documents Reviewed

Documents shown in were reviewed for the stream sediment section of the audit.

Table 25 Stream Sediment Documents Reviewed for the 2022 Audit

Document	Version Reviewed	Sections Applicable to Mine Operations Phase
EMSAMP	2020-01	7.0 – Stream Sediment
Water License QZ14-041 Quartz Mining License QML-0011 2020 Annual Report	N/A	3.6 – Aquatic Environment and Appendix J1 – Eagle Gold Mine Phase 1 EEM Study Design (Minnow Environmental Inc. 2020a) and addenda (Minnow Environmental Inc. 2020b)
Water License QZ14-041 Quartz Mining License QML-0011 2021 Annual	N/A	3.6 – Aquatic Environment and Appendix I – Aquatic Monitoring and EEM Summary (Minnow Environmental Inc. 2022)

3.5.1.2 Stream Sediment Monitoring Program Design in EMSAMP and Phase 1 EEM

The objectives of the stream sediment monitoring program, as described by the EMSAMP, were to:

- collect data on pH and metal levels in the fine sediment fraction in watercourses in the study area, parameters relevant to toxicity and habitat requirements for benthos, fish eggs, and juvenile fish
- obtain data on sediment quality that can be used to evaluate potential Project related changes
- provide ongoing data to support refinement of future monitoring programs.

These data were to be collected from five sites in Haggart Creek between the confluence of Fisher Gulch to the confluence of Lynx Creek (one above Project influence and four below Project influence), two sites in Dublin Gulch (both above Project influence), one site in Lower Eagle Creek (below Project influence), one site in Lynx Creek (reference site in unaffected stream)

Triplicate field samples were to be collected in depositional habitats (i.e., pools) downstream of riffle habitats. Each sample comprised of a composite of five individual grabs. Composite samples were to be placed in individual acid-wash glass bottles and kept cool for delivery to the analytical lab. A field replicate was also to be collected at each site. The fine fraction (i.e., <63 µm fraction) was analyzed in the lab for particle size distribution, pH, total organic carbon, and a suite of 33 metals and metalloids. Only total concentrations were to be analyzed; no dissolved fractions were required by the EMSAMPs.

Results were to be compared to pre-construction baseline values and the BC Interim Sediment Quality Guidelines (ISQG) for arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc (Nagpal et al. 2006). Data analyses would then be done to compare the monitoring data to

baseline results (i.e., pre-2018) and determine whether any statistically significant changes in sediment quality had occurred. Adaptive management thresholds for sediment monitoring were set at:

- 25% higher than median baseline concentrations for those parameters that currently exceed the Probable Effects Level[1] (PEL) as a baseline condition
- The PEL for those parameters that do not exceed PELs at baseline

If parameter concentrations exceeded these thresholds, adaptive management measures in the EMSAMP were to be considered.

3.5.1.3 EMSAMP/EEM Stream Sediment Monitoring Program Results

Stream sediment and benthic invertebrate sampling under the EMSAMP was to be conducted on a biennial basis (i.e., once every two years); sediment monitoring did not occur in 2020, as it was conducted in 2019 and the next scheduled event would have occurred in 2021.

Following the transition to the Phase 1 EEM Study Design in December 2020, sediment sampling was removed from the EEM study design (Victoria Gold 2022). As such, no sediment monitoring occurred in 2021 (Minnow 2022a).

Stream sediment sampling was excluded from the EEM following conservations with ECCC in 2020. The rationale for excluding stream sediment monitoring from the EEM included:

- the Haggart Creek study area contained limited depositional habitat suitable for fine sediment deposition. Instead, substrates were comprised primarily of small cobble and gravel. The general absence of fine sediments in Haggart Creek was deemed to preclude meaningful assessment of potential mine-related influences on sediment chemistry within and/or between watercourses.
- the applicability of stream sediment chemistry monitoring for interpretation of benthic invertebrate community data considered low given that fine sediment composed <5% of available substrates.
- ISQGs are conservative in predicting effects from the Mine because the thresholds identified in the ISQGs are intended for whole sediment samples, not the fine sediment fractions.
- the less than 63 um fraction of sediment that is used to analyze metal concentrations is not representative of whole sediment in the study area and, therefore, is overly conservative.
- Benthic invertebrate community sample sites are characterized by gravels and cobbles, with fine sediment deposits being rare or non-existent. As such, sediments were unlikely to be a significant exposure route for biota metal-uptake.
- Since fish species inhabiting lotic environments of the area (i.e., slimy sculpin and Arctic grayling) largely rely on benthic invertebrates as a food source, the applicability of stream sediment monitoring data to help understand effects on fish was considered to be minimal.

[1] The Probable Effects Level is a threshold above which adverse biological effects frequently occur (more than 50% adverse effects occur above the PEL).

3.5.1.4 Reporting Adequacy, Consistency with Requirements, and Recommendations

Stream sediment sampling was not conducted during 2020 under the EMSAMP, as it was done biannually and was last collected in 2019.

Following the switch to the EEM study design in late 2020, stream sediment sampling was removed because it was concluded that fine sediments targeted for metal analysis comprised a small fraction of available habitat and was not used by benthic invertebrates. Therefore, sediments were unlikely to be a pathway for biological accumulation of potential pollutants. This rationale was supported by ECCC and the EEM approved in December 2020 (Minnow 2022).

As sediment sampling was conducted within the timeline reviewed by this audit and was removed from the study design in 2020, there are no deficiencies for the stream sediment component.

3.5.2 Benthic Macroinvertebrates

3.5.2.1 Documents Reviewed

Documents shown in were reviewed for the benthic invertebrate monitoring section of the audit.

Table 26 Benthic Invertebrate Documents Reviewed For the 2022 Audit

Document	Version Reviewed	Sections Applicable to Mine Operations Phase
EMSAMP	2020-01	8.0 – Benthic Macroinvertebrates
Water License QZ14-041 Quartz Mining License QML-0011 2020 Annual Report	N/A	3.6 – Aquatic Environment and Appendix J1 – Eagle Gold Mine Phase 1 EEM Study Design (Minnow Environmental Inc. 2020a) and addenda (Minnow Environmental Inc. 2020b)
Water License QZ14-041 Quartz Mining License QML-0011 2021 Annual Report	N/A	3.6 – Aquatic Environment and Appendix I – Aquatic Monitoring and EEM Summary (Minnow Environmental 2022)

3.5.2.2 Benthic Invertebrates Monitoring Program Design in EMSAMP and EEM

The objectives of the benthic invertebrate monitoring program, as described by the EMSAMP, were:

- Characterize community diversity and abundance during the transition from baseline and through operation of the Project
- Determine variation relative to baseline data
- Provide supporting information for fisheries assessments and comply with future MDMER requirements

Benthic invertebrate data were to be collected from the same nine sites as the stream sediments described in the EMSAMP. Sampling methods were to be consistent with methods recommended in the Metal Mine Guidance Document for Aquatic Environmental Effects Monitoring (Environmental Canada 2012). Riffle habitats were to be sampled in late summer/fall using a quantifiable bottom sampler (e.g., Surber).

Three replicate samples were to be collected at each site with a minimum separation of three times bank-full width between replicates. Field measurements of water temperature, dissolved oxygen concentration, pH, and conductivity, bankfull and wetted width, depth, gradient and canopy cover were to be measured at each site.

Benthic invertebrates were to be identified to lowest practical level (typically genus) and enumerated by a qualified taxonomic laboratory. Data analysis was to include total number of individuals per sample, number of organisms per unit area, and the following indices:

- Total invertebrate density for each replicate as well as arithmetic mean, standard deviation, median, minimum, and maximum
- Family density for each replicate as well as arithmetic mean, standard deviation, median, minimum, and maximum
- Family richness
- Simpson's diversity or similar index
- Simpson's evenness, or similar index
- Bray Curtis index or similar index
- Taxon (i.e., Family) proportion
- Taxon (i.e., Family) presence/absence

Following statistical analysis, any significant differences from baseline conditions were to be interpreted as a Project effect requiring adaptive management measures listed in the EMSAMPs. Results were to be interpreted relative to the other indices as well as supporting environmental variables measured at the time of sampling, results of fish surveys, and relative to historical sampling. The effect of any outliers on results were to be evaluated.

The sampling program was altered in the Phase 1 EEM Study Design (Minnow 2020a). Ten sampling stations were selected, five in the reference reach in Haggart Creek, upstream of the Mine approximately upstream of W22, and five in the effluent exposed areas downstream of the LDSP at stations W4 and W29 in Haggart Creek,. Sampling stations were spaced approximately 20 m apart. Minnow (2020a) stated that the level of replication in the study design provided adequate statistical power to detect differences of ± two standard deviations from the reference area mean (± 2 SD_{REF}) based on Type I and II error probability (α and β, respectively) set equally at 0.10 as recommended in EEM guidance (Environment Canada 2012).

The revision of sampling sites from the EMSAMP stations to the five upstream and five downstream sites was based on the following rationale:

- During periods of effluent discharge, previous monitoring estimated effluent concentrations ranging from 1% to 15% in the effluent-exposed area. Therefore, sites in this area were suitable for evaluating effects related to Project effluent.
- The proposed reference area is sufficiently upstream of the Lower Dublin Sediment Pond Outlet (and the confluence with Dublin Gulch, which flows through mine influenced area) effluent discharge to preclude any effluent-related influences on physical, chemical, and biological conditions. Metal concentrations in water and sediment collected at the reference area have generally been below applicable guidelines, suggesting no substantial anthropogenic influences in this area.
- Average channel dimensions, water depth, water velocity, and substrate size were similar between the proposed effluent-exposed and reference study areas on Haggart Creek. This reduced the potential confounding influence of differing physical habitat for evaluating effluent-related influences on benthic invertebrates.
- Because the proposed study areas incorporate the locations of stations historically sampled, the use of these study areas for EEM provides temporal continuity and a basis for tracking changes in benthic invertebrate community endpoints over time.

Benthic invertebrate sampling sites targeted shallow (i.e., ≤0.4 m) riffle-run habitat characterized by coarse gravel-small cobble substrate. Samples were to be collected using a Hess sampler (0.1 m^2 sampling area) as recommended in EEM technical guidance (Environment Canada 2012) or a Surber sampler (0.093 m^2 sampling area), depending on water depth. Samplers were to be outfitted with a 300-µm mesh net to provide consistency with all previous benthic invertebrate monitoring. Each of the sampling sites form an aggregate sample, comprised of three sub-samples to increase the total area sampled per site.

Supporting information collected at each benthic station was to include substrate description (type and approximate particle diameter), water velocity (m/s), sampling depth (cm), water quality at the sediment-water interface, stream dimensions (wetted and bankfull width), general habitat notes (e.g., stream morphology, extent of riparian cover, surrounding land use, potential confounding influences), and global positioning system (GPS) coordinates.

Upon completion of the field program, benthic invertebrate samples were to be submitted to a qualified laboratory with Society of Freshwater Sciences (SFS) certified taxonomists. Benthic invertebrate sample processing was to be conducted using standard sorting methods that incorporate recognized QA/QC measures (e.g., Environment Canada 2012).

Benthic invertebrate communities were to be evaluated using EEM primary metrics that were:

- mean taxonomic richness (as identified to family level)
- mean invertebrate density (average number of organisms per m^2)
- Simpson’s Evenness Index
- the Bray-Curtis Index of Dissimilarity as required by the MDMER.

Additional comparisons could also be conducted using lowest practical level (LPL) taxonomic richness, percent composition of dominant or indicator taxa (calculated as the abundance of each respective taxonomic group relative to the total number of organisms in the sample), and any other metrics (e.g., functional feeding groups, habit preference groups) that may assist with data interpretation.

Except for Bray-Curtis Index, all selected endpoints were to be summarized by separately reporting mean, median, minimum, maximum, standard deviation, standard error, and sample size for each study area. For each endpoint, statistical comparisons between the effluent-exposed and reference areas were to be conducted using ANOVA. If data significantly violated the assumption of normality (i.e., not a normal distribution) following transformation, non-parametric statistics were to be applied using the untransformed data. An effect on the benthic invertebrate community was defined as a statistically significant difference between the effluent-exposed area and the reference area at an alpha level of 0.10 (Environment Canada 2012).

The magnitude of effect for all benthic invertebrate community indicators that differ significantly between study areas was to be calculated for the effluent-exposed area based on the formula provided in the MDMER. For effect indicators of density, richness, and Simpson's Evenness, the derived magnitude of difference was to be compared to an applicable critical effect size (CES) (i.e., $\pm 2\ SD_{REF}$). A statistical analysis was to be completed using these latter effect indicators to determine the probability of correctly detecting effects, as well as to determine the degree of confidence placed in the calculations.

The Bray-Curtis Index was to be used to evaluate community level differences between study areas. Specifically, abundance data was to be transformed in preparation for Bray-Curtis Index calculation and community level differences between study areas was to be assessed in a pairwise fashion with homogeneity of group variance calculated according to the PERMDISP2 procedure provided by Anderson (2006). A Mantel Test and distance-based Redundancy Analysis (dbRDA) was to be used to assess for differences in community structure between study areas using R statistical software (as per Borcard and Legendre 2013).

3.5.2.3 EMSAMP/EEM Stream Benthic Invertebrate Monitoring Program Results

Benthic invertebrate community sampling was conducted in September 2021, as per the sampling schedule outlined to meet the MDMER requirement to assess potential impacts of mine effluent on food resources for fish. The 2021 annual monitoring report stated that benthic invertebrate community study methods were conducted in accordance with the ECCC-approved study design for the purpose of meeting the MDMER requirements (Minnow 2020, VGC 2020).

Sampling occurred at Haggart Creek, downstream of the Ditch C confluence (Station W29-01 to W29-05) as the effluent-exposed area, and at Haggart Creek upstream of the Dublin Gulch confluence (Station W22-01 to W22-05) as the reference area. Benthic invertebrate community sampling was conducted using a Hess sampler, with a total of five samples collected from each station.

Benthic invertebrate communities were evaluated using the EEM primary metrics of density, richness, Simpson's Evenness Index, and the Bray-Curtis Index of Dissimilarity as required by the MDMER. In

addition, comparisons of relative abundance of dominant/indicator groups, functional feeding groups, and habitat preference groups between stations were conducted to augment interpretation of effects.

The analysis of benthic invertebrate data was based on recognized statistical approaches to evaluate differences between the effluent-exposed and reference areas of Haggart Creek. The design also incorporated use of critical effect sizes (CES) presented in the MDMER (i.e., ±2 SD_{REF}) to evaluate whether differences in benthic invertebrate community metrics between the effluent-exposed and reference areas was ecologically meaningful. Minnow's (2022) interpretation of the 2021 benthic invertebrate community data indicated:

- Significantly lower benthic invertebrate density downstream of the effluent discharge point in Haggart Creek compared to upstream.
- Benthic invertebrate densities in both areas of Haggart Creek were lower in 2021 than in 2007 and 2018 but richness and relative abundance of sensitive Ephemeroptera at each area were similar to 2007 suggesting that benthic invertebrate community structure has not changed between post- and pre-mine operations.
- No significant difference in species richness between study areas in 2021
- Significantly higher evenness at Station W29 downstream of the mine compared Station W22 to upstream of the mine. Since higher evenness indicates more equitable distribution of individuals across taxa present at a station, the difference in evenness between the effluent-exposed and reference areas was not consistent with an adverse effluent-related effect.
- Bray-Curtis index was significantly different between the Haggart Creek study areas suggesting differences in benthic invertebrate community structure. However, the relative abundance of sensitive Ephemeroptera did not differ significantly between the effluent-exposed and reference area indicating that the differences in community structure were unrelated to differing metals exposure. Instead, a significantly lower relative abundance of tolerant Oligochaeta at the effluent-exposed area compared to the reference area was the difference in community structure between areas in 2021.
- Overall, no adverse mine-related influences on benthic invertebrates were indicated at Haggart Creek in 2021.

3.5.2.4 Reporting Adequacy, Consistency with Requirements, and Recommendations

Benthic invertebrate sampling was not conducted in 2020 under the EMSAMP because previous sampling was conducted in 2019 and, therefore, sampling was not scheduled to occur again until 2021. Following the transition to the Phase 1 EEM Study Design, the benthic invertebrate sampling design was modified, and sampling was conducted in September 2021. Consistency with requirements Audit results are given in Table 27.

Table 27 Benthic Macroinvertebrates Monitoring Program Audit Results

Site	Five Samples Collected? (Yes/No)	Samples Collected at Appropriate Time of Year and from Appropriate Habitat? (Yes/No)	Field QA/QC Protocols Followed? (Yes/No)[1]	Required Lab Analysis Conducted? (Yes/No)	Lab QA/QC Protocols Followed? (Yes/No)[2]	Required Community Indices Calculated? (Yes/No)[3]	Required Statistical Analyses Performed? (Yes/No)[4]	Results Compared to Baseline Data? (Yes/No)	Adaptive Management Requirements Discussed? (Yes/No)
W22-01	Yes	Yes	Unknown	Yes	Unknown	No	No	Yes	Yes
W22-02	Yes	Yes	Unknown	Yes	Unknown	No	No	Yes	Yes
W22-03	Yes	Yes	Unknown	Yes	Unknown	No	No	Yes	Yes
W22-04	Yes	Yes	Unknown	Yes	Unknown	No	No	Yes	Yes
W22-05	Yes	Yes	Unknown	Yes	Unknown	No	No	Yes	Yes
W29-01	Yes	Yes	Unknown	Yes	Unknown	No	No	Yes	Yes
W29-02	Yes	Yes	Unknown	Yes	Unknown	No	No	Yes	Yes
W29-03	Yes	Yes	Unknown	Yes	Unknown	No	No	Yes	Yes
W29-04	Yes	Yes	Unknown	Yes	Unknown	No	No	Yes	Yes
W29-05	Yes	Yes	Unknown	Yes	Unknown	No	No	Yes	Yes

NOTES:
[1] Not discussed in the report
[2] Not discussed in the report
[3] MDMER requirements completed, but not all indices described in the EEM followed
[4] As per EEM Table 3.2

Deficiencies in the annual reporting for the benthic invertebrate monitoring program are summarized in Table 28. While the methods and findings of the benthic invertebrate sampling program in 2021 were generally consistent with the methods presented in the EEM, there were deficiencies in the report in terms of missing quantitative analyses between sites and between years and lack of discussion regarding adaptive management. The identified deficiencies should be addressed going forward.

Table 28 Benthic Macroinvertebrates Monitoring Program Consistency with and Recommendations

Consistency with Requirements Gaps and/or Deficiencies	Recommendations
Multiple versions of monitoring plans may result in confusion or be a potential source of method errors.	It is recommended that the EMSAMP be updated to reflect the EEM Study Design as the current version is out of date with respect to the current study design and analytical methods for benthic invertebrate sampling.
Frequency of monitoring not discussed in EEM	EEM only describes 2021 monitoring, with no mention of what the sampling interval will be (e.g., annual, biannual)
Reporting – no indication of whether field procedures were followed as per the EEM	Provide more detail on how samples were gathered in future reports. No discussion on sampling difficulties, sources of error, or whether amendments to sampling design were done in the field.
Reporting - Lab QA/QC procedures and results – not provided in report or appendices	Provide lab QA/QC procedures and results in appendix
Data analysis – missing statistical analyses comparing sites and contemporary data to pre-construction data	Conduct (or describe if completed) the required ANOVAs and multiple comparison tests as required by the EEM
Data analysis – missing some supporting statistical analyses described in the EEM, with no comment on why it was not done	Conduct (or describe if completed) the necessary analyses or provide rationale as to why it was not done.
Reporting – only qualitative comparisons between sites and years discussed	There is sufficient data from sites and between years to conduct quantitative statistical analysis to determine significant difference between impact and reference sites and trends between years.
Reporting – no discussion of need for adaptive management actions; no statistical analyses performed to inform adaptive management	Discuss adaptive management considering quantitative analysis of site data and trend analysis
Reporting – no analysis or discussion of environmental variables or outlier effects on benthic invertebrate results.	Discuss all potential factors that may introduce error in results.

3.5.3 Fish Population Monitoring

3.5.3.1 Documents Reviewed

Documents shown in were reviewed for the fish and fish habitat monitoring section of the audit.

Table 29 Fish and Fish Habitat Documents Reviewed For the 2022 Audit

Document	Version Reviewed	Sections Applicable to Mine Operations Phase
EMSAMP	2020-01	8.0 – Benthic Macroinvertebrates
Water License QZ14-041 Quartz Mining License QML-0011 2020 Annual Report	N/A	3.6 – Aquatic Environment and Appendix J1 – Eagle Gold Mine Phase 1 EEM Study Design (Minnow 2020a) and addenda (Minnow 2020b)
Water License QZ14-041 Quartz Mining License QML-0011 2021 Annual Report	N/A	3.6 – Aquatic Environment and Appendix I – Aquatic Monitoring and EEM Summary (Minnow Environmental 2022)

3.5.3.2 Fish Population Monitoring Program Design in EMSAMP and EEM

The objectives of the Fish and Fish Habitat monitoring program in the EMSAMP were to assess the effect of mine effluent on fish and to document changes to fish habitat downstream of the Project. A fish tissue study was to be undertaken if the concentration of effluent in the exposure area was >1% in the area within 250 m of the final discharge point, as per Environment Canada EEM guidance.

Fish sampling was to occur annually in July or August and was to include sampling locations in Iron Rust Creek (n=1) upstream of the Project, Haggart Creek (n=3) downstream of the project, and Lynx Creek (n=1), a reference site. Sampling was to be conducted with standard collection methods suitable for the habitats present (e.g., electrofishing, baited minnow traps, angling, seining). The following data was to be collected from fish captured at each sample location with all data to be recorded on modified Resource Inventory Standards Committee (RISC) site cards:

- Abundance (based on catch-per-unit effort)
- Species
- Weight
- Length
- General condition

Adaptive management measures were to be triggered if direct or indirect mortality of fish or change to fish abundance or community assemblage occurred including:

- Fish mortalities
- Chronic toxicity effects to individual fish
- Changes to fish abundance or community assemblages
- Acute or chronic toxicity effects are observed while the effluent discharge standards and receiving water quality objectives are consistently met
- Low flows result in decreased habitat availability
- Changes to fish habitat occur as described in hydrology, sediment, and benthic invertebrate sections, including Increased sedimentation

The Phase 1 EEM fish population survey was to employ a control-impact lethal study design targeting slimy sculpin (*Cottus cognatus*) and a control-impact non-lethal study design targeting Arctic grayling (*Thymallus arcticus*). Fish population sampling under the EEM was to be conducted at the same effluent-exposed sites on Haggart Creek as the benthic invertebrates sampling sites. However, reference fish samples were to be collected from Lynx Creek rather than upstream in Haggart Creek. The rationale for the selection of sentinel fish species, sampling approach, and fish population study areas in the EEM study design was:

- Slimy sculpin and Arctic grayling were the most abundant fish species present at the proposed effluent-exposed and reference areas during baseline and previous Water Use License monitoring. All other fish species were not present in sufficient numbers to meet lethal or non-lethal EEM survey requirements (i.e., minimum of 40 mature adults or 100 individuals, respectively).
- Environment Canada (2012) recommends monitoring two sexually mature, sedentary, fish species using a lethal sampling approach. However, most Arctic grayling captured in Haggart Creek and Lynx Creek have been young-of-the-year (YOY) individuals (i.e., >95% of sampled individuals) and very few adults (i.e., >30 cm long) suitable for the EEM program were present. Additionally, adult Arctic grayling are known to reside in both creeks for only a short duration during the open water season making use of adult Arctic grayling for the fish population study difficult.
- During periods of effluent discharge, effluent concentrations were estimated to range from 1% to 15% at the proposed effluent-exposed area. Therefore, this area was determined to be useful for evaluating effects related to the Project effluent.

- Upper Haggart Creek, upstream of Ditch C, was not selected as a reference area of the EEM fish population survey due to insufficient distance from the proposed effluent-exposed area, relatively low numbers of target fish species present, and low site fidelity and associated exposure time to reflect ambient local conditions on fish health.
- The use of Lynx Creek as a reference area for the fish population survey does not have the same issues as Upper Haggart Creek and is consistent with previously reference sampling areas used for the EMSAMP design. Metal concentrations in water and sediment collected at Lynx Creek were generally below applicable guidelines (except naturally high arsenic concentrations) and were considered indicative of limited anthropogenic influences.

The Phase 1 EEM fish population survey was to be conducted in May 2021 to correspond with the maturation timing of gonad development in slimy sculpin. Slimy sculpin are resident fish that spawn in May at water temperatures ranging from 5° to 10°C. As such, survey timing was planned to occur within the window between maximum gonad maturity and spawning. Water temperatures were to be monitored daily in Haggart Creek following ice-off in spring 2021 to inform the timing of EEM sampling prior to slimy sculpin spawning. Sampling was to be initiated when water temperatures reached 5°C, considering effluent discharge history.

In the Haggart Creek effluent-exposed area and the Lynx Creek reference area, a minimum of 20 sexually mature male and 20 sexually mature female slimy sculpin were targeted for the lethal survey. One hundred (100) adult Arctic grayling were targeted for the nonlethal survey. Sampling methods included the following:

- Slimy sculpin and Arctic grayling would be collected using two-person team consisting of a backpack electrofisher operator and a single netter.
- ‘Open’ station sampling (i.e., without block nets at the upstream and downstream ends) would be conducted in an upstream direction.
- At the conclusion of sampling at each station, total effort (i.e., electrofishing seconds) would be recorded to calculate time-standardized catch-per-unit-effort (CPUE) along with upstream and downstream GPS coordinates, and habitat notes pertinent to the fish population survey.
- All captured fish would be identified to species and enumerated. Slimy sculpin and Arctic grayling would be retained for subsequent measurements.

Slimy sculpin retained for lethal sampling would be transported to a dedicated field laboratory for processing as soon as is practical following capture. Measurements collected from each individual fish were to be recorded on appropriate data sheets in the laboratory and were to include:

- total length measured to the nearest tenth of a millimetre using digital calipers
- fish weight to the nearest milligram using an appropriately sized electronic balance
- external abnormalities and parasites
- sex and/or sexual maturity
- whole gonads and livers weights to the nearest milligram (0.001 g) using digital balance
- internal abnormalities and parasites

Whole ovaries from each sexually mature female were to be placed in individually labelled bags and preserved using an appropriate fixative (e.g., 10% buffered formalin solution) after being weighed. Otoliths (and pectoral fin rays as backup) were to be collected from each individual fish, placed into a separately labelled bag, and submitted to a qualified laboratory for age analysis.

Slimy sculpin ovary samples were examined in the lab to determine fecundity and egg weight. Three gonad tissue sub-samples (minimum 100 eggs each) were to be separated from the ovaries, weighed to the nearest milligram, and the number of eggs in the sub-sample counted with the aid of a dissecting microscope. Age analysis was also conducted at the lab. Otoliths were to be used as the primary aging structure for slimy sculpin, with pectoral fin rays used as backup and/or confirmatory structure. Prepared sections of otoliths or pectoral fin rays were to be mounted on a glass slide and aged (i.e., annuli counted) under a compound microscope. Age was to be recorded with a confidence rating based on edge condition.

Laboratory QA/QC measures applied to processing samples for fecundity determination was to include recounting the numbers of eggs in 10% of subsamples assessed to verify ±5% precision. Egg count data were to be used to estimate total fecundity and the average egg weight for each female.

For Arctic grayling retained for non-lethal sampling, fish were to be processed on the shoreline and the following information collected:

- For individual fish, external condition, fork and total length to the nearest millimetre, and fresh body weight to the nearest milligram using an analytical balance with ± 1% precision or appropriately sized spring scales for fish less than <50 grams.
- For a subset of individual fish spanning the size range of fish captured fish at each study area, otoliths were to be extracted in the field from approximately 10% of the total number of fish sampled from each study area.
- Arctic grayling not retained for age analysis were released into the study area from which they were collected after marking with a visible implant elastomer tag to identify recaptured fish.

Fish community sampling data was to be tabulated and CPUE calculated separately for the Haggart Creek effluent-exposed area and the Lynx Creek reference area. Electrofishing CPUE was to be

calculated as the number of fish captured per electrofishing minute. Analysis of the fish community sampling data was to include comparisons of total fish species richness, total number of fish captured, and total CPUE between study areas. In addition, temporal comparison of fish assemblage and relative abundance (i.e., CPUE) was to be conducted to evaluate potential changes in fish community indicators compared to historical data. Data analysis was to follow those recommended for EEM fish population surveys as described below:

- For the slimy sculpin lethal population survey:
    - fish measurements, summary statistics including mean, median, minimum, maximum, standard deviation, standard error, and sample size were to be calculated separately for each sex, by study area, for all endpoints related to survival (age and age structure), energy use (growth and reproduction), and energy storage (condition and relative liver size).
    - All data sets were to be assessed for normality and equality of variance to determine the suitability of parametric statistical procedures. If data significantly violated the assumption of normality following transformation, non-parametric statistics were to be used.
    - For each of the calculated endpoints, statistical differences between effluent-exposed areas and reference study areas were to be assessed separately for each fish sex using ANOVA, Mann-Whitney U-test, or Analysis-of-Covariance (ANCOVA) as appropriate.
- For the Arctic grayling non-lethal population survey:
    - length-frequency distributions were to be plotted so that, together with aging data, YOY individuals could be distinguished from juveniles and adults for each study area.
    - Summary statistics including mean, median, minimum, maximum, standard deviation, standard error and sample size for length and weight measurements were to be calculated by study area and, if possible, YOY and juvenile/adult age categories separately based on the outcome of the length-frequency distribution analysis.
    - The proportion of YOY fish and individual length and weight measurements were to be used to calculate endpoints associated with survival, growth, reproduction, and energy storage for each study area according to the procedures outlined for a non-lethal assessment.
    - Length-frequency distributions were to be compared using a nonparametric, two-sample, Kolmogorov-Smirnov goodness of fit test.
    - Relative proportions of YOY were to be compared between the effluent-exposed area and reference area to evaluate potential differences in reproductive success.
    - Mean length and body weight were to be compared separately for YOY and juvenile/adult groups between the effluent-exposed area and reference areas using ANOVA, with the data inspected for normality and homogeneity of variance before applying parametric statistical procedures. In cases where data do not meet the assumptions of ANOVA despite log transformation, non-parametric Mann-Whitney U-tests were to be performed.
    - Body weight at fork length (condition) was to be compared using ANCOVA based on methods provided in EEM technical guidance.

An effect on the fish population, defined as a statistically significant difference between an effluent-exposed area and a reference area at an alpha level of 0.10, was to be evaluated for each of the EEM effect endpoints. For endpoints showing significant area differences, the magnitude of difference between the effluent-exposed area and reference area was to be calculated using mean (ANOVA), adjusted mean (ANCOVA with no significant interaction) or predicted values (ANCOVA with significant interaction) as per EEM guidance.

Like the CES applied to the benthic invertebrate community survey, a difference of ± 25% for survival and growth indicators, and a difference of ± 10% for the condition indicator, was to be used as fish population survey CES applicable for defining ecologically relevant differences between study areas.

Finally, an *a priori* power analyses was to be completed to determine appropriate sample sizes for future fish population surveys as recommended by Environment Canada (2012). The power analyses were to be completed based on the mean square error values generated during the ANOVA or ANCOVA procedures. The power analysis results were to be reported as the minimum sample size (i.e., number of fish/area) required to detect a given magnitude of difference between the effluent-exposed and reference area populations for each effect endpoint.

The LDSP Outlet effluent contained mercury and selenium concentrations below the EEM triggers for conducting applicable fish tissue surveys as defined in the MDMER (i.e., average annual concentrations of mercury and selenium in effluent were below 0.10 µg/L and 10 µg/L, respectively) in two separate samples collected over four days in April 2019 (Table 3.5). Therefore, VGC was not required to conduct a fish tissue mercury survey or a fish tissue selenium survey as part of their MDMER obligations for the Eagle Gold Project Phase 1 EEM.

3.5.3.3 EMSAMP/EEM Fish and Fish Population Monitoring Program Results

Sampling occurred in Haggart Creek downstream of the Ditch C confluence (spanning the area between Station W4 and W29) as the effluent-exposed area and in lower Lynx Creek (Station L1) as the reference area in 2021 only. Fish sampling was conducted using a combination of backpack electrofishing, seine netting, and minnow trapping.

The EEM fish community sampling employed a control-impact lethal design targeting slimy sculpin and a control-impact non-lethal design targeting Arctic grayling. The original study design called for one field study in May 2021, but because of safety-related challenges related to high flow and low catch of the selected fish species, a second field study was conducted in September 2021.

Measurements and observations collected from individual fish were in accordance with those recommended for the EEM program to evaluate fish health endpoints related to survival (age and age structure), energy use (growth and reproduction), and energy storage (condition and relative liver size) as applicable to lethal and non-lethal designs. The analysis of fish health data was based on recognized statistical approaches to evaluate differences between the effluent-exposed areas of Haggart Creek and the Lynx Creek reference area in 2021. The analysis also evaluated the results based on CES presented in the MDMER to evaluate whether the degree of any differing fish health endpoints between the effluent-exposed and reference areas were ecologically meaningful.

Fish species captured during the May and September field studies in 2021 generally conformed to the same species and relative numbers reported previously in Haggart Creek and Lynx Creek considering electrofishing methods and time of year. Specifically, slimy sculpin were present in greatest abundance in each creek, followed by Arctic grayling. The 2021 abundance results aligned with previous studies conducted in the years prior to mine operations.

Adult slimy sculpin were used as the primary basis for evaluation of effects of mine effluent exposure on fish in Haggart Creek. Sample sizes for adult male and female slimy sculpin were small during the May survey but, nevertheless, indicated that adult slimy sculpin in Haggart Creek showed no significant differences in age or age structure, growth, relative number, size of eggs produced, or relative liver size compared to those at Lynx Creek. However, significantly lower relative gonad weight (males and females) and condition (males) were found in slimy sculpin from Haggart Creek compared to slimy sculpins from Lynx Creek. The difference in relative gonad weights was believed to reflect later development in fish at Haggart Creek due to naturally cooler water temperatures compared to Lynx Creek.

Although greater numbers of Arctic grayling were captured at Haggart Creek compared to Lynx Creek, the few adult Arctic grayling captured in Lynx Creek were considerably larger than fish captured in Haggart Creek. Nevertheless, the statistical analysis indicated no ecologically significant differences in the condition of Arctic grayling captured in Haggart Creek and in Lynx Creek in 2021. Thus, based on the available data, no adverse mine-related effects on fish health were indicated in Haggart Creek in 2021 (Victoria Gold 2022).

3.5.3.4 Reporting Adequacy, Consistency with Requirements, and Recommendations

Fish community sampling was not conducted in 2020. However, the rationale why sampling was not conducted was not clearly explained in the 2020 Annual Report (Minnow 2021). Consistency with requirements Audit results of the 2021 study are given in Table 30.

Table 30 Fish Population Audit Findings

Site	Appropriate Number of Samples Collected? (Yes/No)	Samples Collected at Appropriate Time of Year and from Appropriate Habitat? (Yes/No)	Field QA/QC Protocols Followed? (Yes/No)[1]	Required Lab Analysis Conducted? (Yes/No)	Lab QA/QC Protocols Followed? (Yes/No)[2]	Required Indices Calculated? (Yes/No)[3]	Required Statistical Analyses Performed? (Yes/No)[4]	Results Compared to Baseline Data? (Yes/No)	Adaptive Management Requirements Discussed? (Yes/No)
Haggart Creek	Yes	Yes	Unknown	Yes	Unknown	Yes	Yes	Yes	Yes
Lynx Creek	Yes	Yes	Unknown	Yes	Unknown	Yes	Yes	Yes	Yes

NOTES:

[1] Not discussed in the report

[2] Not discussed in the report

[3] Presented qualitatively

[4] As per EEM Table 3.4. This is presented qualitatively in the 2021 report.

summarizes the deficiencies in the fish and fish habitat monitoring program and provides recommendations how they can be addressed. In general, the fish and fish habitat monitoring program in 2021 was completed as specified in the EEM. However, while sampling occurred as scheduled in May of 2021, an additional sampling effort was made in September, rather than the summer when fish community was likely most stable and sampling efficiency is highest. Additionally, additional sampling methods were used than what was proposed in the EEM. While this isn't a consistency with requirements issue, it is recommended that the EEM methodologies be updated to account for the potential use of other methods besides backpack electrofishing or lessons learned from previous sampling efforts. Last, there were some areas where the report was less descriptive in terms of quantitative results or could be more transparent and show the statistical and quantitative comparisons between data sets more explicitly. The deficiencies and recommendations presented below should be incorporated in annual reporting going forward.

Table 31 Fish and Fish Habitat Monitoring Program Consistency with Requirements and Recommendations

Consistency with Requirements Gaps and/or Deficiencies	Recommendations
Multiple versions of monitoring plans may result in confusion or be a potential source of method errors.	It is recommended that the EMSAMP be updated to reflect the EEM Study Design, as the current version is fish and fish habitat monitoring.
Field methods – additional sampling methods used, but not described in EEM	The EEM only includes electrofishing as a sampling method, but seine nets and minnow traps were used in the field. Recommend expanding the sampling methods section of the EEM to include these other methods.
Field methods – single pass open sites	Although not required by the MDMER and not a deficiency of the annual monitoring programs, multi- pass depletion estimates in closed sites would provide more accurate and repeatable results and be better for long-term monitoring and statistical analyses
Field methods – Follow up fish and fish habitat surveys conducted in September instead of July or August when fish communities are likely more stable and fish sampling is more efficient	Although not a deficiency of the annual monitoring programs, sampling should be conducted in summer when fish community is most stable and sampling efficiency is highest.
Lab QA/QC procedures and results – not provided in report or appendices	Provide lab QA/QC procedures and results in appendix
Data analysis – missing references to completing statistical analyses comparing sites and contemporary data to pre-construction data	Conduct the required ANOVAs and multiple comparison tests as required by the EEM (e.g., append appropriate statistical analyses in excel format)
Reporting – no mention of why sampling did not occur in 2020	Speak to limitations or rationale if methods are excluded or change from the stated plan in the EEM
Reporting – only qualitative comparisons between sites and years discussed	There is sufficient data from sites and between years to conduct quantitative statistical analysis to determine significant difference between impact and reference sites and trends between years.

Table 31 Fish and Fish Habitat Monitoring Program Consistency with Requirements and Recommendations

Consistency with Requirements Gaps and/or Deficiencies	Recommendations
Reporting – no analysis or discussion of environmental variables, fish results, or outlier effects on benthic invertebrate results.	Discuss all potential factors that may introduce error or skew results.
Reporting – no mention of adaptive management trigger or threshold exceedances	Reports should specify whether any of the adaptive management thresholds in the EMSAMP/EEM were exceeded and if any of the adaptive management measures were required and implemented each year

4 Terrestrial Environment

4.1 Vegetation and Soils

The intent of Victoria Gold's vegetation monitoring program is *"to evaluate changes to vegetation during the life of the Project* (EMSAMP, Section 12.1)", while the intent of the soil monitoring program is *"to evaluate changes to metal and nutrient levels in soils during the life of the Project as a result of dust deposition* (EMSAMP, Section 13.1)".

The focus of "changes to vegetation" is mainly plant metal concentrations, in particular to *"identify whether any trends in metal uptake could be attributed to site activities",* such as mine-generated dustfall, dusts' effects on soil metals concentrations and plants' tissue metal concentrations (via soil-to-root uptake and translocation, and direct dermal adsorption from dusts settled on leaves/stems). However, another objective of the vegetation monitoring program with respect to "changes to vegetation" is *"to assess vegetation species composition to determine vegetative assembly and local ecosystem changes* (EMSAMP, Section 12.3)*"*, presumably that would be associated with any changes in soil metal and nutrient concentrations, or impacts associated with dust deposition on plants.

These objectives have been re-stated here as Stantec has evaluated the 2020 and 2021 monitoring (years 3 and 4 of the program) with respect to both annual sampling and analysis requirements for site vegetation and soils, as well as these broader objectives.

4.1.1 Documents Reviewed

The documents listed in Table 32 were reviewed in evaluating the 2020 and 2021 monitoring of site vegetation and soil element concentrations.

Table 32 Vegetation and Soil Monitoring Related Documents Reviewed

Document	Version Reviewed	Sections Applicable During Operations Phase
Environmental Monitoring Surveillance and Adaptive Management Plan (EMSAMP)	2020-01	Section 12 Vegetation Section 13 Soils
Eagle Gold Mine 2020 Environmental Audit Report	November 30, 2020	Section 4.1 Vegetation and Soils
Re: Eagle Gold Mine QML-0011 Environmental Audit Table 1 Third Party Audit Findings and Victoria Gold Response	December 2, 2020	Vegetation and Soils

Table 32 Vegetation and Soil Monitoring Related Documents Reviewed

Document	Version Reviewed	Sections Applicable During Operations Phase
Eagle Gold Project Water Licence QZ14-041-01 Quartz Mining License QML- 0011 2020 Annual Report		Section 3.9.1 Vegetation Monitoring Program Section 3.9.3 Soils Appendix M Vegetation and Soil Monitoring at the Eagle Gold Project 2020
Eagle Gold Project Water Licence QZ14-041-01 Quartz Mining License QML- 0011 2021 Annual Report		Section 3.9.1 Vegetation Monitoring Program Section 3.9.3 Soils Appendix M Vegetation Monitoring at the Eagle Gold Project 2021

4.1.2 Monitoring Program Requirements

4.1.2.1 Vegetation Monitoring Program

Section 12.3.2 of the EMSAMP established that vegetation (and soil) monitoring would be performed at four permanent plots (D1, D2, D3, D4). These plots were situated in areas with natural overburden soils, and different directions from the mine's main area of operations. Stations D3 and D4 were described as being in areas of the highest dispersion modelling predicted dustfall, and downwind of prevailing winds, respectively. Due to disturbance or activities occurring at plots D1, D2 and D4, those stations were slightly repositioned in 2019 or 2020 and renamed plots D1B, D2B and D4B. In 2020 a fifth plot (D5) was also added to the monitoring program. The five current plots are described in Table 33.

Table 33 Locations of Vegetation and Soil Monitoring Plots

Plot #	Aspect	Elevation (m)	Site Description
D1B	Level	1437	Potato Hills near climate station, 40 m south of original D1.
D2B	West	791	Upslope of the air quality station and the camp climate station, south side of Eagle Creek within influence. Established in 2019 approximately 70 m from original site D2.
D3	Southwest	1356	Top of Eagle Pup/Platinum Gulch drainages near the over-the-top road.
D4B	East	751	On the west side of the access road south of the Haggart Creek culverts and the power line. Established in 2019 approximately 300 m south of the original site D4.
D5	Level	720	Near surface water quality site W5, Haggart Creek upstream of Lynx Creek.

Section 12.3 of the EMSAMP states that *"all permanent vegetation monitoring plots will be sampled once each year during the growing season (July and August) before leaves start to yellow"*. Willow, sedge, bluejoint and northern rough fescue are indicated to be the preferred vegetation types sampled. The wording "each year" in Section 12.3 conflicts with the sampling frequency stated elsewhere. The EMSAMP's *Figure 12.3-1 Vegetation and Soil Monitoring Plot Layout* states *"foliar samples for willow, sedge, bluejoint and northern rough fescue collected every other year"*.

Section 12.3 of the EMSAMP states that *"vegetation samples will be analyzed by an accredited laboratory for metals including mercury using inductively coupled plasma mass spectrometry (ICP-MS). Duplicates of selected vegetation samples and reference standards will also be completed for the purpose of QA/QC of laboratory analytical technique over the Project phases"*.

Section 12.3 of the EMSAMP also states that "*vegetation species composition will be assessed to determine vegetative assembly and local ecosystem changes*."

Section 12.4 of the EMSAMP states that "*in the event vegetation monitoring indicates that metals concentration in vegetation is significantly increasing, VGC will consider additional dust control contingency measures described by the Dust Control Plan to limit particulate matter settling on vegetation."* However, the term "significantly" was not defined in terms of whether that means statistical significance or environmental significance (i.e., ecological and/or human health consumptions risks).

4.1.2.2 Soil Monitoring Program

Section 13.3 of the EMSAMP states that the *"soil monitoring sampling locations were established in conjunction with the permanent vegetation monitoring plots"*, i.e., the same locations listed above in Table 33 (D1B to D5).

Section 13.3 of the EMSAMP states that *"soil monitoring is performed in coordination with vegetation monitoring, once annually during the growing season (July /August)"* and that soil samples are to be *"collected from the surface soil horizon at depths between 0 and 0.5 m"*. Again, the wording "annually" in Section 13.3 is unclear, in relation to the soil sampling program having been meant to accompany the vegetation monitoring program and the EMSAMP's *Figure 12.3-1 Vegetation and Soil Monitoring Plot Layout*. That figure clearly states (in the legend) and illustrates (sampling grid depicting odd years) that soil sampling is to occur every other year. Section 13.3 of the EMSAMP details the methods to be used to measure metals, nutrients, and other parameters in soils. The prescribed method for quantifying metals was the BC method referred to as the Strong Acid Leachate metals (SALM).

Section 13.4 of the EMSAMP states that *"in the event monitoring data indicates that metals concentration in soil within the footprint or at sites established outside the Project footprint is increasing, VGC will engage additional dust control contingency measures described above in the Air Quality Section 11 to limit particulate matter settling on soils."*

4.1.3 Sampling and Reporting Adequacy, Consistency with requirements, and Recommendations

Vegetation sampling and reporting was performed by Laberge Environmental Services in 2020 and 2021. Laberge's methods and results were presented in Appendix M of the Eagle Gold Project 2020 and 2021 Annual Reports.

Soil sampling was performed in 2020 but not 2021. VGC confirmed with Stantec that it shifted the soil sampling program to every-other-year. VGC has met, and possibly gone beyond, its monitoring requirements by collecting vegetation in 2021. VGC should confirm whether the EMSAMP can be interpreted as sampling of soil and vegetation every second year. Such sampling frequency is likely acceptable for the purposes of tracking changes in soil and vegetation metals levels and community composition, in particular if these parameters don't appear to be showing changes relevant to the protection of ecological and human health.

Sampling occurred at all five plot locations listed in Table 33. Samples were analysed by ALS Environment and the laboratory reports were included. Vegetation metal concentrations were presented in tables in both the 2020 and 2021 Annual Reports as range per plant type (Table B-1) and average per plant type (2020 Annual Report Table B-2 and Figure 3, 2021 Annual Report Table B-3 and Figure 3). Soil grain size, nutrients, and metals concentrations were presented in Tables 3, 4, and 5 of the 2020 Annual Report. The 2020 sampling and analysis appears to have lacked inclusion of soil and plant sample duplicates for QA/QC purposes (calculation of lab relative percent differences), while the 2021 sampling program included a few plant sample duplicates, and relative percent differences were calculated and presented in Table B-2, discussed, and were generally low/acceptable. The metals concentrations shown in these tables as well as the reports figures appear to be dry weight results; however, Laberge should confirm this, and for future reports tables and figures should include a reference to tissue concentrations being dry weight or wet weight concentrations. Table B-2 should also indicate that the concentrations shown are average/mean values.

2021 plant tissue concentrations were compared to National Research Council of the National Academies (U.S.) Mineral Tolerance of Animals "maximum tolerable levels (MTLs) of minerals in the feed of animals based on indices of animal health" (NRC, 2005), specifically the MTLs for cattle and rodents. Whereas 2020 plant tissue concentrations were compared to Puls (1994) dietary tolerances for beef cattle, that had previously been used by Stantec (2011). The NRC MTLs are a good choice as a set of food-based ingestion screening benchmarks. The toxicological basis of each MTL is well documented. Table B-1 used MTL values for cattle and rodents. Stantec endorses the decision to include rodents MTL values given small mammals are often a receptor group evaluated in wildlife risk assessments and given this receptor group can have greater exposure to more localized contamination than large wildlife on account of their smaller home ranges. Note that the NRC document also includes MTLs for poultry, and the values for selenium (3 mg/kg) and vanadium (<5 mg/kg) are lower than the values used by Laberge for rodents and cattle. Consideration should be given to including these values for poultry, as their inclusion may make the screening exercise more protective of site bird populations.

The 2020 soil concentrations were compared to the Canadian Council of Ministers of Environment (CCME) guidelines and Yukon Contaminated Sites Regulation (CSR) standards for agricultural and park land use. Arsenic, chromium, molybdenum, nickel were shown to exceed guidelines and standards. Chromium, molybdenum, and nickel were shown to exceed guidelines or standards at stations D3 and D4, while arsenic was shown to exceed guidelines and standards at all five plots.

As indicated in Stantec's previous 2020 Environmental Audit Report, future monitoring reports should attempt to evaluate in greater detail whether there are trends over time in the plant and soil metals concentrations, as wording in the EMSAMP suggests that there needs to be an evaluation of whether metals concentrations are increasing, as opposed to just whether metals concentrations increase above soil guidelines/standards or agricultural screening benchmarks such as MTLs. Stantec suggests that future monitoring could include the following to assist in answering whether metals concentrations are increasing in plants and soils as a result of mine operations:

- Preparation of figures that illustrate all tissue and soil sample results to date (individual sample results or means by plant type for a plot similar to the report's Figure 3) using different colours for different years, and potentially including the pre-mine 2009 plant and soil metal concentrations that are shown in the following reports:
    - Stantec (2011e) Eagle Gold Project: Environmental Baseline Report: Vegetation, prepared for Victoria Gold Corp., June 2011.
    - Stantec (2011g) Eagle Gold Project, Environmental Baseline Report: Surficial Geology, Terrain, and Soils; prepared for Victoria Gold Corp., June 2011.
- Statistics comparing tissue and soil results between stations and over time (since 2018, or since 2009). Such a comparison may be challenging given the limited number of sampling plots and samples collected from each plot.

The plant community composition (species present) was also determined and presented for each plot in both 2020 and 2021, along with some general discussion of the community composition relative to earlier years. It may be difficult determine whether community composition changes are occurring at the plots by only recording species presence. Observations of percent cover by the species present could be added to the field observations and may provide another tool to evaluate changes in community composition over the life of the monitoring program.

At some of the sampling plots different plant species from the EMSAMP's target species of willow, sedge, bluejoint and northern rough fescue were collected in 2020 and 2021. Section 12.3 of the EMSAMP indicates that *"if those particular species are not available within the 2 m circle, then samples are taken from the nearest available specimens"*. It is unclear in the EMSAMP on whether that statement was intended to mean collect whatever plant types were within the sample location/circle, or whether sampling was meant to be shifted to a nearby location where those species were present. The former was likely the intent of the EMSAMP and appears to have been conducted, i.e., collection of what is present as substitute species within the pre-set sampling areas. Collection of alternate species should be fine provided that the species collected each sampling event are similar in order to monitor same-species changes. However, it may be useful to evaluate the cumulative species monitoring data to identify a

priority list of alternate species for sampling at each site if the target species described in the EMSAMP are not available. This may help to provide consistency in vegetation sampling to support analysis of longer-term trends. Such a list might consider plant species of importance as wildlife browse or forage, and for traditional use.

In review of the EMSAMP's methods Stantec has also observed two aspects of the field collections that may limit the program's ability to notice increases in soil metal concentrations associated with dustfall deposition, or to make meaningful comparisons of vegetation metals concentrations between years or stations. 1) Soil sampling appears to be a composite sample of the 0 to 0.5 m interval. Dustfall effects may be more pronounced on shallower more surficial soil. Soil monitoring should be expanded to include separate samples of the LFH layer (litter-fermented-humus) and shallower mineral layer at sites where these different soil horizons are available. 2) The vegetation analyses are for unwashed plants, and therefore it is possible that if higher metals concentrations were observed in a given year, that could be an artifact of weather (duration since rain) and the level of dust adhered to the plants rather than bioaccumulation. If the primary objective of the monitoring program is to identify small increases in plant concentrations (i.e., statistically significant bioaccumulation) then consider analysing rinsed plant samples. Note that unwashed results are better for comparison to the NRC MTLs, and if the data were to be used in a human health and wildlife risk assessment, assuming people, and given wildlife, would not be washing food items.

Overall, Laberge's field investigations and reporting appear to have met the monitoring requirements of the EMSAMP; however, Stantec would encourage VGC to adopt the above recommendations with respect to future reports, specifically such reports should expand on the comparison of metals concentrations in plants and soils over time and between stations. Recommendations are summarized below in Table 34.

Table 34 Vegetation and Soil Monitoring Program Deficiencies and Recommendations

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Unclear wording of EMSAMP with respect to frequency of vegetation and soil sampling	Confirm whether both vegetation and soil sampling can be performed every two years. If acceptable by regulator adopt such a sampling and reporting frequency.
Missing concentration information in Annual Report tables and figures.	Ensure that tables and figures presenting plant metals concentrations indicate whether results are wet weight or dry weight concentrations.
The NRC (2005) MTLs used as screening benchmarks for vegetation metals concentrations only included values for mammals (cattle and rodents).	Consider including the NRC (2005) MTLs for poultry as screening benchmarks for birds.
To date the Annual Reports have focused predominantly on comparing vegetation and soil metals concentrations to benchmark levels, and have not addressed whether concentrations have increased since the mine began operating.	Consider performing a more detailed evaluation/depiction of metal concentrations in plants and soils over time via the use of statistics (examine for feasibility) and figures that differentiate results by year. Include in this comparison the historic pre-mine 2009 vegetation and soil results.

Table 34 Vegetation and Soil Monitoring Program Deficiencies and Recommendations

Consistency with requirements Gaps and/or Deficiencies	Recommendations
The vegetation community assessment has evaluated which species are present at each plot; however, community composition (percent cover by those species present) was not recorded.	Consider including percent cover for those species present at a plot, to possibly facilitate a more quantitative/detailed evaluation of changes in community composition over time.
Alternate species of plants have been sampled from the EMSAMPs preferred species of willow, sedge, bluejoint and northern rough fescue.	Identify a priority list of alternate species for sampling at each plot if the target species described in the EMSAMP are not available.
Plant metals results are for unwashed samples. This makes it difficult to discern whether an increase in concentrations at a given location in a given year reflect greater bioaccumulation, or a greater amount of adhered dust and time since rainfall.	Determine the objectives of the monitoring program and adjust the field program accordingly. For the purpose of discerning if there are small statistically significant increases in plant metals concentrations over time, switch to analysis of rinsed plant samples. For the purpose of collecting data for human health and wildlife risk assessment continue to collect and analyze unwashed plant samples. Alternatively, continued to analyse unwashed samples and archive plant material for later washing and re-analysis if unwashed results indicate an increase in concentrations and one wishes to ascertain if that is due to dust adhesion versus bioaccumulation.
Soil sampling over the 0–0.5 m horizon may be too deep to detect changes in shallower soils resulting from dustfall deposition.	Soil monitoring should be expanded to include separate samples of the LFH layer and shallow mineral layer.

4.2 Wildlife Protection

The intent of VGC's Wildlife Protection Plan (WPP) is to minimize wildlife disturbance at the site through the establishment of wildlife protection policies, employee education, traffic management, and avoidance of disturbance and harassment of wildlife in the Project area (Strata Gold 2017).

4.2.1 Documents Reviewed

Quartz Mine License QML-011 and Water License QZ14-041 both require quarterly and annual reporting on license conditions and management plans related to wildlife protection. This audit reviews available reports, supporting documentation, and on-site audit results against requirements in the WPP and mine licenses. The documents listed in were reviewed as part of the wildlife protection section of the audit.

Table 35 Wildlife Protection Documents Reviewed

Document	Version Reviewed	Sections Applicable during Operations Phase
Wildlife Protection Plan	2017-01	3.0 – Wildlife Protection Procedures 4.0 – Monitoring
Water Licence QZ14-041 Annual Reports	2020 Annual Report 2021 Annual Report	3.9.4 – Wildlife
Quartz Mining License QML-0011 Quarterly Wildlife Reports	September 1, 2020 December 1, 2020 March 1, 2021 June 1, 2021 September 3, 2021 December 1, 2021 February 28, 2022 June 3, 2022	all
Variation Notice, Compliance Monitoring & Inspections, Government of Yukon	March 26, 2021	n/a

4.2.2 Management and Monitoring Program Implementations and Data QA/QC

The WPP guides management and monitoring of wildlife during the mine's construction and operations phases. Section 3.0 of the WPP includes mitigation measures that VGC has committed to implementing and following related to wildlife-human conflicts, land use, transportation, wildlife habitat protection, and the heap leach/events pond operation and management. Section 4.0 of the WPP describes four wildlife-related monitoring programs that are to be implemented at the Mine:

- Wildlife Records Program
- Heap Leach Facility Area and Events Pond Monitoring Program
- Moose Distribution Surveys
- Metal Levels in Vegetation Monitoring Program

An audit of the Wildlife Records Program, Heap Leach Facility Area and Events Pond Monitoring Program, and Moose Distribution Surveys are provided in this section. An audit of the Metal Levels in Vegetation Monitoring Program is provided in Section 4.1 (Vegetation and Soils) of this audit.

Wildlife Records Program

The objective of the Wildlife Records Program is to provide data to evaluate changes to wildlife distribution and habitat use as a result of Mine activities during construction and operations. The wildlife records program includes monitoring of wildlife incidents, documenting observations of focal species (i.e., moose, grizzly bear, olive-sided flycatcher, and rusty blackbird), documenting observations of species on Schedule 1 of the *Species at Risk Act*, and monitoring the implementation of mitigation measures described in Section 3.0 of the WPP. The data collected are also intended to inform adaptive management as required. The WPP requires annual reporting be completed on the findings of the Wildlife Records Program and QML-0011 requires quarterly reporting of wildlife observations and incidents.

The wildlife sections and applicable appendices of the 2020 and 2021 Annual Reports were reviewed. The 2020 Annual Report states that wildlife mitigation measures were implemented through mandatory site orientations, traffic control policies, and training and implementation of the Project's management plans. The Annual Report states that personnel record wildlife sightings and encounters on wildlife observation cards. It is unclear if these observation cards are the same as the Wildlife Observation Form (Appendix E of the WPP).

Wildlife is further addressed in four sections of the 2020 Annual Report:

- Section 3.9.4.1 (Nesting Songbird Surveys) states that 10 nesting songbird surveys were completed prior to clearing activities that took place from May to July 2020. It is unclear how many of these surveys occurred during the reporting period for this audit (i.e., after July 1, 2020). The 2020 Annual Report states that 10 nests were found; however, the nests were either deemed to be inactive or found outside of the active work zones. No information is provided on the methods, types of wildlife features surveyed, survey dates, or survey locations. The Annual Report does not indicate if:
    - prior to surveys VGC consulted with the appropriate regulator and developed management strategies (see Section 3.4 of the WPP), or
    - surveys were completed by a qualified professional.
- Section 3.9.4.2 (Pre-Clearing Wildlife and Wildlife Habitat Surveys) states that pre-clearing wildlife feature surveys were completed and no wildlife features were found. No information is provided on the methods, types of wildlife features surveyed, or survey locations.
- Section 3.9.4.3 (Wildlife Incidents) summarizes wildlife incidents which occurred in 2020. The report states that several incidents with nuisance bears were reported to the Mayo Conservation Officer, but no lethal control was required. The report also states that ongoing education is provided to Site personnel regarding wildlife. The Annual Report does not indicate if wildlife incidents were reported using the Wildlife Incident Form (Appendix D of the WPP).
- Section 3.9.4.4 (Annual Moose Survey) summarizes the annual moose survey. The 2020 moose survey occurred in March 2020, which is outside of the audit period.

The 2021 Annual Report states that wildlife mitigation measures were implemented through mandatory site orientations, traffic control policies, and training and implementation of the Project's management plans. Wildlife is further addressed in four sections of the 2021 Annual Report:

- Section 3.9.4.1 (Nesting Songbird Surveys) states that land disturbance occurred outside of the breeding period and no songbird surveys were completed in 2021.

- Section 3.9.4.2 (Pre-Clearing Wildlife and Wildlife Habitat Surveys) states that one wildlife habitat feature pre-clearing survey was completed in 2021 and no wildlife habitat of note was detected. No information is provided on the methods, types of wildlife habitat surveyed, or survey location.

- Section 3.9.4.3 (Wildlife Incidents) states that there were several observations of animals near the camp and mine site, but no deterrents were deployed. A conservation officer attempted to trap an American marten due to concerns the animal was at risk of injury from mine activities, however the trapping was unsuccessful. The report notes one wildlife mortality, a common raven, which was reported to the Mayo Conservation Officer. The report also states that ongoing education regarding wildlife continues to be provided to Site personnel. The Annual Report does not indicate if wildlife incidents were reported using the Wildlife Incident Form (Appendix D of the WPP).

- Section 3.9.4.4 (Annual Moose Survey) states that the 2021 moose survey did not occur. Victoria Gold was granted a temporary variation from their requirement to complete annual moose surveys due to constraints related to COVID-19.

Quartz Mining License QML-0011 requires that quarterly reporting of wildlife incidents and observation be completed. These reports summarized wildlife incidents and observations as required by QML-0011. The September 2020 through June 2022 quarterly reports were reviewed). The reports state that wildlife mitigation measures continue to be implemented, and that ongoing education regarding wildlife and waste management is provided to site workers. Three bear encounters associated with the waste management facility were recorded in the quarterly reports. The encounters occurred August 24-28, 2020 during a maintenance shutdown of the waste management facility and did not result in bear fatalities or injury. No other incidents at the waste management facility were reported. Detections of two species listed on Schedule 1 of the *Species at Risk Act* (i.e., grizzly bear, olive-sided flycatcher) are included in the quarterly reports. However, there is no indication in the quarterly reports or annual reports if those detections have been reported to the Yukon Conservation Data Centre as required in Section 4.1 of the WPP.

Documentation provided by VGC indicates that the waste management follows the requirements laid out in the WPP. Waste is stored on-site in heavy bins which require a winch to open and the waste compound is surrounded by electrified fence. Waste is either incinerated or transported to an off-site landfill for final disposal.

Three wildlife mortalities are reported in the quarterly reports. A bird mortality (species not recorded) was found at the Heap Leach Facility on July 14, 2020. The quarterly report does not provide any additional information on this mortality and does not specify if the mortality was found in the event pond or another

area of the Heap Leach Facility. A second bird mortality (species not recorded) was found near the powerline adjacent to the main control pond on July 15, 2020. The quarterly report does not provide any additional information on this mortality and the cause of the mortality is unknown. A third bird mortality (common raven) was recorded along a Project road (date unknown), but the quarterly report states that there was no indication that the mortality was related to Project activities. The Annual Report does not indicate if these wildlife mortalities were reported using the Wildlife Incident Form (Appendix D of the WPP).

Heap Leach Facility Area and Events Pond Monitoring Program

The objective of the Heap Leach Facility Area and Events Pond Monitoring Program is to confirm that wildlife access to process solution is restricted. Section 3.5 of the WPP describes mitigation measures to reduce effects on wildlife from interactions with the Heap Leach Facility Area and Events Pond. These mitigations include:

- Fencing the area
- Controlling the growth of vegetation at the site and not reclaiming the events pond shoreline
- Using Bird Balls or a reasonable alternative to deter birds from landing on the events pond.

Section 4.2 of the WPP states that monitoring of the heap leach facility area will be undertaken as part of the Wildlife Records Program and that regular inspections of the events pond will be completed by the Environmental Coordinator. The WPP requires annual reporting be completed on the results of the heap leach facility area monitoring and events pond inspections.

Section 5.5.2 of the 2020 and 2021 Annual Reports report on wildlife monitoring of the Heap Leach Facility. This section states that “Wildlife observations and incidents are documented and reported quarterly through the Environmental department as per QML-0011” (Victoria Gold Corp 2020, 2021). Quartz Mining License QML-0011 annual reports note one bird mortality (July 14, 2020) in association with the Heap Leach Facility Area and events pond area. Information on the species, possible cause of mortality, and location of the mortality was not reported. The Annual Report does not indicate if the wildlife mortality was reported using the Wildlife Incident Form (Appendix D of the WPP). Other wildlife detections in the Heap Leach Facility and Events Pond areas were:

- A grey wolf was observed walking through the Phase 1B Heap Leach Facility area (May 28, 2021)
- A squirrel was observed in the Heap Leach Facility (July 13, 2021)
- A porcupine was observed at the Events Pond (July 22, 2021)
- An owl was observed perched on a sign at the pregnant leach solution pump at the Heap Leach Facility (March 30, 2022)

Section 5.5.2 of the 2020 Annual Report indicates that exclusion fencing will be installed around the perimeter of the Events Pond in 2021. At the time of the site-audit (September 2022) fencing around the Events Pond had not yet been installed. As per information provided by the Environmental Manager, fencing installation was delayed due to the need to install permanent power in the area prior to fencing being installed; fencing installation is now planned for later in 2022 or 2023.

The annual reports do not provide information on whether vegetation management at the Heap Leach Facility Area and Events Pond has occurred.

Section 5.5.2 of the 2020 and 2021 Annual Reports indicate that electronic propane sound cannons are used in the area around the Events Pond during the summer and fall in lieu of Bird Balls to deter wildlife, particularly migratory birds and waterfowl, from landing on the Events Pond. Information on the decision and rationale to substitute sound cannons for Bird Balls, and whether the appropriate regulators or a qualified professional were consulted is not provided.

4.2.3 Reporting Adequacy, Consistency with Requirements, and Recommendations

The content of the Annual Reports and quarterly reports was generally sufficient to confirm consistency with the requirements of the WPP. There were no discrepancies between the wildlife incidents reported in the quarterly and annual reports. However, the annual and quarterly reports do not contain enough information to determine if all mitigation measures contained in the WPP are being implemented. Stantec has identified the following deficiencies and recommendations, which are also summarized in Table 36 :

- Section 3.3 of the WPP includes a requirement to facilitate wildlife movement by providing wildlife crossing and escape points along snowbanks and open ditches. There is no information in the 2020 or 2021 Annual Reports indicating how crossing points are selected, the distance between crossing points, how frequently crossing points are maintained, and what snow depth triggers the creation of crossing points in snowbanks. Stantec recommends that the Annual Report include information on the implementation of measures listed in Section 3.3 of the WPP.
- Section 3.4 of the WPP includes a requirement to complete a wildlife habitat feature survey prior to clearing activities. The Annual Reports do not provide information on the methods, types of wildlife features surveyed, survey locations, or whether this work was carried out by a qualified professional. Stantec recommends that information on the location(s), timing, methods, and results of wildlife habitat feature surveys be included in the Annual Report.
- Section 3.4 of the WPP also includes a requirement to consult with the appropriate regulator (e.g., Yukon Environment, Canadian Wildlife Services) and develop management strategies if clearing activities cannot be scheduled to occur outside the breeding bird window. The annual reports do not indicate if this consultation was carried out and does not provide information on the management strategy developed. Stantec recommends that information on regulatory consultation, and the location(s), timing, methods, and results of pre-clearing nest surveys be included in the Annual Report.

- Section 4.1 of the WPP includes a requirement to report all detections of Species at Risk to the Yukon Conservation Data Centre. Information provided in the annual and quarterly reports is insufficient to determine if this has been completed. Stantec recommends that the Annual Report clearly indicates that this requirement has been completed.
- Stantec recommends that bird mortalities be fully documented using the Wildlife Incident Form (WPP Appendix D) and the species identified by a Qualified Professional either in-person or using a photograph.
- Stantec recommends that Section 3.9.4 of the Annual Report include a reference to wildlife monitoring reported in Section 5.2.2 of the Annual Report. This would more clearly link together the two sections containing wildlife monitoring information.
- All wildlife detections should be fully documented either using the Wildlife Incident Form (WPP Appendix D) or the Wildlife Observation Form (WPP Appendix E). Stantec also recommends that location names be standardized where possible, and that coordinates of wildlife detections be recorded to allow more accurate mapping of wildlife detections. This would assist in evaluating changes to wildlife distribution and habitat use as a result of Mine activities and would facilitate adaptive management to address emerging wildlife issues.

Table 36 Wildlife Protection Monitoring Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendations
Section 3.3 of the WPP includes a requirement to facilitate wildlife movement by providing wildlife crossing and escape points along snowbanks and open ditches. The Annual Reports do not provide information regarding how wildlife crossing points are selected, the distance between crossing points, how frequently crossing points are maintained, and what snow depth triggers the creation of crossing points in snowbanks.	Stantec recommends that the Annual Report include information on the implementation of measures listed in Section 3.3 of the WPP.
Section 3.4 of the WPP includes a requirement to complete a wildlife habitat feature survey prior to clearing activities. The Annual Reports do not provide information on the methods, types of wildlife features surveyed, survey locations, or whether this work was carried out by a qualified professional.	Stantec recommends that information on the location(s), timing, methods, and results of wildlife habitat feature surveys be included in the Annual Report.
Section 3.4 of the WPP includes a requirement to consult with the appropriate regulator (e.g., Yukon Environment, Canadian Wildlife Services) and develop management strategies if clearing activities cannot be scheduled to occur outside the breeding bird window. The annual reports do not indicate if this consultation was carried out and does not provide information on the management strategy developed.	Stantec recommends that information on regulatory consultation, and the location(s), timing, methods, and results of pre-clearing nest surveys be included in the Annual Report.

Table 36 Wildlife Protection Monitoring Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendations
Section 4.1 of the WPP includes a requirement to report all detections of Species at Risk to the Yukon Conservation Data Centre. Information provided in the annual and quarterly reports is insufficient to determine if this has been completed.	Stantec recommends that the Annual Report clearly indicates that this requirement has been completed.
The number of wildlife mortalities reported in the annual and quarterly reports are different, and the reports do not provide information on species, location, or possible cause of death.	Stantec recommends that wildlife mortalities be fully documented using the Wildlife Incident Form (WPP Appendix D) and the species identified by a Qualified Professional either in-person or using a photograph.
There is no linkage between the two sections of the annual report that document wildlife monitoring (Sections 3.9.4 and Section 5.2.2).	Stantec recommends that Section 3.9.4 of the Annual Report include a reference to wildlife monitoring reported in Section 5.2.2 of the Annual Report.
The locations and nature of wildlife detections as reported in the quarterly reports are not clear.	All wildlife detections should be fully documented either using the Wildlife Incident Form (WPP Appendix D) or the Wildlife Observation Form (WPP Appendix E). Stantec also recommends that location names be standardized where possible, and that coordinates of wildlife detections be recorded to allow more accurate mapping of wildlife detections.

5 Geotechnical Stability of Infrastructure and Facilities

This section presents an audit of the geotechnical and physical stability monitoring procedures of infrastructure and facilities on site as specified in the applicable EMSAMP document, compared to the data and information reported in supporting physical inspections, as well as annual and monthly reports. The intent is to determine if ongoing monitoring and data collection meets the commitments outlined in the EMSAMP. This audit is specific to the following areas:

- Permafrost Foundations
- Open Pit
- Material Storage and Stockpiling Areas
- Heap Leach Facility

The scope of this geotechnical stability audit includes review of the documents listed in Table 37, and Table 40.

This audit does not assess the ongoing geotechnical stability of infrastructure of the four areas listed above. This audit also excludes review and assessment of the limit equilibrium slope stability analysis and related Factor of Safety (FOS) design criteria, deformation and/or settlement, comparing reported groundwater tables with established trigger levels in other documentation, and further excludes review of open pit wall stability, catch berm adequacy, the surveillance and inspection checklist of the Adsorption Desorption Recovery (ADR) Plant as laid out in EMSAMP Table 18.3-1, and determination if WRSA or stockpile structures were constructed to design specifications.

5.1 Permafrost Monitoring

5.1.1 Documents Reviewed

The following documents in were reviewed as part of the permafrost physical stability section of the audit.

Table 37 Permafrost Monitoring Program Document Review

Document	Version Reviewed	Sections Applicable During Construction Phase	Sections Applicable During Operations Phase
Quartz Mining License QML-0011	Amendment June 29, 2022	13.0 – Reporting and Inspections	13.0 – Reporting and Inspections
Yukon Water Board, Water License QZ14-041-01	Amendment August 23, 2019	Part D – Operating Conditions	Part D – Operating Conditions
EMSAMP	2020-01	N/A	15.0 – Infrastructure and Facilities

Table 37 Permafrost Monitoring Program Document Review

Document	Version Reviewed	Sections Applicable During Construction Phase	Sections Applicable During Operations Phase
Annual Report for Water License QZ14-041-1 and Quartz Mining License QML-0011 2020	N/A	3.0 – Environmental Monitoring	3.0 – Environmental Monitoring
Annual Report for Water License QZ14-041-1 and Quartz Mining License QML-0011 2021	N/A	3.0 – Environmental Monitoring	3.0 – Environmental Monitoring
Type A Water Use License QZ14-041-1 Monthly Report, One Monthly Report per Quarter from July 2020 to February 2021	N/A	N/A	8.0 – Physical Monitoring Program
Type A Water Use License QZ14-041-1 Monthly Report, One Monthly Report per Quarter from February 2021 to June 2022	N/A	N/A	7.0 – Physical Monitoring Program

5.1.2 Monitoring Program Implementations and Data QA/QC

This section compares the permafrost monitoring program described in the EMSAMP to the field programs and data collected over the audit period reported in the annual and monthly reports.

Permafrost monitoring activities summarized in those documents in Table 37 . The documents were checked for consistency with requirements with monitoring frequency and methods described in the EMSAMP document. Non-consistency with requirements, such as missing monitoring results, AMP thresholds, or other deficiencies in carrying out the monitoring programs are identified in and discussed in section 5.1.3.

Table 38 Permafrost Monitoring Program Implementation

Monitoring Method	EMSAMP Monitoring Requirements	Consistency with Requirements (Yes/No)
Visual Inspection	• Regular Intervals • Freshet, prolonged rainy periods, freeze-up	No[1]
Subsurface Temperature Monitoring (thermistor)	• Quarterly	Yes
Surface Water Quality (TSS, Turbidity)	• Freshet, rainy periods, freeze-up	Yes

NOTE:
[1] Execution of visual inspections not documented or discussed in annual or monthly reports.

5.1.3 Reporting Adequacy, Consistency with Requirements, and Recommendations

Table 41 summarizes the consistency with requirements gaps and/or deficiencies identified with the permafrost monitoring program.

The notable non-consistency with requirements related to permafrost monitoring is the absence of recorded and documented regular visual inspections, specifically during the freshet, rainy periods, and freeze-up. These inspections should be recorded and documented as per the EMSAMP document.

Table 39 Permafrost Monitoring Program Consistency with Requirements and Recommendations

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Regular Visual Inspections not documented or reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from regular visual inspections to identify and quantify any deformation associated with melting of permafrost, such as but not limited to, cracks, subsidence, sinkholes, and sloughing on existing foundations and slope overlay permafrost. Summarize those visual inspections executed during the freshet, prolonged rainy periods, and rising trend in any thermistors.
Thermistor BH-BGC11-42 in the 2020 Q4 (November 2020) quarterly report and thermistor BH-BGC10-7 in the 2021 Q3 (July 2021) quarterly report not included in summary tables of quarterly readings.	Include reasoning for missed readings if none were taken for that quarterly period.

5.2 Open Pit Monitoring

5.2.1 Documents Reviewed

The following documents in Table 42 were reviewed to audit open pit slope stability monitoring.

Table 40 Open Pit Monitoring Program Document Review

Document	Version Reviewed	Sections Applicable to Operations Phase
Quartz Mining License QML-0011	Amendment June 29, 2022	13.0 – Reporting and Inspections
EMSAMP	2020-01	16.0 – Open Pit
Annual Report for Water Licence QZ14-041-1 and Quartz Mining License QML-0011 2020	N/A	3.4 – Groundwater 4.1 – Eagle Pit 4.5 – Engineer's Physical Stability Annual Inspection
Annual Report for Water Licence QZ14-041-1 and Quartz Mining License QML-0011 2021	N/A	3.4 – Groundwater 4.1 – Eagle Pit 4.5 – Engineer's Physical Stability Annual Inspection
2020 Physical Stability Inspection	1	6.0 – Open Pit 18.0 – Recommendations
2021 Physical Stability Inspection	0	7.0 – Open Pit 20.0 – Recommendations
Type A Water Use License QZ14-041-1 Monthly Report, Reporting Period: August 2020 to April 2022	N/A	4.1 – Groundwater 8.0 – Physical Monitoring Program

5.2.2 Monitoring Program Implementation and Data QA/QC

This section compares the open pit monitoring program described in the EMSAMP to the field programs and data collected over the audit period.

Open pit monitoring activities summarized in documents shown in Table 41, were checked for consistency with requirements with monitoring frequency and methods described in the EMSAMP. Non-consistency with requirements, such as missing monitoring results and exceedances of objectives/standards, AMP thresholds, or other deficiencies in carrying out the monitoring programs are identified in Table 41 and discussed in Section 5.2.3.

Table 41 Open Pit Monitoring Program Implementation

Monitoring Method	EMSAMP Monitoring Requirements	Consistency with Requirements (Yes/No)	Notes
Visual Inspection	Daily	No	Execution of daily visual inspections not documented or discussed in annual or monthly report
Drone Survey	Regular (bi-weekly)	Yes	Reported completed in 2021 annual report.
Survey Prisms	Monthly	Yes	Survey prisms installed in pit benches over winter of 2020/2021. Summarized in the 2021 annual report.
Robotic Theodolites	Hourly (if implemented)	N/A	Monitoring method not implemented / installed at open pit.
Piezometer	Quarterly	Yes	The following piezometer installations listed in EMSAMP are reported decommissioned in 2021 annual report: PW-BGC11-02, BH-BGC11-73a, BH-BGC11-73b, and BH-BGC11-73c and are no longer documented in monthly reports.
TDR Cables (not installed)	No frequency	N/A	Monitoring method not implemented / installed at open pit.
Slope Inclinometers (not installed)	No frequency	N/A	Monitoring method not implemented / installed at open pit.
Extensometers	No frequency	Yes	Two extensometers located on the East pit wall monitored cumulatively.
Fixed Slope Radar (not installed)	No frequency	N/A	Monitoring method not implemented / installed at open pit.
Mobile Slope Radar (not installed)	No frequency	N/A	Monitoring method not implemented / installed at open pit.
Stability Reporting	Annually, inspection by an independent engineer conducted before October 1 of each year	Yes	Annual Physical Stability Inspections completed by a qualified engineer from Allnorth during September 8 to 9 of 2021 and September 23 to 24 in 2020 within QML-0011 time frame.

In addition to the EMSAMP monitoring requirements listed above, the QML-0011 requires VGC to respond to recommendations resulting from the annual stability inspection that are related to the open pit. From the two (2) annual inspection within the audit scope for the open pit, for 2020 and 2021, Stantec identified five (5) general and one (1) specific recommendation relevant to the open pit. These recommendations, listed below, are referenced from the 2020 and 2021 physical stability inspection reports (Allnorth, 2020 and 2021).

1. 2021 – VGC should consider monitoring pooled water at the base of the pit, removing water via trash pump as needed.

    a. VGC response: To date, the water accumulations have been minor and are managed on an as needed basis. If volumes are observed to increase in the near term, a trash pump will be installed to transfer water to Ditch A. Management of pit wall seepage and precipitation accumulation is being discussed by the Technical Services Superintendent (i.e., the EoR for the pit) and a consulting engineer who supported the pit design to ensure that long term management strategies are appropriate. The available details of the long-term strategy will be provided with the annual report required by QML-0011 and QZ14-041-1. (Q1 2022)

2. 2020 and 2021 – VGC should assign a qualified, on site, individual to be responsible for monitoring and documentation of any mass earth structures that have significant risks in the case of a failure. The individual should develop a standard operating procedure for the monitoring and risk management of these structures. This individual should be responsible for coordination with a qualified professional to review monitoring data for concerns and trends, if they are not qualified themselves.

    a. VGC response: Monitoring of structures is completed by the Technical Services Department under the direction of the Technical Services Superintendent working closely with the EOR for the areas while following standard operating procedures. The Technical Services Superintendent is the EOR for a number of the Engineered Structures on the Mine site. The results of monitoring and the documentation developed are provided with VGC's annual reports as required by the Quartz Mining Licence (QML-0011) and Water Use License (QZ14-041-1) (ongoing).

3. 2020 & 2021 – VGC should continue to assign individuals to document and be responsible for the monitoring and construction of any structures to determine if the structures are constructed in accordance with design. Any variations between design documents and final construction should be included in final record drawings.

    a. VGC response: Monitoring of structures including construction review to meet design specifications is done by the Technical Services department under the direction of the Technical Services Superintendent working closely with the EOR for the areas. Construction reports and as-built drawings document variations or minor modification from IFC designs (ongoing).

    b. Additionally, VGC has updated the Waste Rock and Overburden Facility Management Plan, that includes QA/QC plan and related OMS Manual to support this work (completed Feb 2022).

4. 2020 & 2021 – Any finalized construction of mass earth structures should include a final construction report that includes any operational and maintenance requirements (if any) to ensure stability of the structure.

    a. VGC response: As per both QML-0011 and QZ14-041-1, the EOR provides final construction reports for Engineered Structures, which includes requirements for maintenance as needed, once the structures are complete (ongoing).

5. 2020 and 2021 – VGC should consider a monitoring program to assist in early warning and detection of any movements in mass earth structures. Such a program might use permanent survey points, slope inclinometers, piezometers, or other tools to measure internal/external movements and pore water pressures. Such a monitoring program should be developed with the assistance of and be implemented with the oversight of a qualified professional.

    a. VGC response: Monitoring programs have been developed, are in use, and undergoing further refinement by the Technical Services department with the oversight of a qualified professional. In addition to routine visual inspection, monitoring for physical stability include the following (ongoing):

        - Pit wall and dump biweekly survey using unmanned aerial vehicle or drone
        - Pit wall monitoring using survey prisms
        - Piezometer water level readings in the pit area

6. 2020 and 2021 – For any stockpiles, cut slopes, and/or fill slopes with over-steepened slopes that do not require immediate rectification (due to proximity to structures, roadways, active work areas, etc.) VGC should still cordon off the area above and/or below the oversteepened slope depending on what would be accessible to site staff.

    a. VGC response: As noted in the 2021 audit report, over-steepened sections identified in previous years at the secondary stockpile perimeter ditch were addressed in 2021. Additional areas were cordoned off in response to the previous audit and these areas will be checked in the snow free period and upgraded/repaired if deemed necessary. Management of other over-steepened slopes will continue in 2022 (ongoing).

Of the six (6) physical stability recommendations from the annual stability inspections, Recommendation one (1) will be discussed in detail in the long-term pit wall seepage plan in the 2022 annual reporting and Recommendations two (2) through six (6) are ongoing and therefore no non-consistency with requirements issued have been identified and no recommendations are made at this time.

5.2.3 Reporting Adequacy, Consistency with Requirements, and Recommendations

Table 42 summarizes the consistency with requirements gaps and/or deficiencies identified with the open pit monitoring program.

The notable non-consistency with requirements related to open pit monitoring is the absence of reported daily visual inspections. These inspections are noted to be completed on a weekly basis using visual and UAV drone observations. This is non-compliant with the daily visual observation frequency as per the EMSAMP 2020-01 document.

There is a lack of consistency between the number of piezometer instruments listed in the EMSAMP document (2020-01) and those with reported water tables in the 2021 annual report and monthly reports. Stantec understands the BH-BGC11-73 series instruments (a, b, and c) were decommissioned in early 2020 and are therefore excluded from the monthly reports. New piezometers documented in the 2021 annual report, are not documented in any of the 2021 monthly reports, or the EMSAMP. In general, Stantec found piezometer monitoring consistent with the quarterly monitoring frequency and provides recommendations for reporting in Table 42.

Survey prisms were installed in pit benches during the winter of 2020/2021. This combined with documented visual inspection, piezometric monitoring, bi-weekly drone survey and annual stability review provides sufficient general monitoring of the performance of the open pit. There are a number of instruments and monitoring approaches listed in the EMSAMP that are not implemented, such as, robotic theodolite, TDR cables, slope inclinometers, fixed slope radar, and mobile slope radar. Stantec understands that these are displacement monitoring options which might be implemented if stability issues arise and additional monitoring is deemed to be required. It is recommended that the EMSAMP be adjusted to indicate the instrumentation to be used for typical operating displacement monitoring as well as the instrumentation which might be implemented if unstable conditions develop or might be installed as contingency to existing instrumentation.

Table 42 Open Pit Monitoring Program Consistency with Requirements and Recommendations

Consistency with Requirements Gaps and/or Deficiencies	Recommendations
Daily visual inspections not reported.	Include an appendix in Annual and Monthly reporting that documents the results of daily visual inspections as per EMSAMP. VGC Annual reports state full visual inspections are completed on a weekly basis; however, EMSAMP states visual inspections of open pit slopes are to completed daily and to be documented in shift log reports, along with daily and weekly records.
Piezometers installed within the pit location (DEEP-08, DEEP-06, and DEEP-04) and documented in section 4.1 (Eagle Pit) of the 2021 annual report, are not documented in section 3.4 (Groundwater) where groundwater well monitoring is documented. These pit piezometers are also not documented in the monthly reports as well the EMSAMP document.	Provide dates of commissioning and relevant information of new and existing piezometers in all applicable sections of the annual and monthly reports. Update EMSAMP revision to show relevant piezometers.
Data for two (2) extensometers, (Extensometers 3 and 4) installed on SB8 instability are not reported in the 2020 annual report.	Provide dates of commissioning and decommissioning for all instrumentation in annual and monthly reports.
There are multiple instrumentation types listed in EMSAMP documentation that monitor displacement in various forms. Currently prisms and extensometers are serving this purpose and others are deemed not required due to normal operating (stable) conditions (robotic theodolites, TDR cables, slope inclinometers, fixed slope radar, mobile slope radar).	Modify the EMSAMP, or provide cross references to other VGC materials, to identify the displacement monitoring instrumentation to be used for normal operating (stable) conditions and instrumentation to be used for unstable conditions or as contingency to existing instrumentation.

5.3 Materials Storage and Stockpile Management Areas Monitoring

5.3.1 Documents Reviewed

The following documents in Table 43 were reviewed to audit the materials storage and stockpile management area monitoring.

Table 43 Materials Storage and Stockpile Management Areas Monitoring Program Document Review

Document	Version Reviewed	Sections Applicable During Operations Phase
Quartz Mining License QML-0011	Amendment June 29, 2022	13.0 – Reporting and Inspections
EMSAMP	2020-01	17.0 – Material Storage and Stockpile Management Areas
2020 Annual Report for Water License QZ14- 041-1 and Quartz Mining License QML-0011	N/A	3.4 – Groundwater 4.4 – Material Storage and Stockpile Management Areas 4.5 – Engineer's Physical Stability Annual Inspection
2021 Annual Report Water License QZ14- 041-1 and Quartz Mining License QML-0011	N/A	3.4 – Groundwater 4.4 – Material Storage and Stockpile Management Areas 4.5 – Engineer's Physical Stability Annual Inspection
2020 Physical Stability Inspection	1	4.0 – Secondary Stockpile 12.0 – Ditch A 17.0 – Un-Named Stockpile Area 18.0 – Recommendations
2021 Physical Stability Inspection	0	4.0 – Secondary Stockpile 6.0 – Heap Leach Overburden Stockpile 14.0 – Ditch A 19.0 – Un-Named Stockpile Area 20.0 – Recommendations
Type A Water Use License QZ14-041-1 Monthly Report, One Monthly Report per Quarter from July 2020 to June 2022	N/A	4.1 – Groundwater 8.0 – Physical Monitoring Program

5.3.2 Monitoring Program Implementation and Data QA/QC

This section compares the materials storage and stockpile management areas monitoring program described in the EMSAMP to the field programs and data collected over the audit period.

Monitoring activities summarized in documents shown in Table 44 were checked for consistency with requirements with monitoring frequency and methods described in the EMSAMP. Non-consistency with requirements, such as missing monitoring results and exceedances of objectives/standards, AMP thresholds, or other deficiencies in carrying out the monitoring programs are identified in Table 44 and discussed in section 5.3.3.

Table 44 Materials Storage and Stockpile Management Areas Monitoring Program Implementation

Monitoring Method	EMSAMP Monitoring Requirements	Consistency with Requirements (Yes/No)	Notes
Visual / Drone inspection	• Daily (WRSA crest) • Weekly (WRSA toe) • Weekly (developing Stockpile) • Monthly (established Stockpile) • Monthly (detailed WRSA)	No	Only the active and inactive EP and PG dumps are noted in the 2021 annual report to be visually, and drone inspected weekly. Stantec understands that reclamation stockpiles do not have monitoring equipment setup to date due to the minimal consequence of failure. Execution of weekly and monthly visual / drone inspections of the secondary stockpile are not documented or discussed in annual or monthly reports.
Piezometers	• Quarterly	No	Piezometer MW19-PGW1b presented in EMSAMP is not listed in Q3 2020 (August monthly report) and Q2 2022 (April monthly report). Stantec understands this piezometer was reported broken in monthly reports within this audit period with plans to fix in 2021. Piezometer MW19-EPW1b had a missed reading without explanation in Q1 of 2021 (February monthly report).
Rock Drain Flow	• Weekly	No	PG WRSA rock drain is still under development, with 100 m of rock drain remaining to be developed as per the 2021 annual report. Construction of the EP WRSA rock drain commenced in March 2021.
Survey Prisms	• No frequency	N/A	Monitoring method not implemented / installed at WRSA or stockpile structures.
Wireline Extensometers	• No frequency	Yes	PG WRSA extensometer monitoring conducted on a regular basis.
Inclinometers	• No frequency	N/A	Monitoring method not implemented / installed at WRSA or stockpile structures.
Radar / photogrammic surveying	• No frequency	N/A	Monitoring method not implemented / installed at WRSA or stockpile structures.

Table 44 Materials Storage and Stockpile Management Areas Monitoring Program Implementation

Monitoring Method	EMSAMP Monitoring Requirements	Consistency with Requirements (Yes/No)	Notes
Annual Physical Stability Inspection	• Annually, inspection by an independent engineer conducted before October 1 of each year	Yes	Annual Physical Stability Inspections completed by a qualified engineer from Allnorth during September 8 to 9th of 2021 and September 23 to 24th in 2020 within QML-0011 time frame.

In addition to the EMSAMP monitoring requirements listed above, the QML-011 requires VGC to respond to recommendations resulting from the annual stability inspections that are related to material storage and stockpile. From the two (2) annual inspection completed, by Allnorth in 2020 and 2021 Stantec identified a total of 11 separate recommendations relevant to the material storage and stockpiles, which are listed below:

1. 2020 – [related to Secondary Stockpile Perimeter ditch] Un-block the feeder ditch/culvert which will carry flow from the Secondary Stockpile perimeter ditch to Ditch A.

    a. VGC response: The secondary stockpile ditch will be cleaned out and tied into Ditch A in 2021 (Q1, Q2 2021)

2. 2020 – [related to Un-Named Stockpile Area] Consider additional ditching and water management in the area to prevent scouring of the road surfaces and erosion around the stockpiles. Ditch water away from the laydown areas to prevent ponding.

    a. VGC response: This area will be inspected prior to freshet 2021 and additional ditching installed, as necessary. This area will also be considered for the 2021 revegetation program (Q1/Q2 2021)

3. 2021 – [related to Secondary Stockpile] Monitor over-steepened slopes, cordon off if accessible by site staff.

    a. VGC response: An internal assessment by the Technical Services Department was conducted in this area and it was determined that it did not present a safety risk to staff. Monitoring of the area will continue to ensure that a risk does not develop (ongoing).

4. 2021 – [related to Heap Leach Overburden Stockpile] Continue to monitor pile for further collapse. Work in conjunction with regulators and geoscience/engineering professionals to design a short-term immediate remedy and long-term solution to the issue.

    a. VGC response: Short-term immediate remedies were executed with the proposed activities communicated to EMR Inspections and conducted under the guidance of onsite experts. The short-term activities included (Q2 2022):

        - Immediate and permanent halt to material placement in the affected area
        - Installation of silt fences, hay bales, willow staking, wattle fencing and containment sumps upgradient of Haggart Creek within the material flow path
        - Visual and instrumentation monitoring (extensometers) of the material stockpile
        - Regrading of the material stockpile in areas where this activity was safe to be undertaken
        - Excavation of portions of the material flow path and backfill with clean durable rock to minimize future erosional potential and to insulate permafrost zones.

    b. VGC response: A long-term solution has been developed with the proposed activities communicated to EMR Inspections and these will be conducted under the guidance of onsite experts. The long-term activities include (complete Q1 2022):

        - Additional regrading of the material stockpile in areas where this activity is safe to be undertaken and where conditions indicate it is necessary for long term stability
        - Installation of extensometers prior to spring freshet if additional surface cracking is observed
        - Monitoring by drone flights to compare surfaces for differential settlement analyses
        - Completion of a spring Heli-seeding program to stabilize the runout zone.

5. 2021 – [related to Un-Named Stockpile Area] Flag over-steepened slopes in area to protect site staff. Consider dismantling over-steepened slopes depending on proximity to roadways, areas frequented by site staff.

    a. VGC response: The material stockpiles identified were intended to be part of the H1 2021 revegetation work; however, ongoing travel restrictions and staff availability impacted our ability to complete this work. This area is currently being monitored and will be considered for revegetation work which may involve regrading if a risk to staff and the environment is identified (Q1/Q2 2022).

6. 2020 & 2021 – VGC should assign a qualified, on site, individual to be responsible for monitoring and documentation of any mass earth structures that have significant risks in the case of a failure. The individual should develop a standard operating procedure for the monitoring and risk management of these structures. This individual should be responsible for coordination with a qualified professional to review monitoring data for concerns and trends if they are not qualified themselves.

    a. VGC response: Monitoring of structures is completed by the Technical Services Department under the direction of the Technical Services Superintendent working closely with the EOR for the areas while following standard operating procedures. The Technical Services Superintendent is the EOR for a number of the Engineered Structures on the Mine site. The results of monitoring and the documentation developed are provided with VGC's annual reports as required by the Quartz Mining Licence (QML-0011) and Water Use License (QZ14-041-1) (ongoing).

    b. VGC response: Additionally, VGC has updated the Waste Rock and Overburden Facility Management Plan, that includes QA/QC plan and related OMS Manual to support this work (Completed Feb 2022).

7. 2020 & 2021 – VGC should continue to assign individuals to document and be responsible for the monitoring and construction of any structures to determine if the structures are constructed in accordance with design. Any variations between design documents and final construction should be included in final record drawings.

    a. VGC response: Monitoring of structures including construction review to meet design specifications is done by the Technical Services department under the direction of the Technical Services Superintendent working closely with the EOR for the areas. Construction reports and as-built drawings document variations or minor modification from IFC designs (ongoing).

    b. Additionally, VGC has updated the Waste Rock and Overburden Facility Management Plan, that includes QA/QC plan and related OMS Manual to support this work (completed Feb 2022).

8. 2020 & 2021 – Any finalized construction of mass earth structures should include a final construction report that includes any operational and maintenance requirements (if any) to ensure stability of the structure.

    a. VGC response: As per both QML-0011 and QZ14-041-1, the EOR provides final construction reports for Engineered Structures, which includes requirements for maintenance as needed, once the structures are complete (ongoing).

9. 2020 & 2021 – VGC should consider a monitoring program to assist in early warning and detection of any movements in mass earth structures. Such a program might use permanent survey points, slope inclinometers, piezometers, or other tools to measure internal/external movements and pore water pressures. Such a monitoring program should be developed with the assistance of and be implemented with the oversight of a qualified professional.

    a. VGC response: Monitoring programs have been developed, are in use, and undergoing further refinement by the Technical Services department with the oversight of a qualified professional. In addition to routine visual inspection, monitoring for physical stability include the following (ongoing):

        - Pit wall and dump biweekly survey using unmanned aerial vehicle or drone
        - Extensometer installation on active lifts of the waste rock storage areas with regular movement calculations conducted.

10. 2020 & 2021 – For any stockpiles, cut slopes, and/or fill slopes with over-steepened slopes that do not require immediate rectification (due to proximity to structures, roadways, active work areas, etc.) VGC should still cordon off the area above and/or below the over-steepened slope depending on what would be accessible to site staff.

    a. VGC response: As noted in the 2021 audit report, over-steepened sections identified in previous years at the secondary stockpile perimeter ditch were addressed in 2021. Additional areas were cordoned off in response to the previous audit and these areas will be checked in the snow free period and upgraded/repaired if deemed necessary. Management of other over-steepened slopes will continue in 2022 (ongoing).

11. 2020 & 2021 – [related to Secondary Stockpile] It is recommended that VGC tie the perimeter ditch into the collection sump.

    a. VGC response: The section identified had been connected in response to the prior audit; however, it is acknowledged that clean out and maintenance is required. This work is currently contemplated to take place in Q2, 2022. As noted in the 2021 annual report, work was completed in 2021 to armor a portion of the perimeter interception ditch and tie into the collection sump (Q2 2022).

5.3.3 Reporting Adequacy, Consistency with Requirements, and Recommendations

Table 45 summarizes consistency with requirements gaps and/or deficiencies identified with the materials storage and stockpile management areas monitoring program.

The notable non-consistency with requirements is the absence of documented visual inspections. These inspections should be recorded and documented as required in the EMSAMP document. It is unclear if the frequency of required inspections is being executed. Stantec understands that reclamation stockpiles pose minimal consequence of failure and therefore do not have monitoring equipment installed. However, documenting weekly (during development) and monthly (established stockpiles) visual inspections should occur. There is no documentation of visual inspections completed in the monthly or annual reports of the Secondary (90-Day stockpile), and so it is unclear if they are being completed.

The EMSAMP documents require weekly inspections of WRSA rock drain discharge areas, once fully operational. As per the 2021 annual report, about 275 m of the PG WRSA Rock Drain was built in 2021, with 100 m of rock drain development remaining. Construction of the EP WRSA rock drain commenced in March 2021. Though these structures are not built to full specification, they are operational, and weekly monitoring would be required.

Of the 11 physical stability recommendations from the annual stability inspections, recommendations #1, 2, 4, and 5 were scheduled for completion within the time frame of this environmental audit. The remaining recommendations are ongoing, planned for future implementation, or are listed as completed by VGC.

- Recommendation 1 is not addressed in the available documentation, with no mention of the secondary stockpile ditch.
- Recommendation 2 is not addressed in the available documentation. Stantec understands that this work may have been impacted by ongoing travel restrictions.
- Recommendation 4 is addressed with ongoing short-term activities being executed and long-term activities that have been completed.
- Recommendation 5 is not addressed in the available documentation. Stantec understands that this work may have been impacted by ongoing travel restrictions.

Table 45 Materials Storage and Stockpile Management Areas Monitoring Program Consistency with Requirements and Recommendations

Consistency with requirements Gaps and/or Deficiencies	Recommendations
It is unclear whether daily WRSA crest inspections, weekly WRSA toe and developing stockpile inspections, monthly established stockpile and detailed WRSA inspections are being executed. Records specifying visual and drone inspections of structures are to be maintained along with daily and weekly records detailing the location and type of materials placed in the WRSAs, as per EMSAMP.	Include an appendix in Annual and Monthly reporting that summarizes frequencies and all the visual observations made on stockpile structures.
Stantec understands that piezometer MW19-PGW1b was damaged and intended to be fixed in 2021. The status of this piezometer was not reported in the Q3 2020 (August monthly report) and Q2 2022 (April monthly report).	Include status of broken piezometers in all monthly reports if not decommissioned.
Piezometer MW19-EPW1b reading in Q1 of 2021 (February monthly report) was missed in monthly report without reasoning.	Provide reasoning for missed piezometer readings.
Though not built to full specification, the WRSA rock drains are operational, and it is unclear if they are being inspected weekly as per EMSAMP.	Conduct and provide weekly inspection records of the WRSA rock drain discharge areas in the monthly or annual reports.
Follow up and close out of physical stability recommendations 1, 2 and 5 not documented in annual or monthly reports.	Provide documentation detailing the follow up and response actions for addressing recommendations.

5.4 Heap Leach Facility Monitoring

5.4.1 Documents Reviewed

The following documents in Table 46 were reviewed to audit Heap Leach Facility monitoring.

Table 46 Heap Leach Facility Monitoring Program Document Review

Document	Version Reviewed	Sections Applicable During Construction Phase	Sections Applicable During Operations Phase
Quartz Mining License QML-0011	Amendment June 29, 2022	13.0 – Reporting and Inspections	13.0 – Reporting and Inspections
EMSAMP	2020-01	N/A	18.0 – Heap Leach and Process Facilities
2020 Annual Report for Water Licence QZ14-041-1 and Quartz Mining License QML-0011	N/A	3.4 – Groundwater 4.3 – Heap Leach Facility and Process Facilities 4.5 – Engineer's Physical Stability Annual Inspection	3.4 – Groundwater 4.3 – Heap Leach Facility and Process Facilities 4.5 – Engineer's Physical Stability Annual Inspection
2021 Annual Report for Water Licence QZ14-041-1 and Quartz Mining License QML-0011	N/A	3.4 – Groundwater 4.3 – Heap Leach Facility and Process Facilities 4.5 – Engineer's Physical Stability Annual Inspection	3.4 – Groundwater 4.3 – Heap Leach Facility and Process Facilities 4.5 – Engineer's Physical Stability Annual Inspection
2020 Annual Inspection of Eagle Gold HLF	REV A	2.0 – 2020 Annual Inspection	2.0 – 2020 Annual Inspection
2021 Annual Inspection of Eagle Gold HLF	REV 0	2.0 – 2021 Annual Inspection	2.0 – 2021 Annual Inspection
2020 Physical Stability Inspection	1	5.0 – Heap Leach Facility 18.0 – Recommendations	5.0 – Heap Leach Facility 18.0 – Recommendations
2021 Physical Stability Inspection	0	5.0 – Heap Leach Facility 20.0 – Recommendations	5.0 – Heap Leach Facility 20.0 – Recommendations
Type A Water Use License QZ14-041-1 Monthly Report, One Monthly Report per Quarter from July 2020 to June 2022	N/A	N/A	2.3.3 – In-Heap Pond 4.1 – Groundwater Monitoring

5.4.2 Monitoring Program Implementation and Data QA/QC

This section compares the Heap Leach Facility (HLF) monitoring program described in the EMSAMP to the field programs and data collected and provided for the purpose of the audit over the audit period.

Heap Leach Facility monitoring activities summarized in documents shown in Table 46 were checked for consistency with requirements with monitoring frequency and methods described in the EMSAMP. The details for the non-consistency with requirements, such as missing monitoring results and exceedances of objectives/standards, AMP thresholds, or other deficiencies in carrying out the monitoring programs are identified in Table 48 and discussed in Section 5.4.3.

Table 47 Heap Leach Facility Monitoring Program Implementation

Monitoring Method	EMSAMP Monitoring Requirements	Consistency with Requirements (Yes/No)	Notes
Visual Inspections	• Weekly (HLF Embankment) • Weekly (Leach Pad Liner and embankment) • Weekly (Stacked Leach Ore) • Weekly (Solution Collection and Recovery System) • Daily (Leak Detection and Recovery System Monitoring Ports) • Weekly (Monitoring Vault) • Weekly (Event Pond Liners) • Monthly (Conveyors and Radial Stacker) • Daily (General HLF Components and Events Pond)	No	Execution of daily, weekly, visual inspections not documented or discussed in annual or monthly reports. It is unclear if all required visual inspections are completed based on information Stantec has received.
Piezometer	• Continuous (Embankment, In Heap) • Daily (Heap leap pad during freshet) • Monthly (Other)	No	Piezometer MW19-HLF1a listed in EMSAMP is not reported in the August 2020 monthly report. Piezometer MW10-AG3 was not reported decommissioned in the November and August 2020 monthly reports. The following piezometers listed in EMSAMP, were only installed in Q3 2022: MWXX-AGR6, MW10-AG3A, MWXX-HLF2a, MWXX-HLF2b, MWXX-HLF3a, MWXX-HLF3b, MWXX-HL4a, MWXX-HLF4b.

Table 47 Heap Leach Facility Monitoring Program Implementation

Monitoring Method	EMSAMP Monitoring Requirements	Consistency with Requirements (Yes/No)	Notes
Inclinometer	• Continuous (Embankment) • Monthly (Other)	Yes	Inclinometer INC-1, installed on the dam embankment has continuous data reported in the 2020 and 2021 Independent annual inspection reports.
Fluid Levels (Events Pond)	• Daily (If available storage is reached) • Weekly (Otherwise)	Yes	Reported daily in monthly reports.
Geochemical sampling of pregnant and barren process solution	Quarterly	No	Records of geochemical sampling of pregnant and barren solution not found in available documentation.
HLF and Dam Inspection (by an Engineer)	Annually	Yes	2020 and 2021 Annual Inspections of Eagle Gold HLF.
Physical Stability Inspection	Annually	Yes	2020 and 2021 Physical Stability Inspections.
Event Driven Inspection	Following an unusual event (heavy rainfall, freshet, earthquake)	N/A	No event driven inspection occurrence discussed in routine reporting reviewed for the audit.
Dam Safety Review (DSR)	Every 5 years	N/A	Dam Safety Review (DSR) not required during time scope of audit.
Surveillance and Inspection of Adsorption, Desorption, and Recovery (ADR) Plant	Regularly	N/A	ADR Plant surveillance and inspection checklist laid out in EMSAMP documents outside scope of this physical stability section of the environmental audit. Stantec assumes this is documented by VGC supervisor and operator and records filed on site.

In addition to the EMSAMP monitoring requirements listed above, the QML-0011 requires VGC to respond to recommendations resulting from the annual stability inspection that are related to the HLF. From the two (2) annual inspection completed, by Allnorth in 2020 and 2021, Stantec identified a total of sixteen (16) separate recommendations relevant to the HLF, listed below:

1. 2020 – [regarding Heap Leach Facility] Continue to monitor the cut slopes around the perimeter of the HLF for erosion. Maintain the upper bench and remove sloughing material as required.

    a. VGC response: This area will be monitored and repaired with the continued construction and eventual stacking of ore into the Phase 1B expansion area. The Engineer of Record for the HLF has subsequently provided the Phase 1B as built report and the annual HLF inspection report which assessed HLF conditions in greater detail. The deficiencies identified by the EOR will be addressed as necessary 2021 (Q4 2020, 2021).

2. 2020 – [regarding Heap Leach Facility] Consider re-grading temporary access road (slope towards interception ditch) above HLF to prevent pooling water forming. Monitor soft/deflecting areas of temporary access road above HLF, particularly above HLF liner anchor trench.

    a. VGC response: The temporary access road area will be monitored in the spring of 2021 to establish if re-grading is necessary. This section of the HLF will ultimately be reworked to allow for the construction of Phase 2 of the HLF H2 2021. The Engineer of Record for the HLF is currently preparing the Phase 1B as built report which will include commentary and recommendations on areas of the current configuration of the HLF which may require additional maintenance or upgrade. Any deficiencies identified by the EOR will be addressed as necessary in H1 2021 (Q1/Q2 2021).

3. 2020 – [regarding Heap Leach Facility] Check Phase 1B Interception Ditch design and complete construction if needed for sections that are lined but not armored. Check design for sloping requirements to outfall and confirm whether installed ditch meets design and monitor ditch for potential of pooling water.

    a. VGC response: The Engineer of Record for the HLF is currently preparing the Phase 1B as built report which will include commentary and recommendations on areas of the current configuration of the HLF which may require additional maintenance or upgrade. Any deficiencies identified by the EOR will be addressed as necessary in H1 2021 (Q1/Q2 2021).

4. 2020 – [regarding ADR] Review engineering requirements for the North Toe Ditch to confirm ditch size and need for rock armoring. Toe ditch is currently tied into the roadside ditch, which should also be reviewed for engineering requirements. Recommend reviewing hydraulic design of both ditches to determine what is necessary.

    a. VGC response: Review of design will be completed if surface runoff is observed to be above the carrying capacity of the ditch. To date, no observations of uncontrolled surface runoff has been observed in this ditch (As necessary).

5. 2021 – [regarding Heap Leach Facility] Check Phase 1B Interception Ditch and monitor sediment collection. Clear sediment collection at drain sump.

    a. VGC response: Construction of the Phase 2 area of the HLF (i.e., upgradient of the Phase 1B Interception Ditch) will commence in late Q1/early Q2 2022. This work will include conversion of the Phase 1B Interception Ditch into an anchor trench for liner deployment once the Phase 2 Interceptor Ditch is operational. These construction activities will entirely mitigate this concern; however, if the ditch and sump will be operational through the freshet period due to construction timing it will be inspected and cleaned out to ensure that it can function effectively (Q1 to Q3 2022).

6. 2021 – [regarding Event Pond] Repair excavator damage to HLF spillway liner.

    a. VGC response: The concrete cloth to complete this repair has been purchased and is on site. The repair work will commence when conditions allow (i.e., consistently warmer than ~-20ºC) and in advance of freshet (Q1/Q2 2022).

7. 2021 – [regarding Event Pond] Clear crushed material out of Event Pond spillway mouth. If equipment access is needed for the South-East corner of the pond, consider constructing additional road accesses as appropriate.

    a. VGC response: The material will be removed Q1 2022. If ongoing access across the spillway is deemed necessary beyond that time, a crossing system will be installed that does not impact the carrying capacity of the spillway (e.g., rig mats) (Q1 2022).

8. 2020 & 2021 – [regarding Heap Leach Facility] Continue to monitor the toe slope below the HLF for rill erosion.

    a. VGC response: This area has been reviewed by the Technical Services and Process Departments of VGC and the EOR and, as proposed by the EOR, coarse fill (6” minus rock) will be backfilled into this area. As shown in Figure 23 of the 2021 annual report (VGC, 2021), the embankment face has been reseeded and is showing good vegetation growth in all other areas (Q2 2022).

9. 2020 & 2021 – [regarding Event Pond] Monitor minor erosion of cut slopes and maintain as required.

    a. VGC response: Revegetation work was undertaken in 2020 to stabilize this area. The minor erosion on the cut slopes above the Events Pond will continue to be monitoring and will be maintained if deemed necessary by the EoR for the HLF (as necessary).

10. 2020 & 2021 – [regarding Event Pond] Monitor pooling water above the North side of the Event Pond and regrade area to prevent pool formation or install a water handling system (sump pumps, etc.).

    a. VGC response: The area will continue to be monitored on an ongoing basis to determine if the installation of a water handling system or additional grading to improve drainage is warranted (as necessary).

11. 2020 & 2021 – [regarding Event Pond] Monitor material deposits on HLF spillway and Event Pond to ensure the spillway and pond designs are not compromised through either blockage of flow or reduced pond capacity.

    a. VGC response: The spillways for the HLF and Events Pond were inspected by the EOR and it was determined that the minor material deposits would not impact their functionality as the accumulated material would be washed out in a major event and not reduce capacity (N/A).

12. 2020 and 2021 – VGC should assign a qualified, on site, individual to be responsible for monitoring and documentation of any mass earth structures that have significant risks in the case of a failure. The individual should develop a standard operating procedure for the monitoring and risk management of these structures. This individual should be responsible for coordination with a qualified professional to review monitoring data for concerns and trends, if they are not qualified themselves.

    a. VGC response: Monitoring of structures is completed by the Technical Services Department under the direction of the Technical Services Superintendent working closely with the EOR for the areas while following standard operating procedures. The Technical Services Superintendent is the EOR for a number of the Engineered Structures on the Mine site. The results of monitoring and the documentation developed are provided with VGC's annual reports as required by the Quartz Mining Licence (QML-0011) and Water Use License (QZ14-041-1) (ongoing).

13. 2020 & 2021 – VGC should continue to assign individuals to document and be responsible for the monitoring and construction of any structures to determine if the structures are constructed in accordance with design. Any variations between design documents and final construction should be included in final record drawings.

    a. VGC response: Monitoring of structures including construction review to meet design specifications is done by the Technical Services department under the direction of the Technical Services Superintendent working closely with the EOR for the areas. Construction reports and as-built drawings document variations or minor modification from IFC designs (ongoing).

    b. Additionally, VGC has updated the Waste Rock and Overburden Facility Management Plan, that includes QA/QC plan and related OMS Manual to support this work (completed Feb 2022).

14. 2020 & 2021 – Any finalized construction of mass earth structures should include a final construction report that includes any operational and maintenance requirements (if any) to ensure stability of the structure.

    a. VGC response: As per both QML-0011 and QZ14-041-1, the EOR provides final construction reports for Engineered Structures, which includes requirements for maintenance as needed, once the structures are complete (ongoing).

15. 2020 and 2021 – VGC should consider a monitoring program to assist in early warning and detection of any movements in mass earth structures. Such a program might use permanent survey points, slope inclinometers, piezometers, or other tools to measure internal/external movements and pore water pressures. Such a monitoring program should be developed with the assistance of and be implemented with the oversight of a qualified professional.

    a. VGC response: Monitoring programs have been developed, are in use, and undergoing further refinement by the Technical Services department with the oversight of a qualified professional. In addition to routine visual inspection, monitoring for physical stability includes the following (ongoing):

        - Vibrating wire piezometer water level readings in the HLF dam foundation bedrock and dam fill just above the western and eastern underdrains to determine pore water pressures; and,
        - Slope inclinometer readings in the HLF dam crest.

16. 2020 and 2021 – For any stockpiles, cut slopes, and/or fill slopes with over-steepened slopes that do not require immediate rectification (due to proximity to structures, roadways, active work areas, etc.) VGC should still cordon off the area above and/or below the over steepened slope depending on what would be accessible to site staff.

    a. VGC response: As noted in the 2021 audit report, over-steepened sections identified in previous years at the secondary stockpile perimeter ditch were addressed in 2021. Additional areas were cordoned off in response to the previous audit and these areas will be checked in the snow free period and upgraded/repaired if deemed necessary. Management of other over-steepened slopes will continue in 2022 (ongoing).

5.4.3 Reporting Adequacy, Consistency with Requirements, and Recommendations

Table 48 summarizes the consistency with requirements gaps and/or deficiencies identified with the Heap Leach Facility monitoring program.

The notable non-consistency with requirements is the absence of documented routine (visual) inspections. These inspections should be recorded and documented as per the EMSAMP document. Based on the available information, it is unclear if monitoring of all HLF structures is completed at required frequencies.

There is a lack of consistency between the piezometer instruments listed in the EMSAMP document (2020-01) and those with reported water tables in the monthly reports. Piezometer MW19-HLF1a listed in the EMSAMP, is listed without a water level in the August 2020 monthly report. Piezometer MW10-AG3, is reported decommissioned in the Q1 2021 monthly report and there after, however there is no mention of its decommissioning in the November and August 2020 monthly reports. The following piezometers listed in 2020 EMSAMP have only been installed in Q3 2022: MWXX-HLF2a, MWXX-AGR6 MWXX-HLF2b, MWXX-HLF3a, MWXX-HLF3b, MWXX-HL4a, MWXX-HLF4b. These piezometers have therefore not been documented in the monthly reports within the audit timeframe.

Of the sixteen (16) physical stability recommendations from the annual inspection reports, recommendations #1, 2, 3, 6, 7 and 8 were scheduled for completion within the time period of this environmental audit. The remaining recommendations are listed as ongoing, scheduled for future implementation, or complete by VGC.

- Recommendation 1 is addressed in greater detail within the 2021 annual HLF inspection report completed by the EoR. The EoR recommends monitoring the downstream slope for rill erosion and placing rip-rap along the groin of the HLF spillway access road and embankment.
- Recommendation 2 was also addressed in the 2021 annual inspection report. VGC has responded to complete this work post freshet 2022.
- Recommendation 3 is not addressed in the 2020 or 2021 annual inspection reports, and review of the Phase 1B Interception Ditch design is not documented.
- Recommendation 6 is addressed in the 2021 EoR annual inspection which indicates that concrete cloth armoring has been placed on the emergency spillway.
- Recommendation 7 has not been addressed in the available documentation.
- Recommendation 8 is still being addressed. Visible vegetation along the HLF toe is reducing erosion and rilling in the interim Proposed backfilled coarse fill (6” minus rock) into the area is not addressed to be complete in available information.

Table 48 Heap Leach Facility Monitoring Program Consistency with Requirements and Recommendations

Consistency with Requirements Gaps and/or Deficiencies	Recommendations
Routine (visual) inspections (daily, weekly) not reported. It is unclear if all visual inspections are completed for all components of the HLF at their required frequency based on the annual and monthly reports.	Include an appendix in Annual and Monthly reporting that summarizes the observations from visual inspections.
Based on the 2021 annual report, three Vibrating Wire Piezometers (VWPs) installed in the In-Heap Pond, appear to be collecting data, but it is unclear if they are being monitored continuously. These piezometers, along with the embankment piezometers (P1, P2 and P3) are not included in the EMSAMP revision.	Provide continuous data plots of In-Heap piezometers in monthly and annual reports. Include records of In-Heap and embankment piezometers in the next EMSAMP revision.
The following piezometers/groundwater wells listed in EMSAMP are not reported in the annual or monthly reports due to being installed in Q3 2022: MWXX-AGR6, MW10-AG3A, MWXX-HLF2a, MWXX-HLF2b, MWXX-HLF3a, MWXX-HLF3b, MWXX-HL4a, MWXX-HLF4b.	Provide documentation of piezometers that are still to be installed in the monthly and annual reports, listed in the EMSAMP. Update the EMSAMP as required.
Records of pregnant and barren solution sampling not available in monthly and annual reports.	Include documentation of pregnant and barren solution sampling in the geochemical sampling sections of the monthly and annual reports.
Follow up and close out of physical stability recommendation 3, 7 and 8 not documented in annual or monthly reports.	Provide documentation detailing the follow up and response actions for addressing recommendation.

6 Solid Waste and Hazardous Materials Management

6.1 Documents Reviewed

Documents in Table 49 were reviewed for the solid waste and hazardous materials management section of the audit. As this aspect of site environmental management is carried out in the field and documented by handwritten reports required at various frequencies (daily, weekly, monthly, quarterly), Stantec modified the audit approach to review representative inspection logs and reports presented in the following section.

Table 49 Waste Management Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
Solid Waste and Hazardous Materials Management Plan	2017-02	All sections

6.2 Monitoring Program Implementations and Data QA/QC

Implementation of the Solid Waste and Hazardous Materials Management Plan (during operations) was and is carried out through scheduled inspections and related documentation of inspections. Field inspections are carried out, according to the frequencies specified in the Solid Waste and Hazardous Materials Management Plan by VGC Environmental Technicians, and reports are reviewed by site VGC Environmental Coordinators for items that require corrective action by operations staff or senior management. Corrective actions are tracked in a dedicated log and updated upon completion. Table 50 presents the waste logs and inspection reports reviewed for this audit.

Table 50 Waste Logs and Inspection Reports Reviewed

Waste Category	Frequency	Record	Record Date/Period
Hazardous Waste	As Required	Completed hazardous waste manifest	July 13, 2020
Wet/Dry Waste	As Required	Incinerator Operations Log	July 26–Sept 1, 2020
Wet/Dry Waste	Weekly	Incinerator Maintenance Log	May–June 2019
Hazardous Waste	Daily	Hazardous Substance Inspection Checklist (Fuel Stations/Propane Tanks	Week of July 21, 2020
Solid Waste/Fuel	Weekly	Environmental QA/QC Inspection (includes inspection of site waste management, fuel management and spill kits)	Week of July 10 and 27, 2020
Brush	As Required	Control Burn Log	January–August 2020

6.3 Reporting Adequacy, Consistency with Requirements, and Recommendations

The review of relevant logs and inspection reports listed in Table 50 indicates that in the majority of instances logs are filled out adequately and inspection reports show no concerns. The review did, however, find that burn logs are occasionally missing information about timing of burn events and that inspection reports repeatedly found sorting of hazardous and of non-hazardous waste "unsatisfactory". Repeated "unsatisfactory" notations suggest a systemic issue rather than a temporary lapse in procedures, and updates to the Solid Waste and Hazardous Material Management Plan is recommended. Table 51 summarizes the gaps and recommendations identified.

Table 51 Waste Management Consistency with Requirements and Recommendations

Consistency with Requirements Gaps and/or Deficiencies	Recommendations
Burn Log miss time information occasionally	Management should periodically check logs and address missing information.
Sorting of hazardous waste repeatedly found unsatisfactory	The Solid Waste and Hazardous Materials Management Plan should be reviewed and sections relevant to hazardous waste management updated.
Sorting of non-hazardous waste repeatedly found unsatisfactory	The Solid Waste and Hazardous Materials Management Plan should be reviewed and sections relevant to non-hazardous solid waste management updated

7 Spill Response

7.1 Documents Reviewed

Documents in were reviewed for the spill response section of the audit. Spill response training, procedures and reporting measures were audited against the 2017-02 and 2021-01 versions of the Spill Response Plan. Version 2021-01 updates terminology from StrataGold to Victoria Gold, adds additional reporting (e.g., to First Nation of Na-Cho Nyak Dun) and expands contaminated soil characterization comparted to the 2017-02 version. There do not appear to be fundamental changes in approach and procedures for dealing with spills or spill kit locations.

Table 52 Spill Response Documents Reviewed

Document	Version Reviewed	Sections Applicable to Operations Phase
Spill Response Plan	2017-02	All
Spill Response Plan	2021-01	All
Water Licence QZ14-041 Quartz Mining License QML- 0011 2020 Annual Report	N/A	N/A
Water Licence QZ14-041 Quartz Mining License QML- 0011 2021 Annual Report	N/A	NA

7.2 Spill Response Plan Implementation Program Implementations and Data QA/QC

 provides the audit results of the spill response program. The table only covers the reporting period and does not include spills prior to July 1, 2020 or after June 30, 2022.

Table 53 Audit Results of Spill Response Program

Year	No. of Reportable Spills	Response Procedures Implemented	Reporting	Training and Prevention
2020	• Process solution 1 • Diesel 1 • Oil 2 • Coolant 1 • Sewage 1	• The spill reports provided indicate that spills were responded to in accordance with the Spill Response Plan • Contaminated materials were place in the HLF, land treatment farm, or treated with lime depending on the material involved	• Spill reports indicate that all but one spill were reported to spill report line within timelines prescribed in Spill Contingency Plan • One oil spill report identified the spill as reportable but did not indicate if required reporting occurred.	• For the process solution and diesel spills the reporting includes a root cause analysis and identification of measures to prevent similar future spills.
2021	• Process solution 3 • Oil 2 • Coolant 2 • Sewage 2 • Ammonia nitrate solution 1	• The spill reports provided indicate that spills were responded to in accordance with the Spill Contingency Plan • Contaminated materials were place in the HLF, land treatment farm, treated with lime, or in the case of ammonia nitrate placed in blast locations. Contaminated oil absorbent pads were shipped off site.	• Spill reports indicate that spills were reported to spill report line within timelines prescribed in Spill Contingency Plan	• For the process solution spills, the reporting includes a root cause analysis and identification of measures to prevent similar future spills.
2022	• Process solution 2 • Diesel 2 • Oil 8 • Coolant 1	• The spill reports provided indicate that spills were responded to in accordance with the Spill Contingency Plan • Contaminated materials were place in the or land treatment farm	• Spill reports indicate that spills were reported to spill report line within timelines prescribed in Spill Contingency Plan	• For the process solution spills the reporting includes a root cause analysis and identification of measures to prevent similar future spills.

7.3 Reporting Adequacy, Consistency with requirements, and Recommendations

The documentation available for the audit indicates that spill response and clean up follow the approved Spill Contingency Plan and that reporting is generally timely and with adequate information. There are two oil spill reports during the reporting period that do not indicate if the spill was reported to the Spill Line. One diesel spill report is missing basic information such as the final contaminated material disposal location. These spills were comparatively small. Additional observations include:

- Process solution spilled outside the lined heap leach containment area during the audit period (July 1, 2020 to June 30, 2022), whereas the previous audit did not identify process solution spills.
- There is a marked increase in the first half year of 2022 in oil spills compared to 2021 and 2020 but also 2019 and 2018 (reported in previous audit). There does not appear to pattern as spills occurred in different places and circumstances. Some involved improper handling of containers, other failed hoses, or other equipment.

Above observations suggest there may be a trend towards more process solution spills and towards more oil spills. Stantec is aware that VGC has added earthworks and drainage in 2022 and already has implemented mitigations for process solution spillage. VGC should consider providing additional training in oil spill prevention. Table 54 summarizes observations and recommendations.

Table 54 Spill Response Consistency with Requirements and Recommendations

Consistency with Requirements Gaps and/or Deficiencies	Recommendations
Two spill reports did not indicate if spill line was called	Management should review reports and address missing information.
Process solution spilled outside the heap leach containment area	Monitor the effectiveness of the mitigation measures already put in place.
Number of oil spills increased in first half of 2022	Provide additional spill prevention training.

8 Reclamation and Closure

This most recent version of the Reclamation and Closure Plan (RCP) (Version 2020-01) during the audit period was submitted to YWB and the EMR in October 2020 in accordance with Clause 148 (b) of QZ14-041-1 and Clause 7.2 of QML-0011 that requires an update to the RCP every 2 years. The 2020 RCP included an updated Reclamation Cost Estimate, comprised of Current, 2-Year Peak Liability and End of Mine (EOM) security calculations. On June 27, 2022, the Government of Yukon concluded its assessment of the closure-related risk and liabilities at the Eagle Gold Mine and issued its *Reason for Decision: Financial Security Determination for the Eagle Gold Mine Site (QML-0011)*. The 2020 RCP is currently in the regulatory review process.

The scope of this audit does not include assessing the content of RCP 2020-01. The audit focus is limited to the *"progress and success of reclamation and closure efforts completed to date"*; as outlined in QML-0011 (Part VI, 12.2.d). Planned reclamation and closure efforts for the 2020-2022 period are initially outlined in the approved 2018 RCP (2018-03), then again in the 2020 RCP submission (2020-01). Planned reclamation activities included select progressive reclamation efforts, as well as advancing various closure research programs. No mine areas were expected to undergo final closure during this time. Reclamation progress and performance results are evaluated based on information presented in the 2020 and 2021 Annual Reports, which are required by QML-0011 to capture completed reclamation activities/research, results, and plans for upcoming activities. The EMSAMP includes monitoring and management frameworks that are relevant to closure and post-closure phases of the project, but does not include requirements for progress updates of progressive reclamation and/or closure research programs.

8.1 Documents Reviewed

The documents listed in Table 55 were reviewed in evaluating the 2020 and 2021 progressive reclamation and reclamation research efforts completed.

Table 55 Reclamation and Closure Documents Reviewed

Document	Version Reviewed	Sections Applicable During Operations Phase
Eagle Gold Mine, Reclamation and Closure Plan	2018-03	Section 7 Progressive Reclamation Section 10 Reclamation and Closure Research Programs
Eagle Gold Mine, Reclamation and Closure Plan	2020-01	Section 7 Progressive Reclamation Section 10 Reclamation and Closure Research Programs
Environmental Monitoring Surveillance and Adaptive Management Plan (EMSAMP)	2020-01	Section 12 Vegetation Section 13 Soils
2020 Annual Report for Eagle Gold Project Water Licence QZ14-041-01 and Quartz Mining License QML-0011	April 2021	Section 6 Reclamation and Closure Appendices M, N, O, P, W, X, Y
2021 Annual Report for Eagle Gold Project Water Licence QZ14-041-01 and Quartz Mining License QML-0011	April 2022	Section 6 Reclamation and Closure Appendices M, N, U1, U2, U3

8.2 Program Implementation and Results

8.2.1 Progressive Reclamation

Section 7 of the approved 2018-03 Reclamation and Closure Plan identifies three opportunities and approximately timelines for progressive reclamation at the Mine:

- **Platinum Gulch WRSA** - Bottom-up placement of waste rock at the Platinum Gulch WRSA to its final configuration, placement of an engineered cover will commence near the end of the 3-year waste rock deposition period (approx. 2019-2022), and construction of a field scale proto Passive Treatment System (PTS) will follow (approx. 2023) once construction of the engineered cover is completed.
- **Eagle Pup WRSA** – Construction of the engineered cover is scheduled to commence in the first year of closure, but work may begin prior to this time if final contouring of the WRSA is completed.
- **Ice-Rich Overburden Storage Area** – Revegetation planned for inactive areas to minimize sediment movement during rainfall and runoff events

While not listed in Section 7 of the RCP (2018-03), revegetation planning is discussed throughout the document as key reclamation activity and research program. A summary of revegetation progress is discussed in Section 8.2.1.4, and revegetation research studies are presented Section 8.2.2.1.

8.2.1.1 Platinum Gulch WRSA

The 2020 and 2021 Annual Reports summarize completed waste rock placement at the Platinum Gulch (PG) WRSA for each reporting year and describe bottom-construction sequencing as proposed in the 2018 RCP. The 2021 Annual Report identifies a 10 m increase to the design surface was completed by the EOR to provide additional capacity, and a total capacity of 1,025 kt remains in the two lower lifts.

In 2020 a pilot-scale trial cover was completed on the 1370 masl bench and instrumented with two monitoring stations, one on the bench plateau and one on the southeast facing slope. Recommendations for an additional trial cover and monitoring station on a north facing slope were made in 2021.

Progressive reclamation at the PG WRSA appears to be largely on track with sequencing described in the 2018 RCP, however the timing for final waste rock placement at PG WRSA, additional cover construction (trials or larger areas), and/or PTS construction planned for the near time was not found in the RCP (2020-01) or the 2020 and 2021 Annual Reports. Additional detail on the progress of engineered cover and PTS research is in Section 8.2.2. Initial research results presented in the documents reviewed do not identify any major alterations to the existing closure concepts, although research programs are in early phases.

8.2.1.2 Eagle Pup WRSA

The Annual Reports note that waste rock placement at the EP WRSA began in 2021, construction of the engineered cover at the WRSA is not expected until closure. This is consistent with timing suggested in the 2018 RCP.

8.2.1.3 Ice-Rich Overburden Storage Area

Total quantities of material placed at this facility were not found in the Annual Reports, although a lack of significant quantities of ice-rich overburden encountered is noted. VGC staff have indicated this facility has not been constructed.

8.2.1.4 Revegetation Program

The 2020 RCP states: *"the objective of the initial revegetation program is to design and implement erosion control measures using revegetation and bioengineering techniques that would act as interim methods to control potential erosion and to also inform final reclamation decisions with respect to appropriate seed mixes and revegetation methods".*

Active revegetation activities commenced in at the Site in 2019 with treatment at five areas and additional areas treatments have been applied at other areas in 2020 and 2021. The 2020 and 2021 Annual Reports document the areas, methods and treatment details for each reporting year. Treatments and associated erosion control measures noted in these reports document a mix of hand and broadcast seeding, tree planting, pole drains, wattle fencing, coco-matting, fascine installations and willow staking. Variations in species mix and application densities also are noted across the 2020 and 2021 Annual Reports.

Appendix O of the 2021 Annual Report provides valuable notes on the observed surface material conditions (e.g. texture, organic matter, stones), topsoil placement and other relevant observations. Some initial recommendations made by VGCs consultant for additional surface preparation (e.g. decompaction, topsoil addition) and treatment timing are developed based on results of the 2019 treatments, and establishment of permanent monitoring plots are suggested to complete annual assessments and provide a consistent framework for evaluating work completed to date and informing future refinements.

VGC has made progress with revegetation activities consistently through 2019-2022. It is recommended that a formal monitoring program is developed to adequately capture treatment results. This may be incorporated into the operational vegetation monitoring program evaluated in Section 4.1. Due to the timelines associated with establishing a sustainable vegetation cover that contributes to surface stability and erosion control, and/or future land use targets (i.e. wildlife habitat), success will be determined by evaluating future monitoring results.

Select revegetation research topics have been identified by VGC and their consultants, these are presented in 8.2.2.1.

8.2.2 Reclamation and Closure Research

Section 10 of the approved 2018-03 Reclamation and Closure Plan identifies six research study topics:

- Revegetation Trials
- Engineered Covers
- Vegetation Rooting Study
- Passive Water Treatment
- Heap Biological Detoxification and in-Heap Bioreactor Research Program
- Groundwater Arsenic Attenuation Study

Progress and reported findings from each of these research studies is summarized in the sections below.

8.2.2.1 Revegetation Trials

The 2018 RCP identifies historical revegetation trials completed by Laberge Environmental Services (2012) on the Peso Mineral Exploration Site near the Eagle Gold Project area. Monitoring results in Section 10 of the 2018 RCP reported several findings:

- *All seeded plots with no treatments supported no to very sparse vegetative cover and stressed growth,*
- *The plots with the amendments 'biochar and compost' are still providing the most robust and dense vegetation cover and growth.*
- *Alpine Bluegrass, Tufted Hairgrass, Glaucous Bluegrass, Tickle Grass, Sheep Fescue, Alder and hedysarum have been identified in the revegetation trial plots and several areas exhibiting good overall health.*

Laberge (2012) also notes that for successful plant growth and survival at the Peso site, some form of amendment is required, and the blocks with the healthiest and most robust plants were located on the forest margin where moisture retention was thought to be increased.

Additional candidate trial sites are identified in the 2018 RCP for future work in boreal high, boreal low and riparian ecosystems, although no specific timelines or treatment methods are described. The 2020 RCP summarizes comparable observations for the Peso plots, highlighting the trials completion following the 2018 monitoring program and their successfully establishing a vegetation cover on acidic, highly mineralized soils.

Although there is no overarching revegetation plan presented in the 2018 and 2020 RCPs, the Project has an active revegetation program focusing on short-term erosion control that has included revegetation efforts at a number of areas each year from 2019-2021. This work is described in Section 8.2.1.4 and provides numerous informal trial sites for observation, although the audit could not find a summary of planned monitoring to capture observations and results to inform future efforts and refine a site-wide revegetation design in the RCP.

Since 2018, additional research trials sites were established in 2020 to evaluate the success of three native species on two trial plot locations with north and south facing aspects. Year 1 (2021) monitoring results are presented in Appendix N of the 2021 Annual Report, but given the early stage of this trial observations and recommendations are limited.

8.2.2.2 Engineered Covers

The stated objective of the research program for closure cover designs is to build confidence in the initial long-term cover system design performance analyses in terms of net water percolation and to inform eventual large-scale closure cover system construction. Research tasks and audit comments associated with engineered covers are outlined in Table 56.

Table 56 Overview of Engineered Covers Research Program and Audit Comments

Task	Summary Progress and Reported Findings	Audit Comments
Task 1: Update the conceptual model of cover performance	As outlined in the 2020 RCP: *The base case cover system considered for closure of the HLF and WRSAs is conceptually expected to behave as a store and release system where 20 to 50% of effective precipitation will infiltrate the cover system to underlying waste or spent ore.* No major updates to the conceptual model of cover performance are noted to date. Evaluation of the existing concept was completed in 2021 and reported with cover trial monitoring results (2021 Annual Report, Appendix W).	No comment.
Task 2: Develop a material characterization plan for candidate cover system materials	A cover material characterization program was completed in September 2021 and summarized in the 2021 Annual Report (Appendix X). The program focused on overburden stockpiles at the site and suitability for use in cover construction. Findings indicated the existing overburden stockpiles included materials comparable to those used in cover trials on the 1370 bench of PG WRSA and would likely perform similarly in net percolation reduction. Soil in multiple stockpiles was low in organic matter and considered likely to require amendments for successful revegetation. Materials required for construction of a low permeability layer (i.e. barrier layer) appear limited in volume within the current site stockpiles.	This task has progressed as planned in the 2018 RCP. An updated material volume balance using the results of this program and existing cover concept, as well as, additional soil replacement requirements for reclamation, was not found in the 2020 RCP or 2021/22 Annual Reports.
Task 3: Conduct a material characterization of HLF and WRSA waste materials;	The 2018 RCP notes that representative samples of spent heap leach and waste rock material will be collected when deemed the material available from the existing facilities is appropriately representative and submitted for geotechnical characterization. The 2020 RCP suggests this may occur in 2021 and 2022. Annual Reports do not provide progress on this item.	Although waste material characterization is likely occurring, testing/results and reporting with respect to the implications for closure should be included in Annual Reports.
Task 4: Conduct enhanced meteorological monitoring on various slope aspects;	Pilot scale trial cover was constructed at the PG WRSA in September 2020. The trial cover included two instrumented station locations, on the plateau and inter-bench slope. Each location includes soil and meteorological data collection equipment.	In general, these tasks have advanced as proposed in the 2018 RCP and initial performance results suggest the net percolation targets are achievable.

Table 56 Overview of Engineered Covers Research Program and Audit Comments

Task	Summary Progress and Reported Findings	Audit Comments
Task 5: Conduct closure cover system field trials for performance monitoring	Findings in the 2021 Annual Report (Appendix W) suggested trial cover was performing within the expected range for net water percolation (20%-50%) using a store and release concept. Recommendations following the first year of monitoring results included: • Installation of a performance monitoring station on a north-facing aspect of the WRSA to capture differences in water content, net radiation, and snow depth across different aspects of the landform. • Completion of a comprehensive annual field saturated hydraulic conductivity testing campaign to capture differences in this parameter across the cover system field trial, and track cover system evolution over time. • Investigation of how a compacted layer of overburden could reduce NP rates further (as required)	Annual Reports and future RCP iterations should include ongoing performance updates and proposed schedule for additional pilot trial locations (as applicable).
Task 6: Assess the effect of high pH water treatment solids on the heap cover	This research program will assess suitability of the mine water treatment solids for use as heap cover material. A proposed timeline and/or progress updates were not found for this work in the 2020 RCP or Annual Reports.	Proposed timelines for this work should be included in future RCP iterations and Annual Reports.

8.2.2.3 Vegetation Rooting Study

The objective of the vegetation rooting study is to gather information on plant rooting depth and develop optimal requirements for cover thicknesses to encourage maximum evapotranspiration from covers. A detailed study plan outlining literature review, soil and vegetation sampling and analyses and field trial monitoring is included in the 2020 RCP.

No proposed timelines, progress results or research findings were found in review of the 2020 RCP or 2020 and 2021 Annual Report. VGC staff have indicated this research program has not commenced.

8.2.2.4 Passive Water Treatment

PTS are proposed for a number of mine areas at closure. As stated in the 2018 RCP, the objective of the PTS reclamation research program is to address uncertainties associated with the removal rate coefficients and thermodynamic minimums possible for the predicted water quality at closure. A detailed research plan and schedule was provided with the 2018 RCP and updated in the 2020 RCP including the timeline in Table 57.

Table 57 Overview of Passive Water Treatment Research Program outlined in 2020 RCP

Phase	Start Date	End Date
Phase 1: Information Gathering	September 2012	2020
Phase 2: Indoor Pilot Scale	2019	2021
Phase 3: Outdoor Pilot Scale	2021	2022
Phase 4: On-site Demonstration Scale	2022	2023
Phase 5: Full Scale Implementation	TBD	Into post-closure

The 2021 Annual Report provides progress updates and initial results from Phase 1-2 of this work. The preliminary tasks focused on the PG WRSA PTS and included desktop literature/site data review, site investigation to assess key inputs (e.g., subsurface conditions, borrow sources for constructed wetland treatment system (CWTS) substrate, wetland plant survey and collection), develop concept design and sizing, and identify constructability constraints. Appendix Y of the 2021 Annual Report provides summary detail on the completed work and recommendations for next steps which include a series of off-site bench scale testing.

Work completed to date is summarized clearly in the 2021 Annual Report. No proposed timeline for bench-scale testing (i.e., Phase 2: Indoor Pilot Scale) was noted in the audit review. Findings of completed work are preliminary but did not identify any critical flaws in the existing RCP concepts to employ a PTS at the PG WRSA.

8.2.2.5 Heap Biological Detoxification and in-Heap Bioreactor Research Program

The 2020 RCP notes that the Water Use Licence QZ14-041 outlines a requirement “to verify the proposed biological detoxification of the heap, including incorporation of data gathered through the operation of the HLF and information from the use of similar technology at heap facilities operated in similar climatic conditions.” The licence also requires “a phased program, similar to that provided for the PTSs, for the proposed in-heap bioreactor treatment system including the assessment of the ability to maintain reducing condition in the long term and the potential for rebound and/or release of metals.” The 2018 and 2020 RCP include a research plan outline and background for this issue in Appendix C of both submissions.

The 2020 RCP discusses a pilot bioreactor program with participation from the Yukon Industrial Research Chair – Northern Mine Remediation which has used mine influenced water discharging from the PG WRSA and catchment area in evaluating the impact of ambient freeze-thaw stresses on sulfate reducing bacteria and metals removal. It is unclear if this work is intended to inform future work for the HLF.

No proposed timelines for this research program are provided with the description in the 2020 RCP or 2021 Annual Report.

8.2.2.6 Groundwater Arsenic Attenuation Study

The Section 10 of the 2018 and 2020 RCPs describes historical data showing dissolved arsenic concentrations at the mine area which exceed applicable territorial and federal water quality guidelines. The RCPs outline the following research activities:

- Utilize the existing groundwater information to establish the processes that could likely be controlling constituent migration. Geochemical modeling would be used to derive saturation indices that could indicate the sinks that are currently responsible for metals removal.
- Potential sources of constituents such as the WRSAs would be monitored to determine if the WRSAs are inducing chemistry changes in groundwater that could shift the chemical equilibrium to either favor or reduce the processes that are currently affecting arsenic or other metals' migration
- Known or modeled migration pathways would be further evaluated to determine if specific lithologies provide mechanisms that can be quantified to yield predictions of migration potential or reduction in migration potential under planned operating conditions.

No proposed timeline, progress updates or findings were found in the 2020 or 2021 Annual Reports.

8.3 Reporting Adequacy, Consistency with Requirements and Recommendations

Reporting on planned and completed progressive reclamation and reclamation research is required to be completed within the Reclamation and Closure Plan updates and the Annual Report. In large part this information was found in review of the 2020 RCP, 2020 Annual Report and 2021 Annual Report.

Progressive Reclamation is not addressed directly in the 2020 and 2021 Annual Reports, but can be inferred from the summary of completed construction activities as they related to closure (e.g. construction of the Platinum Gulch WRSA). Based on the Annual Reports progressive reclamation has been occurring as planned and waste rock placement has allowed VGC to advance cover trials at the Platinum Gulch WRSA. VGC and their consultants have also successfully completed revegetation efforts each year from 2019-2021. This will provide valuable information for refining site preparation, topsoil replacement and revegetation designs if proper monitoring and reporting is completed. Stantec recommends VGC consider incorporating these revegetation sites into a formal monitoring program to provide a consolidated location for performance results rather than a series of technical memorandums appended to Annual Report submissions.

Progress and success of reclamation research is difficult to discern from the reviewed documents. Although the 2020 RCP and Annual Reports identify and provide written discussion on reclamation research, items such as research task schedules, progress updates and/or key findings were not found for all reclamation research programs. The Engineered Covers and Passive Water Treatment programs appear to have made positive progress, although the timelines in the 2020 RCP and 2021 Annual Report appear slightly delayed from the initial schedule provided in the 2018 RCP. Timelines and milestones associated with the remaining research programs were not found. Stantec recommends VGC develop a

summary schedule for all reclamation and closure research programs, as outlined in Schedule C, Condition 4.1.c. of the QML-0011. Additionally, the next iteration of the RCP should include comment on research program findings to date, and if/how this impacts the existing closure concepts for the different mine areas.

Table 58 Closure Deficiencies and Recommendations

Consistency with Requirements Gaps and/or Deficiencies	Recommendation/Corrective Action
VGC and their consultants have successfully completed revegetation efforts each year from 2019-2021. This will provide valuable information for refining site preparation, topsoil replacement and revegetation designs if proper monitoring and reporting is completed. Stantec recommends VGC consider incorporating these revegetation sites into the ongoing vegetation monitoring programs or equivalent.	Stantec recommends VGC consider incorporating the revegetation sites in a formal monitoring program to provide a consolidated location for performance results rather than a series of technical memorandums for different areas that are appended to Annual Report submissions.
Progress and success of reclamation research is difficult to discern from the reviewed documents. Although the 2020 RCP and Annual Reports identify and provide written discussion on reclamation research, items such as research task schedules, progress updates and/or key findings were not found for all reclamation research programs.	Stantec recommends VGC develop a summary schedule for all reclamation and closure research programs, as outlined in Schedule C, Condition 4.1.c. of the QML-0011. Additionally, the next iteration of the RCP should include comment on research program findings to date, and if/how this impacts the existing closure concepts for the different mine areas.

9 On Site Environmental Audit

This section presents the design intent, format, and observations/findings of the on-site Environmental Audit conducted September 28-30, 2022, at the Victoria Gold Mine in the Yukon. Conducting an Environmental Audit every two years is a requirement of Section 12.0 of Quartz Mining License QML-0011, dated June 29, 2022. The Audit was conducted by Environmental Auditor Michael Patterson B.Sc. B.Env. of Stantec.

Access to the site was via plane from Trail to Vancouver to Whitehorse to Mayo, and then by vehicle with the Corporate Environmental Manager for VGC. Prior to arrival on site, a number of required safety and training protocols from VGC were completed. Accommodations and meals were provided by VGC at their mine site Camp. On-site tours and inspections were led by the Corporate Environmental Manager, or the Environmental Manager. Tours of specific site operations were most often led by the Manager of the specific operation, with participation from Environmental personnel.

In addition to conducting the on-site audit, the on-site auditor supported the Stantec review team by responding to specific team requests for site photographs or specific site locations (i.e., GPS coordinates). Site photographs are provided in Appendix A.

A Close-out Meeting, to present the draft findings/observations was held for Mine Management on September 30th. Present at the Meeting were: Lindsay Rear, Corporate Environmental Manager, Bill Bowden, Environmental Manager, and Andrew Balance, Acting General Manager Mine Operations.

9.1 Documents Reviewed

The primary documentation, as outlined by VGC in their Audit Scope are listed below. This list is consistent with the documents listed in Section 2.0 of Quartz Mining License QML-0011.

Table 59 Environmental Protection and Environmental Permits and Management Plans

Document	Version Reviewed	Sections Applicable
Environmental Monitoring, Surveillance and Adaptive Management Plan	Version 2020-01 dated February 2020	All
Water Management Plan, 2020-01	2020-01	All
Solid Waste and Hazardous Materials Management Plan	2017-02	All
Spill Response Plan	2021-01	All
Wildlife Protection Plan	2017-01	All
Eagle Gold Mine 2020 Environmental Audit Report	November 30, 2020	All
Quartz Mining License QML-0011	June 29, 2022	All

9.2 Audit Findings

The site audit produced a total of six exception-based audit findings which are described in detail below. Exception-based audit findings are those where the practices undertaken at the site did not match the requirement of the audit criteria (those components as generally identified in sections 2 to 8 of this report).

9.2.1 Finding #1

Reclamation and Closure Plans – Section 7.2 of QML-0011 Dated June 29, 2022 requires the following: "The Licensee must submit to the Director an updated reclamation and closure plan on or before October 1st, 2016 and every two (2) years thereafter, commencing after the Effective Date of this Licence". The Effective date of the current licence is March 24, 2016. The permit identifies in Section 4.1 that the "Reclamation and Closure Plan, Version 2018-03", is the Approved Plan.

However, Section 7.2 of the License requires the submission of an updated reclamation and closure plan every two (2) years thereafter. Section 8.1 of the License requires: "the Licensee must implement each approved plan as of the date each plan becomes an approved plan" and in Section 8.2 "The Licensee must undertake reclamation at the site in accordance with the approved reclamation and closure plan."

It is unclear how VGC can achieve and implement all of the requirements of a 2018 Reclamation and Closure Plan (which predates the July 1, 2020 start of commercial production) to accommodate normal annual mining variations in production and operations.

It is understood that the Reclamation and Closure Plan RCP 2020-01 was not approved, and that RCP 2022-01 was submitted to the Yukon Department of Energy, Mines and Resources for approval October 3, 2022.

9.2.2 Finding #2

Elevated visual turbidity in Haggart Creek following rainfall event on September 29-30, 2022. As shown in Photo 14 – "Haggart Creek Below Mine – After Overnight Rainfall, with input from Site Ditching (Sept. 30, 2022)" visual observations suggest that the turbidity of the ditch effluent would be influencing the turbidity of Haggart Creek. While not a regulatory monitoring site, VGC should evaluate whether this ditch source can cause exceedances of regulatory standards downstream. It should also be noted that visual inspections of Dublin Gulch during the audit visit, upstream of mine workings, suggested that elevated turbidity upstream of mine affected disturbances was present.

9.2.3 Finding #3

The close-up photograph Photo 12 – "Coarse Sediment Buildup at Staff Gauge W-21" indicates a significant buildup of coarse material within this reach of the stream channel. This buildup of material would be expected to significantly affect any flow rating curves developed for this location. The buildup of coarse sediment would make the conversion of staff gauge readings to flows unreliable. The staff gauge should be maintained as needed.

9.2.4 Finding #4

The 2020 Annual report notes in Section 5.2.2 – Cyanide Management, that fencing would be erected to reduce Wildlife Access to the Events Pond. The 2021 Annual report notes that this fencing will be erected in 2022. As indicated in photo 24: “Eagle Pit looking West Across Eagle Creek and Dublin Gulch to Event Pond, Heap Leach Facility and ADR – dated September 29, 2022” there is no fencing erected around the pond, as of the date of the audit.

9.2.5 Finding #5

It was noted during the audit that some of the Management Plans are dated as much as five years ago (2017). Specifically, the current Wildlife Protection Plan is dated 2017-01, which predates the start of commercial production. As indicated in Schedule C, Part 1 of Quartz Mining License QML-0011, it states: “For greater certainty, if there is no approved plan that addresses the activity to be carried out, the activity cannot be carried out until a plan is approved for the conduct of the activity.” Based on information gathered during the audit, it was not evident that a schedule for updating Management Plans is in place that considers changes to mine operations and environmental conditions at the site.

9.2.6 Finding #6

Photographs 18 and 19 were taken on September 28th and 29th, respectively and show the Camp Site Gasoline and Diesel Fuel Storage Area, after a small precipitation event and during a fuel delivery operation. Adjacent to the fuel handling and storage area is a water management ditch that eventually reports to the receiving environment. Site personnel have indicated that the Storage Area was constructed with a buried liner for secondary containment of the fuel storage tanks. However, due to the general slope of the surrounding area, spillage or releases from the storage tanks or vehicles being refuelled may flow to the adjacent water management ditch, and potentially to the receiving water. This risk may be greater in winter when the ground is frozen and less permeable.

10 Summary and Recommendations

Stantec conducted this audit and prepared this report with the objective of assessing whether VGC's environmental management plans and regulatory controls set out in the Quartz Mining Licence (QML)-0011 are implemented in and about the mine, and that the environmental management systems and controls are functioning as intended.

Stantec has audited VGCs implementation of environmental and physical stability monitoring programs against the versions of the management plans, including EMSAMP, Water Management Plan and Wildlife Protection Plan, in effect during the reporting period (July 1, 2020 to June 30, 2022) for consistency with these plans and with regulatory standards and thresholds set out in these plans.

Overall, the implementation of VGC's environmental management system can be described as adequate and no immediate concerns for water quality and quantity, aquatic habitat, air quality, soils, vegetation, wildlife and wildlife habitat, stability of physical structures and waste management have been identified.

Gaps, deficiencies and recommendations for improvements discussed above are shown in Table 60 for all disciplines.

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Meteorology	
The meteorology data quality management process is unclear. Spare parts for the meteorology station should be readily available at the Eagle Gold site. The site documentation for each meteorology monitoring site should be collected and documented. Records of maintenance activities.	• Reference industry standards followed for data quality management in the next annual report. • Keep spare climate station sensors on-site for rapid deployment should sensors/equipment begin to fail, or data gaps are noted. • For each meteorology station, information should be compiled for its location, list of instrumentation, sensor height above ground, description of surrounding ground cover, description of potential biases, photos in each of the four cardinal directions. • Each station should have a logbook in which the various maintenance activities can be recorded.

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Air Quality	
The air quality data quality management process is unclear Spare parts for the air quality stations should be readily available at the Eagle Gold site The site documentation for each air quality monitoring site should be collected and documented. Records of maintenance activities Annual report was missing the results from the particulate matter metals analyses Annual report did not include the laboratory reports	• Reference industry standards followed for data quality management in the next annual report and the EMSAMP. • Keep spare parts for the air quality monitoring stations on-site for rapid deployment should sensors/equipment begin to fail, or data gaps are noted. • For each air quality monitoring station, information should be compiled for its location, list of instrumentation, sensor height above ground, description of surrounding ground over, description of potential biases, photos in each of the four cardinal directions. • Include a summary of the quarterly results for the particulate matter metals analyses in the subsequent annual reports. • Include the air quality laboratory reports as appendices to the subsequent annual reports.
Surface Water Hydrology	
EMSAMPs reference RISC (2009) as the document which was used to develop hydrology data collection. This document is out of date; Version 2.0 of that document was published in 2018.	The EMSAMP surface water hydrology program should be updated to reflect Version 2 of the hydrometric standards (RISC 2018).
The annual reports and the monthly reports do not consistently document the monitoring activities or status of each of the 29 surface water hydrology stations. Consistency with requirements can not always be determined.	Recommend including the full list of 29 sites from the EMSAMP in each of the annual and monthly reports, and summarizing the current status of each (e.g., automated monitoring ongoing, not active, not discharging, manual flow measurement collected this month). Consistency with requirements can not be determined if status is not documented.
For automated stations, winter and freshet time periods were not clearly delineated as to allow for demonstration of consistency with requirements as outlined in the EMSAMPs.	Recommend one of two changes: 1 Document approximate dates of freshet start and logger deployment each year in the monthly and annual reports to delineate winter, freshet, and open water periods (each of which have different monitoring requirements), or 2 Update the EMSAMP requirements for the freshet period to better acknowledge i) the subjectivity of determining freshet period and/or ii) the difficulty of obtaining flow measurements during freshet flows.
The EMSAMPs list general tasks to be completed at each field visit and during QA/QC (Section 2.3.1). Completion of these tasks, including grading of each hydrometric station, was discussed in general in annual reports but documentation was not provided for audit review, for each station per requirements of RISC (2018).	Provide summary information regarding the completion of the tasks and QA/QC steps associated with each field visit in the annual reports, and/or indicate (in reporting) that these data have been documented internally and are available upon request. This could be done through “station datasheets” for each of the stations, with a full station history log. Formal grading of each station (per RISC 2018) would be a good addition demonstrating QA/QC completion.

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
QA/QC related to field and analytical tasks (e.g., benchmark surveys, station condition, field processes, photos, equipment calibration) were not documented.	Recommend that QA/QC processes in accordance with Section 2.3.1 in EMSAMP 2020-01, EC 2001, RISC 2018 are documented and provided in reporting.
Surface Water Quality	
2020 Annual Report – Section 3.2.2 QA/QC Program Sample IDs.	This was corrected in the 2021 Annual Report. Continue corrective action in future reports.
Reported surface water quality detection limits did not align with the EMSAMP for hardness (0.6 mg/L reported and 0.5 mg/L in EMSAMP), total and dissolved barium (0.00010 mg/L reported and 0.00005 mg/L in EMSAMP), and total and dissolved strontium (0.0002 mg/L reported and 0.0001 mg/L in EMSAMP).	Discuss with laboratory (e.g., ALS) to reduce detection limit for the listed parameters. If the upper detection limit is not achievable a description/rationale should be included in the report and the EMSAMP be updated. I
2021 Annual Report – QA/QC total samples not consistent in report body, tables, and appendices	Review database inputs/outputs and quality review procedures and reports.
Selected Monthly Reports – Describe QA/QC data as Section 3.3.5 of the EMSAMP states QA/QC results will be reported on for each month of the sampling program.	Include tabulated results of surface water quality samples including identifying which samples are QA/QC in monthly reports.
Ground Water Quantity and Quality	
Some wells included in the monthly report are not part of the EMSAMP.	• Reporting should only include the wells listed in the EMSAMP.
Groundwater quantity and quality monitoring from some wells was performed less frequently than the schedule prescribed in EMSAMP.	• A number of factors, including those beyond the control of VGC may result in a scheduled monitoring not being performed (e.g. frozen conditions, weather, equipment malfunction, unsafe condition, construction). The monthly reporting needs to consistently provide the rationale for missed monitoring in tabular format and if any corrective action will be or has been taken. Corrective actions could include monitoring well repair, replacement, improved accessibility, etc. and should be relevant to the specific well concern.
The Q3 2020 data was not provided in the monthly reports.	• Include the Q3 2020 groundwater quantity and quality data in the monthly report.
No continuous water level data provided in monthly reports.	• VGC should consider including the continuous water level data hydrographs in the monthly reports. This would enable an ongoing analysis of groundwater levels which might identify changes which could lead to a circumstance of noncompliance with the permit. • If the continuous water level data will not be included in the monthly reports, a statement should be included indicating that the continuous water level data will be included and reviewed as part of the annual report.

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
EMSAMP (S. 5.2) presents groundwater quality parameters to be analyzed in the monitoring program. It is not clear in the monthly reports if all parameters are being analyzed.	• Review water license conditions and laboratory records to confirm if required parameters were analyzed and provide in monthly reports. • Include all analyzed parameters and laboratory reports in monthly reporting.
No data interpretation is provided in the monthly reports.	• VGC should consider completing ongoing data analysis and interpretation in their monthly reports. This will enable the early identification of any trends which could lead to a circumstance of noncompliance with the permit. • If data interpretation is not planned to be included in the monthly reports, a statement should be included indicating that data review and interpretation consistent with the requirements of the EMSAMP will be provided in the annual reports.
EMSAMP (S. 5.3.2 and 5.3.3) describes the field QA/QC program for groundwater quality monitoring, which includes collection and analysis of trip blanks, field blanks and duplicates. The field QA/QC program is not included in the monthly reports.	A statement should be included in the monthly reports that the field QA/QC program was implemented consistent with EMSAMP and a complete analysis of the QA/QC will be provided in the annual reports.
Geochemical Monitoring	
2020 and 2021 Annual Report – Sample type description of surficial material static testing for construction use	Include details on the material sample collected (i.e., surficial, or bedrock) and why these samples were collected (i.e., 1 per 100,000 m^3 material moved or distinct geological unit).
2020 and 2021 Annual Report – Appended analytical data	Include all analytical data in appendices.
2020 and 2021 Annual Report – QA/QC samples	Collect field replicate samples of operational monitoring samples, include discussion of result (including relative percent differences) in report body, and append dataset.
2020 and 2021 Annual Report – Details of blast rounds	Include details of blast rounds to demonstrate consistency with EMSAMP. Include geological logs of blast holes.
2020 Annual Report – Reported mined tonnage of previous year	Annual waste rock samples are collected based on the tonnage mined from the previous year. Recommend including previous year tonnage when describing annual waste rock samples.
2020 Annual Report – Monthly seep sample survey	Include details of monthly seep sample survey in report.
2020 and 2021 Annual Report – Shake flask extraction size fraction	Check with off-site laboratory (ALS) if shake flask extraction is conducted on <2 mm and <1 cm size fraction.
2020, 2021, and 2022 Monthly Reports – QA/QC samples	Collect field replicate samples, include relative percent differences, and discuss results in the report body. Explicitly describe which samples are duplicates of respective parent sample.

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Aquatic Resources – Benthic Macroinvertebrates Monitoring	
Multiple versions of monitoring plans may result in confusion or be a potential source of method errors.	It is recommended that the EMSAMP be updated to reflect the EEM Study Design as the current version is out of date with respect to the current study design and analytical methods for benthic invertebrate sampling.
Frequency of monitoring not discussed in EEM	EEM only describes 2021 monitoring, with no mention of what the sampling interval will be (e.g., annual, biannual)
Reporting – no indication of whether field procedures were followed as per the EEM	Provide more detail on how samples were gathered in future reports. No discussion on sampling difficulties, sources of error, or whether amendments to sampling design were done in the field.
Reporting - Lab QA/QC procedures and results – not provided in report or appendices	Provide lab QA/QC procedures and results in appendix
Data analysis – missing statistical analyses comparing sites and contemporary data to pre-construction data	Conduct (or describe if completed) the required ANOVAs and multiple comparison tests as required by the EEM
Data analysis – missing some supporting statistical analyses described in the EEM, with no comment on why it was not done	Conduct (or describe if completed) the necessary analyses or provide rationale as to why it was not done.
Reporting – only qualitative comparisons between sites and years discussed	There is sufficient data from sites and between years to conduct quantitative statistical analysis to determine significant difference between impact and reference sites and trends between years.
Reporting – no discussion of need for adaptive management actions; no statistical analyses performed to inform adaptive management	Discuss adaptive management considering quantitative analysis of site data and trend analysis
Reporting – no analysis or discussion of environmental variables or outlier effects on benthic invertebrate results.	Discuss all potential factors that may introduce error in results.
Aquatic Resources – Fish and Fish Habitat Monitoring	
Multiple versions of monitoring plans may result in confusion or be a potential source of method errors.	It is recommended that the EMSAMP be updated to reflect the EEM Study Design, as the current version is fish and fish habitat monitoring.
Field methods – additional sampling methods used, but not described in EEM	The EEM only includes electrofishing as a sampling method, but seine nets and minnow traps were used in the field. Recommend expanding the sampling methods section of the EEM to include these other methods.
Field methods – single pass open sites	Although not required by the MDMER and not a deficiency of the annual monitoring programs, multi- pass depletion estimates in closed sites would provide more accurate and repeatable results and be better for long-term monitoring and statistical analyses

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Field methods – Follow up fish and fish habitat surveys conducted in September instead of July or August when fish communities are likely more stable and fish sampling is more efficient	Although not a deficiency of the annual monitoring programs, sampling should be conducted in summer when fish community is most stable and sampling efficiency is highest.
Lab QA/QC procedures and results – not provided in report or appendices	Provide lab QA/QC procedures and results in appendix
Data analysis – missing references to completing statistical analyses comparing sites and contemporary data to pre-construction data	Conduct the required ANOVAs and multiple comparison tests as required by the EEM (e.g., append appropriate statistical analyses in excel format)
Reporting – no mention of why sampling did not occur in 2020	Speak to limitations or rationale if methods are excluded or change from the stated plan in the EEM
Reporting – only qualitative comparisons between sites and years discussed	There is sufficient data from sites and between years to conduct quantitative statistical analysis to determine significant difference between impact and reference sites and trends between years.
Reporting – no analysis or discussion of environmental variables, fish results, or outlier effects on benthic invertebrate results.	Discuss all potential factors that may introduce error or skew results.
Reporting – no mention of adaptive management trigger or threshold exceedances	Reports should specify whether any of the adaptive management thresholds in the EMSAMP/EEM were exceeded and if any of the adaptive management measures were required and implemented each year
Vegetation and Soil Monitoring	
Unclear wording of EMSAMP with respect to frequency of vegetation and soil sampling	Confirm whether both vegetation and soil sampling can be performed every two years. If acceptable by regulator adopt such a sampling and reporting frequency.
Missing concentration information in Annual Report tables and figures.	Ensure that tables and figures presenting plant metals concentrations indicate whether results are wet weight or dry weight concentrations.
The NRC (2005) MTLs used as screening benchmarks for vegetation metals concentrations only included values for mammals (cattle and rodents).	Consider including the NRC (2005) MTLs for poultry as screening benchmarks for birds.
To date the Annual Reports have focused predominantly on comparing vegetation and soil metals concentrations to benchmark levels, and have not addressed whether concentrations have increased since the mine began operating.	Consider performing a more detailed evaluation/depiction of metal concentrations in plants and soils over time via the use of statistics (examine for feasibility) and figures that differentiate results by year. Include in this comparison the historic pre-mine 2009 vegetation and soil results.
The vegetation community assessment has evaluated which species are present at each plot; however, community composition (percent cover by those species present) was not recorded.	Consider including percent cover for those species present at a plot, to possibly facilitate a more quantitative/detailed evaluation of changes in community composition over time.
Alternate species of plants have been sampled from the EMSAMPs preferred species of willow, sedge, bluejoint and northern rough fescue.	Identify a priority list of alternate species for sampling at each plot if the target species described in the EMSAMP are not available.

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Plant metals results are for unwashed samples. This makes it difficult to discern whether an increase in concentrations at a given location in a given year reflect greater bioaccumulation, or a greater amount of adhered dust and time since rainfall.	Determine the objectives of the monitoring program and adjust the field program accordingly. For the purpose of discerning if there are small statistically significant increases in plant metals concentrations over time, switch to analysis of rinsed plant samples. For the purpose of collecting data for human health and wildlife risk assessment continue to collect and analyze unwashed plant samples. Alternatively, continued to analyse unwashed samples and archive plant material for later washing and re-analysis if unwashed results indicate an increase in concentrations and one wishes to ascertain if that is due to dust adhesion versus bioaccumulation.
Soil sampling over the 0–0.5 m horizon may be too deep to detect changes in shallower soils resulting from dustfall deposition.	Soil monitoring should be expanded to include separate samples of the LFH layer and shallow mineral layer.
Wildlife Protection Monitoring	
Section 3.3 of the WPP includes a requirement to facilitate wildlife movement by providing wildlife crossing and escape points along snowbanks and open ditches. The Annual Reports do not provide information regarding how wildlife crossing points are selected, the distance between crossing points, how frequently crossing points are maintained, and what snow depth triggers the creation of crossing points in snowbanks.	Stantec recommends that the Annual Report include information on the implementation of measures listed in Section 3.3 of the WPP.
Section 3.4 of the WPP includes a requirement to complete a wildlife habitat feature survey prior to clearing activities. The Annual Reports do not provide information on the methods, types of wildlife features surveyed, survey locations, or whether this work was carried out by a qualified professional.	Stantec recommends that information on the location(s), timing, methods, and results of wildlife habitat feature surveys be included in the Annual Report.
Section 3.4 of the WPP includes a requirement to consult with the appropriate regulator (e.g., Yukon Environment, Canadian Wildlife Services) and develop management strategies if clearing activities cannot be scheduled to occur outside the breeding bird window. The annual reports do not indicate if this consultation was carried out and does not provide information on the management strategy developed.	Stantec recommends that information on regulatory consultation, and the location(s), timing, methods, and results of pre-clearing nest surveys be included in the Annual Report.

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Section 4.1 of the WPP includes a requirement to report all detections of Species at Risk to the Yukon Conservation Data Centre. Information provided in the annual and quarterly reports is insufficient to determine if this has been completed.	Stantec recommends that the Annual Report clearly indicates that this requirement has been completed.
The number of wildlife mortalities reported in the annual and quarterly reports are different, and the reports do not provide information on species, location, or possible cause of death.	Stantec recommends that wildlife mortalities be fully documented using the Wildlife Incident Form (WPP Appendix D) and the species identified by a Qualified Professional either in-person or using a photograph.
There is no linkage between the two sections of the annual report that document wildlife monitoring (Sections 3.9.4 and Section 5.2.2).	Stantec recommends that Section 3.9.4 of the Annual Report include a reference to wildlife monitoring reported in Section 5.2.2 of the Annual Report.
The locations and nature of wildlife detections as reported in the quarterly reports are not clear.	All wildlife detections should be fully documented either using the Wildlife Incident Form (WPP Appendix D) or the Wildlife Observation Form (WPP Appendix E). Stantec also recommends that location names be standardized where possible, and that coordinates of wildlife detections be recorded to allow more accurate mapping of wildlife detections.
Permafrost Monitoring	
Regular Visual Inspections not documented or reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from regular visual inspections to identify and quantify any deformation associated with melting of permafrost, such as but not limited to, cracks, subsidence, sinkholes, and sloughing on existing foundations and slope overlay permafrost. Summarize those visual inspections executed during the freshet, prolonged rainy periods, and rising trend in any thermistors.
Thermistor BH-BGC11-42 in the 2020 Q4 (November 2020) quarterly report and thermistor BH-BGC10-7 in the 2021 Q3 (July 2021) quarterly report not included in summary tables of quarterly readings.	Include reasoning for missed readings if none were taken for that quarterly period.
Open Pit Monitoring	
Daily visual inspections not reported.	Include an appendix in Annual and Monthly reporting that documents the results of daily visual inspections as per EMSAMP. VGC Annual reports state full visual inspections are completed on a weekly basis; however, EMSAMP states visual inspections of open pit slopes are to completed daily and to be documented in shift log reports, along with daily and weekly records.

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Piezometers installed within the pit location (DEEP-08, DEEP-06, and DEEP-04) and documented in section 4.1 (Eagle Pit) of the 2021 annual report, are not documented in section 3.4 (Groundwater) where groundwater well monitoring is documented. These pit piezometers are also not documented in the monthly reports as well the EMSAMP document.	Provide dates of commissioning and relevant information of new and existing piezometers in all applicable sections of the annual and monthly reports. Update EMSAMP revision to show relevant piezometers.
Data for two (2) extensometers, (Extensometers 3 and 4) installed on SB8 instability are not reported in the 2020 annual report.	Provide dates of commissioning and decommissioning for all instrumentation in annual and monthly reports.
There are multiple instrumentation types listed in EMSAMP documentation that monitor displacement in various forms. Currently prisms and extensometers are serving this purpose and others are deemed not required due to normal operating (stable) conditions (robotic theodolites, TDR cables, slope inclinometers, fixed slope radar, mobile slope radar).	Modify the EMSAMP, or provide cross references to other VGC materials, to identify the displacement monitoring instrumentation to be used for normal operating (stable) conditions and instrumentation to be used for unstable conditions or as contingency to existing instrumentation.
Materials Storage and Stockpile Management Areas Monitoring	
It is unclear whether daily WRSA crest inspections, weekly WRSA toe and developing stockpile inspections, monthly established stockpile and detailed WRSA inspections are being executed. Records specifying visual and drone inspections of structures are to be maintained along with daily and weekly records detailing the location and type of materials placed in the WRSAs, as per EMSAMP.	Include an appendix in Annual and Monthly reporting that summarizes frequencies and all the visual observations made on stockpile structures.
Stantec understands that piezometer MW19-PGW1b was damaged and intended to be fixed in 2021. The status of this piezometer was not reported in the Q3 2020 (August monthly report) and Q2 2022 (April monthly report).	Include status of broken piezometers in all monthly reports if not decommissioned.
Piezometer MW19-EPW1b reading in Q1 of 2021 (February monthly report) was missed in monthly report without reasoning.	Provide reasoning for missed piezometer readings.
Though not built to full specification, the WRSA rock drains are operational, and it is unclear if they are being inspected weekly as per EMSAMP.	Conduct and provide weekly inspection records of the WRSA rock drain discharge areas in the monthly or annual reports.
Follow up and close out of physical stability recommendations 1, 2 and 5 not documented in annual or monthly reports.	Provide documentation detailing the follow up and response actions for addressing recommendations.

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Heap Leach Facility Monitoring	
Routine (visual) inspections (daily, weekly) not reported. It is unclear if all visual inspections are completed for all components of the HLF at their required frequency based on the annual and monthly reports.	Include an appendix in Annual and Monthly reporting that summarizes the observations from visual inspections.
Based on the 2021 annual report, three Vibrating Wire Piezometers (VWPs) installed in the In-Heap Pond, appear to be collecting data, but it is unclear if they are being monitored continuously. These piezometers, along with the embankment piezometers (P1, P2 and P3) are not included in the EMSAMP revision.	Provide continuous data plots of In-Heap piezometers in monthly and annual reports. Include records of In-Heap and embankment piezometers in the next EMSAMP revision.
The following piezometers/groundwater wells listed in EMSAMP are not reported in the annual or monthly reports due to being installed in Q3 2022: MWXX-AGR6, MW10-AG3A, MWXX-HLF2a, MWXX-HLF2b, MWXX-HLF3a, MWXX-HLF3b, MWXX-HL4a, MWXX-HLF4b.	Provide documentation of piezometers that are still to be installed in the monthly and annual reports, listed in the EMSAMP. Update the EMSAMP as required.
Records of pregnant and barren solution sampling not available in monthly and annual reports.	Include documentation of pregnant and barren solution sampling in the geochemical sampling sections of the monthly and annual reports.
Follow up and close out of physical stability recommendation 3, 7 and 8 not documented in annual or monthly reports.	Provide documentation detailing the follow up and response actions for addressing recommendation.
Waste Management	
Burn Log miss time information occasionally	Management should periodically check logs and address missing information.
Sorting of hazardous waste repeatedly found unsatisfactory	The Solid Waste and Hazardous Materials Management Plan should be reviewed and sections relevant to hazardous waste management updated.
Sorting of non-hazardous waste repeatedly found unsatisfactory	The Solid Waste and Hazardous Materials Management Plan should be reviewed and sections relevant to non-hazardous solid waste management updated
Spill Response	
Two spill reports did not indicate if spill line was called	Management should review reports and address missing information.
Process solution spilled outside the heap leach containment area	Monitor the effectiveness of the mitigation measures already put in place.
Number of oil spills increased in first half of 2022	Provide additional spill prevention training.

Table 60 Summary of Findings

Consistency with requirements Gaps and/or Deficiencies	Recommendations
Closure	
VGC and their consultants have successfully completed revegetation efforts each year from 2019-2021. This will provide valuable information for refining site preparation, topsoil replacement and revegetation designs if proper monitoring and reporting is completed. Stantec recommends VGC consider incorporating these revegetation sites into the ongoing vegetation monitoring programs or equivalent.	Stantec recommends VGC consider incorporating the revegetation sites in a formal monitoring program to provide a consolidated location for performance results rather than a series of technical memorandums for different areas that are appended to Annual Report submissions.
Progress and success of reclamation research is difficult to discern from the reviewed documents. Although the 2020 RCP and Annual Reports identify and provide written discussion on reclamation research, items such as research task schedules, progress updates and/or key findings were not found for all reclamation research programs.	Stantec recommends VGC develop a summary schedule for all reclamation and closure research programs, as outlined in Schedule C, Condition 4.1.c. of the QML-0011. Additionally, the next iteration of the RCP should include comment on research program findings to date, and if/how this impacts the existing closure concepts for the different mine areas.

11 Closure and Limitations

Stantec has compiled this report for the 2022 Environmental Audit of the Eagle Gold Mine as required by Condition 12.0 of the mine's Quartz Mining Licence QML-0011 issued by the Government of Yukon. Stantec makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and referred to or utilized in the preparation of this report was assumed by Stantec to be accurate. The audit was undertaken exclusively for the purpose outlined herein and was limited to those details specifically referenced in this memo. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. If there are questions or comments regarding this work, please contact the undersigned.

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APPENDIX A

Appendix A Site Audit Photographs

A.1 Air Quality and Weather Monitoring

Photo 1 **Air Quality Monitoring Station AQ2 – (Outside of Building) – Near Eagle Creek**

September 29, 2022

Photo 2 **Air Quality Monitoring Station AQ2 –(Inside of Building) – Near Eagle Creek**

September 29, 2022

Photo 3 **Camp Meteorological Station – MET-1**

Near Eagle Creek

Photo 4 **Potato Hills Air Quality Station AQ-1**

September 29, 2022

Photo 5 **PASS – Passive Air Sampling System**

Located in Exploration Area East of Victoria Gold Mine Operation.

September 29, 2022

Photo 6 **MAPTREK Sentry Lightning Detection System, Showing Sensor**

Location – Above Eagle Pit

September 29, 2022

A.2 Hydrology Monitoring

Photo 7 **Station Marker W4 for Haggart Creek below Dublin Gulch**

September 29, 2022

Photo 8 **Staff Gauge for Site W4 on Haggard Creek below Dublin Gulch Confluence**

September 29, 2022

Photo 9 **Station Marker W4-Mix for Site Haggart Creek Mixing Zone below Dublin Gulch**

September 29, 2022

Photo 10 **Station Marker W21 for Dublin Gulch below Events Pond**

September 29, 2022

Photo 11 **Staff Gauge at Station W21 (Dublin Gulch below Events Pond). Note buildup of coarse gravels within stream channel**

September 29, 2022

Photo 12 **Close-up of Coarse Sediment Buildup at Staff Gauge W-21 (Dublin Gulch below Events Pond)**

September 29, 2022

Photo 13 **Haggart Creek Below Mine near Station W4– After Overnight Rainfall, with input from Site Ditching**

September 30, 2022

Photo 14 **Dublin Gulch Upstream Reference Station W1. Turbid water following overnight rainfall**

September 30, 2022

Photo 15 **Dublin Gulch at W1-Upstream of Mine – following overnight rainfall**

September 30, 2022

Photo 16 **Sediment Control Ponds south of Eagle Pup Waste Rock Storage Area and Dublin Gulch**

September 28, 2022

A.3 Fuel Handling and Storage

Photo 17 **Gasoline and Diesel Fuel Storage Tanks. Note drainage ditch beyond tanks on photo right-centre**

September 28, 2022

Photo 18 **Diesel Fuel Delivery to Storage Tank. Note drainage ditch just ahead of truck, no secondary containment**

September 29, 2022

A.4 Inert Waste Storage

Photo 19 **Eagle Pit – Entrance to Inert Waste Storage Area**

September 28, 2022

Photo 20 **Eagle Pit – Inert Waste Storage Area**

September 28, 2022

A.5 Mining Operations

Photo 21 **Eagle Pit showing Blasting and Drilling Pattern**

September 29, 2022

Photo 22 **Eagle Pit Showing Stockpile Area**

September 29, 2022

Photo 23 **Eagle Pit Looking West Across Eagle Creek and Dublin Gulch to Event Pond, Heap Leach Facility, and ADR**

September 29, 2022

Photo 24 **Heap Leach Facility (HLF) Phase 1 – Note Sprinklers in HLF, and Primary Crusher in Background**

September 28, 2022

Photo 25 **HLF Under Construction, Looking south-southwest from South End of Phase 3**

September 28, 2022

Photo 26 **Heap Leach Facility (HLF) Phase 2 – Looking East from south end of Phase 3**

September 28, 2022

Photo 27 **Heap Leach Facility Underdrain Collection System**

September 30, 2022

Table 1: Third Party Audit Findings and Victoria Gold Response

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
METEOROLOGY		
The meteorology data quality management process is unclear. Spare parts for the meteorology station should be readily available at the Eagle Gold site. The site documentation for each meteorology monitoring site should be collected and documented. Records of maintenance activities.	• Reference industry standards followed for data quality management in the next annual report. • Keep spare climate station sensors on-site for rapid deployment should sensors/equipment begin to fail, or data gaps are noted. • For each meteorology station, information should be compiled for its location, list of instrumentation, sensor height above ground, description of surrounding ground cover, description of potential biases, photos in each of the four cardinal directions. • Each station should have a logbook in which the various maintenance activities can be recorded.	Future Annual Reports will reference any relevant industry standards followed for data quality management. Service personnel from the manufacturer (Campbell Scientific) are engaged on an annual basis to perform maintenance and calibration on both the Camp and Potato Hills weather stations. This professional service, which includes sensor testing and replacement as necessary, ensures that the weather stations are working optimally for the majority of the year. Additionally, a supply of spare sensors that do not require manufacturer expertise to replace (i.e., temperature and pressure) are kept on site for installation by VGC personnel. These sensors are utilized to supplement periods when weather station dedicated sensors are malfunctioning. Standard sensors for the weather stations require proprietary expertise to install and require a visit from Campbell Scientific. A maintenance log to compliment the annual Campbell Scientific maintenance report will be developed and kept moving forward. VGC will consider the inclusion of a general description and photo record of the station to provide an easy reference for the station condition for new/unfamiliar staff in the maintenance log.
AIR QUALITY		
The air quality data quality management process is unclear. Spare parts for the air quality stations should be readily available at the Eagle Gold site. The site documentation for each air quality monitoring site should be collected and documented. Records of maintenance activities. Annual report was missing the results from the particulate matter metals analyses. Annual report did not include the laboratory reports.	• Reference industry standards followed for data quality management in the next annual report and the EMSAMP. • Keep spare parts for the air quality monitoring stations on-site for rapid deployment should sensors/equipment begin to fail, or data gaps are noted. • For each air quality monitoring station, information should be compiled for its location, list of instrumentation, sensor height above ground, description of surrounding ground over, description of potential biases, photos in each of the four cardinal directions. • Include a summary of the quarterly results for the particulate matter metals analyses in the subsequent annual reports. • Include the air quality laboratory reports as appendices to the subsequent annual reports.	Future Annual Reports and updates to the EMSAMP will reference any relevant industry standards followed for data quality management. VGC has an air quality management plan that outlines monitoring methodologies on site. It incorporates standard operating procedures and operating manuals that include QA/QC and calibration methodologies for air quality monitoring devices on the Project. Regular calibrations are performed on the continuous air quality monitors and repairs are actioned as necessary As with the climate station maintenance program, the third-party equipment supplier (ADVM) is contracted by VGC to perform regular site visits to evaluate the operation of air quality monitoring equipment on the Project. The service agreement with ADVM also includes data QA/QC and validation on continuous air quality data on a monthly, quarterly, and annual basis. The expertise required to install and repair air quality monitoring devices on the project means site visits from a subject expert are necessary. These site visits include supplying all spare parts necessary to ensure the continued operation of the monitoring equipment thus keeping spare parts on the Project site are considered unnecessary. A maintenance log will be developed and kept moving forward. VGC will consider the inclusion of a general description and photo record of the station to provide an easy reference for the station condition for new/unfamiliar staff in the maintenance log. Quarterly metals results are presented in monthly water licence reports as well as quarterly air quality reports. The selection of Monthly Reports reviewed for the purposes of auditing the air quality monitoring program are assumed to have not included the

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
		specific Monthly Reports that would have provided the auditor with this information. The review of the quarterly air quality reports required under the Air Emissions Permit was not within the scope of the Environmental Audit. VGC practice has been to not include laboratory reports as an appendix to the Annual Report if the laboratory data had already been provided in the Monthly Reports submitted to regulators.
SURFACE WATER HYDROLOGY		
EMSAMPs reference RISC (2009) as the document which was used to develop hydrology data collection. This document is out of date; Version 2.0 of that document was published in 2018.	• The EMSAMP surface water hydrology program should be updated to reflect Version 2 of the hydrometric standards (RISC 2018).	VGC will review the updated standard and determine if it provides greater clarity or guidance for current monitoring practices and modify the program, and the ESMAMP, as necessary.
The annual reports and the monthly reports do not consistently document the monitoring activities or status of each of the 29 surface water hydrology stations. Consistency with requirements can not always be determined.	• Recommend including the full list of 29 sites from the EMSAMP in each of the annual and monthly reports, and summarizing the current status of each (e.g., automated monitoring ongoing, not active, not discharging, manual flow measurement collected this month). Consistency with requirements can not be determined if status is not documented.	VGC provides data for all hydrology monitoring stations that are active in the Monthly and Annual Reports. As stations become active due to infrastructure development, they are added to the reporting structure. Currently VGC reports on 22 of the 29 surface water hydrology stations; the remaining sites will be added as they become active.
For automated stations, winter and freshet time periods were not clearly delineated as to allow for demonstration of consistency with requirements as outlined in the EMSAMPs.	Recommend one of two changes: 1 Document approximate dates of freshet start and logger deployment each year in the monthly and annual reports to delineate winter, freshet, and open water periods (each of which have different monitoring requirements), or 2 Update the EMSAMP requirements for the freshet period to better acknowledge i) the subjectivity of determining freshet period and/or ii) the difficulty of obtaining flow measurements during freshet flows.	The occurrence of freshet is not uniform across the site and the timing of onset is specific to each hydrometric station, which reflects a strong aspectual and physiographic influence on the duration, intensity, and timing of snowmelt. Further, the determination of the onset of freshet is subjective, as melt may occur rapidly or episodic (due to cold snaps and refreezing). In general, based on regular reconnaissance of the stream reaches during April, the hydrometric stations are deployed as soon as possible (once the station is essentially ice-free and when there are minimal effects of channel-ice on water levels); thus, the onset of freshet can be assumed to coincide with the deployment of loggers. To meet licence conditions, our opinion of the onset of freshet for each hydrograph will be annotated on the figures. The EMSAMP will be updated to reflect the subjectivity of determining freshet. In general, as noted in the EMSAMP, flows are obtained if they can be measured in a safe manner.
The EMSAMPs list general tasks to be completed at each field visit and during QA/QC (Section 2.3.1). Completion of these tasks, including grading of each hydrometric station, was discussed in general in annual reports but documentation was not provided for audit review, for each station per requirements of RISC (2018).	• Provide summary information regarding the completion of the tasks and QA/QC steps associated with each field visit in the annual reports, and/or indicate (in reporting) that these data have been documented internally and are available upon request. This could be done through “station datasheets” for each of the stations, with a full station history log. Formal grading of each station (per RISC 2018) would be a good addition demonstrating QA/QC completion.	Section 2.3.1 within the EMSAMP outlines 7 tasks to be performed during site visits. Currently all of these tasks are completed as required. It is acknowledged that the field monitoring sheets and the hydrology monthly tracker document do not explicitly document the completion of these tasks. VGC will add a maintenance log to its tracking files to document issues encountered and repairs. Currently maintenance activities are documented within field sheets.
QA/QC related to field and analytical tasks (e.g., benchmark surveys, station condition, field processes, photos, equipment calibration) were not documented.	• Recommend that QA/QC processes in accordance with Section 2.3.1 in EMSAMP 2020-01, EC 2001, RISC 2018 are documented and provided in reporting.	Hydrology data (measurement panels, photos, station condition, etc.) is documented in field monitoring sheets. A summary of benchmark surveys, QA/QC and maintenance recommendations will be included in the Annual Report. All hydrology data is reviewed on a monthly and annual basis and hydrographs are professionally produced by a consulting hydrologist on an annual basis.
SURFACE WATER QUALITY		
2020 Annual Report – Section 3.2.2 QA/QC Program Sample IDs.	• This was corrected in the 2021 Annual Report. Continue corrective action in future reports.	This recommendation will be actioned by VGC in future reporting.

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
Reported surface water quality detection limits did not align with the EMSAMP for hardness (0.6 mg/L reported and 0.5 mg/L in EMSAMP), total and dissolved barium (0.00010 mg/L reported and 0.00005 mg/L in EMSAMP), and total and dissolved strontium (0.0002 mg/L reported and 0.0001 mg/L in EMSAMP).	• Discuss with laboratory (e.g., ALS) to reduce detection limit for the listed parameters. If the upper detection limit is not achievable a description/rationale should be included in the report and the EMSAMP be updated.	VGC will engage ALS to determine if the ALS method detection limits currently utilized are industry standard and sufficiently below any applicable water quality objectives, in which case the revised EMSAMP will reflect this; if the current detection limits are not sufficiently below applicable water quality objectives, then VGC will request that ALS decrease their detection limits.
2021 Annual Report – QA/QC total samples not consistent in report body, tables, and appendices	• Review database inputs/outputs and quality review procedures and reports.	This recommendation will be actioned by VGC in future reporting.
Selected Monthly Reports – Describe QA/QC data as Section 3.3.5 of the EMSAMP states QA/QC results will be reported on for each month of the sampling program.	• Include tabulated results of surface water quality samples including identifying which samples are QA/QC in monthly reports.	VGC appends QA/QC sample results to the monthly reports utilizing identifying codes to determine the type of QA/QC and are thus considered to be reported on. The approach, results and discussion related to the program is then provided as an appendix to the Annual Report and is prepared by a third-party consultant. VGC considers this approach to be consistent with the intention of the EMSAMP.
GROUND WATER QUANTITY AND QUALITY		
Some wells included in the monthly report are not part of the EMSAMP.	• Reporting should only include the wells listed in the EMSAMP.	VGW will ensure that only wells relevant to the EMSAMP are included in Monthly and Annual Reports.
Groundwater quantity and quality monitoring from some wells was performed less frequently than the schedule prescribed in EMSAMP.	• A number of factors, including those beyond the control of VGC may result in a scheduled monitoring not being performed (e.g. frozen conditions, weather, equipment malfunction, unsafe condition, construction). The monthly reporting needs to consistently provide the rationale for missed monitoring in tabular format and if any corrective action will be or has been taken. Corrective actions could include monitoring well repair, replacement, improved accessibility, etc. and should be relevant to the specific well concern.	VGC will provide rationale within Monthly Reports for scheduled groundwater well monitoring events that do not occur as prescribed in the EMSAMP. These notes will be made in the comments section of each summary table provided in Monthly Reports.
The Q3 2020 data was not provided in the monthly reports.	• Include the Q3 2020 groundwater quantity and quality data in the monthly report.	It is believed that the information reviewed by the auditor did not include the specific monthly report in which this data was provided. The Q3 groundwater quality information and COAs were included in the September 2020 Monthly Report.
No continuous water level data provided in monthly reports.	• VGC should consider including the continuous water level data hydrographs in the monthly reports. This would enable an ongoing analysis of groundwater levels which might identify changes which could lead to a circumstance of noncompliance with the permit. • If the continuous water level data will not be included in the monthly reports, a statement should be included indicating that the continuous water level data will be included and reviewed as part of the annual report.	There is no specific permit requirement related to a change in groundwater levels on the mine site. Further, VGC believes that consideration of this data on an annual basis is more appropriate given that changes in surface water flows are reviewed monthly and significant changes that cannot be explained either by precipitation trends or project discharges would then trigger an analysis of potential groundwater flow impacts. VGC will review and incorporate continuous water level data and hydrographs into the Annual Report, as has been done in previous years and will reference that this will be done in each Monthly Report.
EMSAMP (S. 5.2) presents groundwater quality parameters to be analyzed in the monitoring program. It is not clear in the monthly reports if all parameters are being analyzed.	• Review water license conditions and laboratory records to confirm if required parameters were analyzed and provide in monthly reports. • Include all analyzed parameters and laboratory reports in monthly reporting.	VGC has a groundwater ALS analyses package that is tailored to ensuring the EMSAMP required analytes are taken. VGC will continue to provide COA results within Monthly Reports when groundwater quality sampling is undertaken.
No data interpretation is provided in the monthly reports.	• VGC should consider completing ongoing data analysis and interpretation in their monthly reports. This will enable the early identification of any trends which could lead to a circumstance of noncompliance with the permit. • If data interpretation is not planned to be included in the monthly reports, a statement should be included indicating that data review and interpretation consistent with the requirements of the EMSAMP will be provided in the annual reports.	Currently analysis of groundwater data occurs within the Annual Report. Data interpretations on a monthly basis is a future goal of VGC as resources allow.

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
EMSAMP (S. 5.3.2 and 5.3.3) describes the field QA/QC program for groundwater quality monitoring, which includes collection and analysis of trip blanks, field blanks and duplicates. The field QA/QC program is not included in the monthly reports.	• A statement should be included in the monthly reports that the field QA/QC program was implemented consistent with EMSAMP and a complete analysis of the QA/QC will be provided in the annual reports.	This recommendation will be actioned by VGC in future reporting.
GEOCHEMICAL MONITORING		
2020 and 2021 Annual Report – Sample type description of surficial material static testing for construction use.	• Include details on the material sample collected (i.e., surficial, or bedrock) and why these samples were collected (i.e., 1 per 100,000 m^3 material moved or distinct geological unit).	This recommendation will be actioned by VGC in future reporting.
2020 and 2021 Annual Report – Appended analytical data.	• Include all analytical data in appendices.	VGC provides this data within Monthly Reports; the practice has been that if analytical data has been provided each monthly then it is not necessary to provide again with the Annual Report
2020 and 2021 Annual Report – QA/QC samples.	• Collect field replicate samples of operational monitoring samples, include discussion of result (including relative percent differences) in report body, and append dataset.	VGC performs a QA/QC monitoring plan for all blast hole chip composite samples. The Technical Services Department takes blanks and duplicates at a rate of ~ 17% of all samples which is well above Industry Standard. VGC commits to developing a QA/QC plan for construction rock and waste rock characterization programs
2020 and 2021 Annual Report – Details of blast rounds.	• Include details of blast rounds to demonstrate consistency with EMSAMP. Include geological logs of blast holes.	Details are maintained on lithology and physical characteristics of blast rounds in five distinct categories that are related to metasediments and granodiorite. These records can be provided upon request however VGC believes presenting them in the Annual Report provides no significant value or context for the results.
2020 Annual Report – Reported mined tonnage of previous year.	• Annual waste rock samples are collected based on the tonnage mined from the previous year. Recommend including previous year tonnage when describing annual waste rock samples.	The section in future Annual Reports providing details regarding waste rock geochemical sampling will include the total tonnage of waste mined to ensure that it is clear whether EMSAMP specified sampling frequency has been achieved.
2020 Annual Report – Monthly seep sample survey.	• Include details of monthly seep sample survey in report.	To date, except for the flow from the rock drains, seeps emanating from the WRSAs have not been observed. Water samples are collected downstream of the toes of the WRSA, after flows from the rock drain have emerged from the toe of the dumps. Weekly drone inspections occur at the PG and EP WRSA to evaluate potential changing conditions including those related to seepage related instabilities. Details of these observations, when coupled with drone imagery analysis, is impractical to provide on a monthly basis; However, VGC will work towards including more detail regarding seep surveys in Annual Reports.
2020 and 2021 Annual Report – Shake flask extraction size fraction.	• Check with off-site laboratory (ALS) if shake flask extraction is conducted on <2 mm and <1 cm size fraction.	VGC will engage ALS to determine methodology of Shake flask extraction testing.
2020, 2021, and 2022 Monthly Reports – QA/QC samples.	• Collect field replicate samples, include relative percent differences, and discuss results in the report body. Explicitly describe which samples are duplicates of respective parent sample.	QA/QC samples are collected at a rate above industry standard for blast hole chip composite samples. VGC commits to performing QA/QC samples on waste rock characterization and construction rock samples. QA/QC samples will be noted within the Monthly Reports starting 2023.
AQUATIC RESOURCES – BENTHIC MACROINVERTIBRATES MONITORING		
Multiple versions of monitoring plans may result in confusion or be a potential source of method errors.	• It is recommended that the EMSAMP be updated to reflect the EEM Study Design as the current version is out of date with respect to the current study design and analytical methods for benthic invertebrate sampling.	The EMSAMP will be updated to provide more detail on sampling methods as per the EEM study submitted, including frequency of monitoring, methodologies and potential sources of error. EEM study designs are submitted and monitoring is performed on a three year schedule. This replaces the methodologies and frequencies outlined in the EMSAMP.
Frequency of monitoring not discussed in EEM.	• EEM only describes 2021 monitoring, with no mention of what the sampling interval will be (e.g., annual, biannual).	

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
Reporting – no indication of whether field procedures were followed as per the EEM.	• Provide more detail on how samples were gathered in future reports. No discussion on sampling difficulties, sources of error, or whether amendments to sampling design were done in the field.	The methodologies sections of the EEM report discusses monitoring methodologies. Pertinent sampling difficulties did not exist with the exception of grayling presence in Spring. Sources of error (i.e., water velocity and sampling substates of similar characteristics) were discussed within the Interpretative Monitoring Report. It is acknowledged that the full report was not included within the 2021 Annual Report; however, the completion of the report, in accordance with the MDMER, occurred after the submission deadline for the WUL/QML Annual Report and it will be provided in the 2022 Annual Report.
Reporting – Lab QA/QC procedures and results – not provided in report or appendices.	• Provide lab QA/QC procedures and results in appendix.	Lab QA/QC procedures are documented within Appendix C of the first Interpretative Monitoring Report submitted to Environment and Climate Change Canada (ECCC) and will be included within the 2022 Annual Report.
Data analysis – missing statistical analyses comparing sites and contemporary data to pre-construction data.	• Conduct (or describe if completed) the required ANOVAs and multiple comparison tests as required by the EEM.	This is not a requirement of the submitted Study Design. This is the first EEM and the design and methodology was approved under the submitted design to ECCC. There were no previous EEM studies to compare data; previous studies were not completed under the same methodology. Statistical analyses are not required under the MDMER however qualitative comparisons were performed.
Data analysis – missing some supporting statistical analyses described in the EEM, with no comment on why it was not done.	• Conduct (or describe if completed) the necessary analyses or provide rationale as to why it was not done.	Analyses stated in the methodology section of the Interpretative Report as well as the Study Design document were completed and reported on. Data is presented is Section 5 and Appendix C of the first Interpretative Monitoring Report.
Reporting – only qualitative comparisons between sites and years discussed.	• There is sufficient data from sites and between years to conduct quantitative statistical analysis to determine significant difference between impact and reference sites and trends between years.	It is not a requirement to perform temporal statistical analyses under the MDMER. The differences between methodologies for programs prior to official EEMs is different than EEM monitoring methodologies. Once VGC has initiated the second Project EEM under similar methodologies, VGC will engage the selected external consultant to evaluate the merit of comparing results between study timeframes as opposed to reference and exposure study design.
Reporting – no discussion of need for adaptive management actions; no statistical analyses performed to inform adaptive management	• Discuss adaptive management considering quantitative analysis of site data and trend analysis	The EEM Study Design replaced the EMSAMP methodologies once the MDMER and EEM program timelines were triggered. Adaptive management actions follow MDMER protocols. If two EEM studies exhibit differences between reference and exposure sites then the third study design is regulated and prescribed by ECCC to determine potential causes. ECCC makes decisions and recommendations for the Project to mitigate and manage effects being observed. Potential effects and differences between reference and exposure sites observed were not attributed to Mine related influences. Further discussions and summaries will be presented within the 2022 Annual Report and will be discussed in relation to management practices laid out within the EMSAMP.
Reporting – no analysis or discussion of environmental variables or outlier effects on benthic invertebrate results.	• Discuss all potential factors that may introduce error in results.	In situ measurements were performed during sampling. Section 4 (in situ WQ comparisons) and Appendix C of the first Interpretative Monitoring Report states the habitat characteristics and an analysis performed to compare in situ water quality and habitat characteristics.
AQUATIC RESOURCES – FISH AND FISH HABITAT MONITORING		
Multiple versions of monitoring plans may result in confusion or be a potential source of method errors.	• It is recommended that the EMSAMP be updated to reflect the EEM Study Design, as the current version is fish and fish habitat monitoring.	This recommendation will be actioned by VGC in the next iteration of the EMSAMP.
Field methods – additional sampling methods used, but not described in EEM	• The EEM only includes electrofishing as a sampling method, but seine nets and minnow traps were used in the field. Recommend expanding the sampling methods section of the EEM to include these other methods.	Moving forward seine netting will not be used as it was determined it was not effective at collecting fish. Potential Minnow traps use was outlined in section 2.4.2 of the Interpretative Monitoring Report.

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
Field methods – single pass open sites	• Although not required by the MDMER and not a deficiency of the annual monitoring programs, multi- pass depletion estimates in closed sites would provide more accurate and repeatable results and be better for long-term monitoring and statistical analyses	High flows experienced in spring precludes this type of monitoring study due to deep and fast moving water. Water velocity and turbid conditions complicate closed station methodologies and present health and safety concerns and thus were determined to be inappropriate for the study design.
Field methods – Follow up fish and fish habitat surveys conducted in September instead of July or August when fish communities are likely more stable and fish sampling is more efficient	• Although not a deficiency of the annual monitoring programs, sampling should be conducted in summer when fish community is most stable and sampling efficiency is highest.	The timing of the fish surveys will be re-examined in the second EEM study design submission. Sexually major endpoints must be collected in spring for Sculpin. Since Grayling were not captured in spring, VGC discussed with ECCC and went above and beyond industry standard to perform a second grayling monitoring program in fall which, based on previous studies, is the most likely timing to find Grayling within Haggart Creek.
Lab QA/QC procedures and results – not provided in report or appendices	• Provide lab QA/QC procedures and results in appendix	Appendix B of the EEM Interpretative Monitoring Report documents QA/QC procedures and results. This information will be provided in the 2022 Annual Report for the QML and WUL.
Data analysis – missing references to completing statistical analyses comparing sites and contemporary data to pre-construction data	• Conduct the required ANOVAs and multiple comparison tests as required by the EEM (e.g., append appropriate statistical analyses in excel format)	There was not enough data for statistically significant sculpin comparisons due to the sample size from previous monitoring. This is not a requirement of MDMER and comparisons between historical non EEM studies is difficult to perform due to differing methodologies.
Reporting – no mention of why sampling did not occur in 2020	• Speak to limitations or rationale if methods are excluded or change from the stated plan in the EEM	It is acknowledged that the EMSAMP included consideration of sampling in 2020; however, the EEM Study Design was finalized after the EMSAMP effective date and subsequently updated the sampling schedule so that it was initiated in 2021.
Reporting – only qualitative comparisons between sites and years discussed	• There is sufficient data from sites and between years to conduct quantitative statistical analysis to determine significant difference between impact and reference sites and trends between years.	As discussed above in the benthics section, methods and frequency between historical EMSAMP monitoring programs and EEM study designs do not follow the same methodologies lending low merit to statistically significant comparisons. Qualitative comparisons were performed to provide possible commentary on the data sets.
Reporting – no analysis or discussion of environmental variables, fish results, or outlier effects on benthic invertebrate results.	• Discuss all potential factors that may introduce error or skew results.	Water quality and quantity were discussed as potential skewing variables. Fish results are discussed in section 6 of the EEM Interpretative Monitoring Report. The methodology section of the report also reviews variables used in the analyses. Habitat variables in the future could be flushed out for future considerations.
Reporting – no mention of adaptive management trigger or threshold exceedances	• Reports should specify whether any of the adaptive management thresholds in the EMSAMP/EEM were exceeded and if any of the adaptive management measures were required and implemented each year	Potential required management actions, outlined in the EMSAMP, resultant of findings in the EEM interpretative report will be discussed in the 2022 Annual Report. The EEM Interpretative Report utilizes critical effect sizes to inform on results and potential required management actions related to the MDMER. MDMER triggers such as differences to age, growth, reproduction and liver size are used to trigger further studies. Fish Condition related to body weight and length also have the potential to trigger further studies.
VEGETATION AND SOIL MONITORING		
Unclear wording of EMSAMP with respect to frequency of vegetation and soil sampling	• Confirm whether both vegetation and soil sampling can be performed every two years. If acceptable by regulator adopt such a sampling and reporting frequency.	This recommendation will be actioned by VGC in the next iteration of the EMSAMP. Currently vegetation monitoring occurs on an annual basis while soil sampling occurs once every two years.
Missing concentration information in Annual Report tables and figures.	• Ensure that tables and figures presenting plant metals concentrations indicate whether results are wet weight or dry weight concentrations.	This recommendation will be actioned by VGC in the next Annual Report.
The NRC (2005) MTLs used as screening benchmarks for vegetation metals concentrations only included values for mammals (cattle and rodents).	• Consider including the NRC (2005) MTLs for poultry as screening benchmarks for birds.	This recommendation will be discussed with the professional conducting vegetation sampling and, if deemed appropriate, comparisons to the poultry benchmarks will be added.

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
To date the Annual Reports have focused predominantly on comparing vegetation and soil metals concentrations to benchmark levels, and have not addressed whether concentrations have increased since the mine began operating.	• Consider performing a more detailed evaluation/depiction of metal concentrations in plants and soils over time via the use of statistics (examine for feasibility) and figures that differentiate results by year. Include in this comparison the historic pre-mine 2009 vegetation and soil results.	VGC will endeavor to include this analysis within future monitoring programs.
The vegetation community assessment has evaluated which species are present at each plot; however, community composition (percent cover by those species present) was not recorded.	• Consider including percent cover for those species present at a plot, to possibly facilitate a more quantitative/detailed evaluation of changes in community composition over time.	VGC will engage the qualified external professional performing the monitoring and request that they evaluate if this metric will provide merit to results.
Alternate species of plants have been sampled from the EMSAMPs preferred species of willow, sedge, bluejoint and northern rough fescue.	• Identify a priority list of alternate species for sampling at each plot if the target species described in the EMSAMP are not available.	VGC will engage the qualified external professional performing the monitoring and request that they identify a list of alternate species for sampling.
Plant metals results are for unwashed samples. This makes it difficult to discern whether an increase in concentrations at a given location in a given year reflect greater bioaccumulation, or a greater amount of adhered dust and time since rainfall.	• Determine the objectives of the monitoring program and adjust the field program accordingly. For the purpose of discerning if there are small statistically significant increases in plant metals concentrations over time, switch to analysis of rinsed plant samples. For the purpose of collecting data for human health and wildlife risk assessment continue to collect and analyze unwashed plant samples. Alternatively, continued to analyse unwashed samples and archive plant material for later washing and re-analysis if unwashed results indicate an increase in concentrations and one wishes to ascertain if that is due to dust adhesion versus bioaccumulation.	VGC will engage the qualified external professional performing the monitoring and request that they consider this recommendation and advise if refinement of the program is necessary.
Soil sampling over the 0–0.5 m horizon may be too deep to detect changes in shallower soils resulting from dustfall deposition.	• Soil monitoring should be expanded to include separate samples of the LFH layer and shallow mineral layer.	VGC will engage the qualified external professional performing the monitoring and if deemed appropriate and feasible, the scope will be added.
WILDLIFE PROTECTION MONITORING		
Section 3.3 of the WPP includes a requirement to facilitate wildlife movement by providing wildlife crossing and escape points along snowbanks and open ditches. The Annual Reports do not provide information regarding how wildlife crossing points are selected, the distance between crossing points, how frequently crossing points are maintained, and what snow depth triggers the creation of crossing points in snowbanks.	• Stantec recommends that the Annual Report include information on the implementation of measures listed in Section 3.3 of the WPP.	The VGC Site Services Department maintains the access road and snow banks to effectively allow wildlife to pass. Currently wildlife passage surveys and access road cut out surveys and inspections are performed on a monthly basis. VGC will include this information in future Annual Report as appropriate.
Section 3.4 of the WPP includes a requirement to complete a wildlife habitat feature survey prior to clearing activities. The Annual Reports do not provide information on the methods, types of wildlife features surveyed, survey locations, or whether this work was carried out by a qualified professional.	• Stantec recommends that information on the location(s), timing, methods, and results of wildlife habitat feature surveys be included in the Annual Report.	Currently surveys are conducted by the operations survey crews when disturbance limits are laid out. Specific documentation on these activities is not kept however VGC will ensure future wildlife surveys are documented.
Section 3.4 of the WPP includes a requirement to consult with the appropriate regulator (e.g., Yukon Environment, Canadian Wildlife Services) and develop management strategies if clearing activities cannot be scheduled to occur outside the breeding bird window. The annual reports do not indicate if this consultation was carried out and does not provide information on the management strategy developed.	• Stantec recommends that information on regulatory consultation, and the location(s), timing, methods, and results of pre-clearing nest surveys be included in the Annual Report.	VGC performs Active Migratory Bird Nest Surveys (AMBNS) during periods legislated by the Migratory Birds Convention Act if clearing cannot be avoided within the summer window. Details of AMBNS will be provided within the 2022 Annual Report. VGC utilizes a qualified external professional for advice on matters related to protected nesting birds as required.
Section 4.1 of the WPP includes a requirement to report all detections of Species at Risk to the Yukon Conservation Data Centre. Information provided in the annual and quarterly reports is insufficient to determine if this has been completed.	• Stantec recommends that the Annual Report clearly indicates that this requirement has been completed.	This recommendation will be actioned by VGC in the next Annual Report.
The number of wildlife mortalities reported in the annual and quarterly reports are different, and the reports do not provide information on species, location, or possible cause of death.	• Stantec recommends that wildlife mortalities be fully documented using the Wildlife Incident Form (WPP Appendix D) and the species identified by a Qualified Professional either in-person or using a photograph.	VGC will ensure that wildlife mortalities are documented in accordance with the WPP.
There is no linkage between the two sections of the annual report that document wildlife monitoring (Sections 3.9.4 and Section 5.2.2).	• Stantec recommends that Section 3.9.4 of the Annual Report include a reference to wildlife monitoring reported in Section 5.2.2 of the Annual Report.	This recommendation will be actioned by VGC in the next Annual Report.
The locations and nature of wildlife detections as reported in the quarterly reports are not clear.	• All wildlife detections should be fully documented either using the Wildlife Incident Form (WPP Appendix D) or the Wildlife Observation Form (WPP Appendix E). Stantec also recommends that location names be standardized where possible,	During the initial construction and operations phase of the Project, VGC found that operational staff would less frequently record observations of wildlife with the template considered in the WPP hence a shorter version was prepared and distributed throughout the site. The forms associated with both wildlife observations and incidents

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
	and that coordinates of wildlife detections be recorded to allow more accurate mapping of wildlife detections.	will be updated in the next iteration of the WPP to ensure that relevant data is recorded and that the form is a format that is more likely to be completed by site personnel. VGC is considering utilizing a two sided card that includes a site map so the locations can be more consistently reported as GPS locations are not practical for a workforce the size of Eagle.
PERMAFROST MONITORING		
Regular Visual Inspections not documented or reported.	• Include an appendix in Annual and Monthly reporting that summarizes the observations from regular visual inspections to identify and quantify any deformation associated with melting of permafrost, such as but not limited to, cracks, subsidence, sinkholes, and sloughing on existing foundations and slope overlay permafrost. Summarize those visual inspections executed during the freshet, prolonged rainy periods, and rising trend in any thermistors.	The majority of clearing and grubbing work associated with the Project and in particular with WRSAs has been completed. Significant permafrost destabilization has not been noted to date. Test pitting programs are performed when clearing and grubbing activities occur in areas without extensive geotechnical knowledge. Monthly surveys are performed by professional external surveyors in active work areas and weekly drone inspections are performed to review changing conditions associated with potential permafrost destabilization (amongst other potential geotechnical considerations). A displacement map developed from drone surveys can be included on a quarterly basis in the applicable Monthly Reports. This will be coupled with a greater assessment of thermistor trends as necessary.
Thermistor BH-BGC11-42 in the 2020 Q4 (November 2020) quarterly report and thermistor BH-BGC10-7 in the 2021 Q3 (July 2021) quarterly report not included in summary tables of quarterly readings.	• Include reasoning for missed readings if none were taken for that quarterly period.	VGC will endeavor to include all applicable thermistor data or rationale for missed readings in all future reporting.
OPEN PIT MONITORING		
Daily visual inspections not reported.	• Include an appendix in Annual and Monthly reporting that documents the results of daily visual inspections as per EMSAMP. VGC Annual reports state full visual inspections are completed on a weekly basis; however, EMSAMP states visual inspections of open pit slopes are to completed daily and to be documented in shift log reports, along with daily and weekly records.	Daily visual inspections of active mining areas are completed by geotechnical professionals from the VGC Technical Services Department. Inspection notes are completed when irregularities or exceptions are observed within active work area. VGC will include a visual inspection log with the 2022 Annual Report. This data is not considered necessary for the purposes of Monthly Reporting.
Piezometers installed within the pit location (DEEP-08, DEEP-06, and DEEP-04) and documented in section 4.1 (Eagle Pit) of the 2021 annual report, are not documented in section 3.4 (Groundwater) where groundwater well monitoring is documented. These pit piezometers are also not documented in the monthly reports as well the EMSAMP document.	• Provide dates of commissioning and relevant information of new and existing piezometers in all applicable sections of the annual and monthly reports. Update EMSAMP revision to show relevant piezometers.	VGC will provide an update on installed and operating piezometers within the 2022 Annual Report and future Annual Reports. The EMSAMP will also be updated to include all functional piezometers.
Data for two (2) extensometers, (Extensometers 3 and 4) installed on SB8 instability are not reported in the 2020 annual report.	• Provide dates of commissioning and decommissioning for all instrumentation in annual and monthly reports.	VGC will provide a summary within Annual Reports of installation and decommission of extensometers on site.
There are multiple instrumentation types listed in EMSAMP documentation that monitor displacement in various forms. Currently prisms and extensometers are serving this purpose and others are deemed not required due to normal operating (stable) conditions (robotic theodolites, TDR cables, slope inclinometers, fixed slope radar, mobile slope radar).	• Modify the EMSAMP, or provide cross references to other VGC materials, to identify the displacement monitoring instrumentation to be used for normal operating (stable) conditions and instrumentation to be used for unstable conditions or as contingency to existing instrumentation.	The EMSAMP will be updated to indicate what type of monitoring methods are currently being used for normal operating (stable) conditions and the types of instrumentation to be used for unstable conditions.
MATERIALS STORAGE AND STOCKPILE MANAGEMENT AREAS MONITORING		
It is unclear whether daily WRSA crest inspections, weekly WRSA toe and developing stockpile inspections, monthly established stockpile and detailed WRSA inspections are being executed. Records specifying visual and drone inspections of structures are to be maintained along with daily and weekly records detailing the location and type of materials placed in the WRSAs, as per EMSAMP.	• Include an appendix in Annual and Monthly reporting that summarizes frequencies and all the visual observations made on stockpile structures.	When issues are identified during visual inspections, field notes are then produced to summarize the inspection. Weekly drone flights are reviewed for changing conditions and instabilities. Information related to these programs will be summarized in future Annual Reports.

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
Stantec understands that piezometer MW19-PGW1b was damaged and intended to be fixed in 2021. The status of this piezometer was not reported in the Q3 2020 (August monthly report) and Q2 2022 (April monthly report).	• Include status of broken piezometers in all monthly reports if not decommissioned.	Future Monthly Reports will include the status of all piezometers that have not previously been identified as decommissioned. An annual update will be performed to summarize locations that have been decommissioned or are operating.
Piezometer MW19-EPW1b reading in Q1 of 2021 (February monthly report) was missed in monthly report without reasoning.	• Provide reasoning for missed piezometer readings.	This recommendation will be actioned by VGC in future reporting.
Though not built to full specification, the WRSA rock drains are operational, and it is unclear if they are being inspected weekly as per EMSAMP.	• Conduct and provide weekly inspection records of the WRSA rock drain discharge areas in the monthly or annual reports.	This recommendation will be actioned by VGC in future Annual reporting.
Follow up and close out of physical stability recommendations 1, 2 and 5 not documented in annual or monthly reports.	• Provide documentation detailing the follow up and response actions for addressing recommendations.	The All North Physical Stability Inspection Report is included within Annual Reports and includes discussion of the status of items previously identified by their engineering professionals which VGC considers appropriate for closing out matters. If VGC identifies omissions by All North (due to VGC correcting a previously identified recommendation) in future reports they will be discussed in the Annual Report.
HEAP LEACH FACILITY MONITORING		
Routine (visual) inspections (daily, weekly) not reported. It is unclear if all visual inspections are completed for all components of the HLF at their required frequency based on the annual and monthly reports.	• Include an appendix in Annual and Monthly reporting that summarizes the observations from visual inspections.	Routine visual inspections are completed in accordance with shift cycle reports completed by the VGC Process Department However, a specific tracking sheet has not been developed to date. VGC commits to updating their inspection process to include documentation on specific inspections.
Based on the 2021 annual report, three Vibrating Wire Piezometers (VWPs) installed in the In-Heap Pond, appear to be collecting data, but it is unclear if they are being monitored continuously. These piezometers, along with the embankment piezometers (P1, P2 and P3) are not included in the EMSAMP revision.	• Provide continuous data plots of In-Heap piezometers in monthly and annual reports. Include records of In-Heap and embankment piezometers in the next EMSAMP revision.	The EMSAMP will be revised to reflect the current distribution of piezometers. Summary data for the VWPs installed within the HLF will be provided within Annual Reports. Piezometers are currently checked on a monthly basis.
The following piezometers/groundwater wells listed in EMSAMP are not reported in the annual or monthly reports due to being installed in Q3 2022: MWXX-AGR6, MW10-AG3A, MWXX-HLF2a, MWXX-HLF2b, MWXX-HLF3a, MWXX-HLF3b, MWXX-HL4a, MWXX- HLF4b.	• Provide documentation of piezometers that are still to be installed in the monthly and annual reports, listed in the EMSAMP. Update the EMSAMP as required.	The EMSAMP will be updated to reflect the current status of all active monitoring wells. All the piezometers/wells noted (with the exception of MW10-AG3) were installed in October 2022. MW10-AG3 was decommissioned. Documentation of these installations will be included in the Annual Report.
Records of pregnant and barren solution sampling not available in monthly and annual reports.	• Include documentation of pregnant and barren solution sampling in the geochemical sampling sections of the monthly and annual reports.	Sampling and recording of cyanide concentrations of the pregnant and barren solution are completed internally each shift to inform cyanide addition rates. This information is not considered relevant for the purposes of ongoing monitoring otherwise. VGC is however increasing the frequency of full suite analysis of pregnant and barren solution to support the refinement of geochemical source term predictions used in the site water quality model. This information will be provided to the external consultant responsible for geochemical source term derivation and water quality modeling and will be summarized in their reports as appropriate.
Follow up and close out of physical stability recommendation 3, 7 and 8 not documented in annual or monthly reports.	• Provide documentation detailing the follow up and response actions for addressing recommendation.	The All North Physical Stability Inspection Report is included within annual reports and includes discussion of the status of items previously identified by their engineering professionals which VGC considers appropriate for closing out matters. If VGC identifies omissions by All North (due to VGC correcting a previously identified recommendation) in future reports they will be discussed in the Annual Report.
WASTE MANAGEMENT		
Burn Log miss time information occasionally	• Management should periodically check logs and address missing information.	VGC site management will endeavor to periodically audit logs and address missing information.
Sorting of hazardous waste repeatedly found unsatisfactory	• The Solid Waste and Hazardous Materials Management Plan should be reviewed and sections relevant to hazardous waste management updated.	VGC periodically provides site wide memorandums and education to the general work force to reinforce proper waste sorting procedures. Hazardous waste sorting facilities have been improved and increased in size as the Project has progressed. Regular inspections and specific nonconformance emails aim to address specific cases observed.

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
Sorting of non-hazardous waste repeatedly found unsatisfactory	• The Solid Waste and Hazardous Materials Management Plan should be reviewed and sections relevant to non-hazardous solid waste management.	VGC periodically provides site wide memorandums and education to the general work force to reinforce proper waste sorting procedures. Regular inspections and specific nonconformance emails aim to address specific cases observed.
SPILL RESPONSE		
Two spill reports did not indicate if spill line was called	• Management should review reports and address missing information.	VGC will ensure that future Spill Reports are fully completed. Occasionally, a spill has occurred near a shift change which can make timely completion of the required documentation difficult and efforts are being made to ensure that in instances where a shift change is imminent that a higher priority is placed on completing the reporting forms.
Process solution spilled outside the heap leach containment area.	• Monitor the effectiveness of the mitigation measures already put in place.	Corrective actions resultant from Process Solution releases have been implemented to mitigate future occurrences. VGC works with YG, FNNND and Cyanco to implement recommendations from external stakeholders associated with process solution releases. The areas where prior mitigations have been put in place are routinely inspected by VGC personnel and key external stakeholders.
Number of oil spills increased in first half of 2022	• Provide additional spill prevention training.	Spill prevention and response training in a key and constant component of communication from the site Environmental Department to other work groups. These efforts will continue through the life of the mine to support proper spill prevention.
CLOSURE		
VGC and their consultants have successfully completed revegetation efforts each year from 2019-2021. This will provide valuable information for refining site preparation, topsoil replacement and revegetation designs if proper monitoring and reporting is completed. Stantec recommends VGC consider incorporating these revegetation sites into the ongoing vegetation monitoring programs or equivalent.	• Stantec recommends VGC consider incorporating the revegetation sites in a formal monitoring program to provide a consolidated location for performance results rather than a series of technical memorandums for different areas that are appended to Annual Report submissions.	VGC will consider whether a consolidated program can be executed on site with the available resources.
Progress and success of reclamation research is difficult to discern from the reviewed documents. Although the 2020 RCP and Annual Reports identify and provide written discussion on reclamation research, items such as research task schedules, progress updates and/or key findings were not found for all reclamation research programs.	• Stantec recommends VGC develop a summary schedule for all reclamation and closure research programs, as outlined in Schedule C, Condition 4.1.c. of the QML-0011. Additionally, the next iteration of the RCP should include comment on research program findings to date, and if/how this impacts the existing closure concepts for the different mine areas.	The status of each research task was updated in the Oct 2022 RCP submission, and subsequent RCP revisions (every two years) will include these updates, including a summary schedule.
SITE AUDIT FINDINGS		
Elevated visual turbidity in Haggart Creek following rainfall event on September 29-30, 2022. As shown in Photo 14 – “Haggart Creek Below Mine – After Overnight Rainfall, with input from Site Ditching (Sept. 30, 2022)” visual observations suggest that the turbidity of the ditch effluent would be influencing the turbidity of Haggart Creek. While not a regulatory monitoring site, VGC should evaluate whether this ditch source can cause exceedances of regulatory standards downstream. It should also be noted that visual inspections of Dublin Gulch during the audit visit, upstream of mine workings, suggested that elevated turbidity upstream of mine affected disturbances was present.		Elevated parameters observed in laboratory results are routinely followed up by site environmental personnel to determine if mine site infrastructure is potentially responsible for the observed conditions. Mitigations strategies are implemented if mine influence is suspected in accordance with the adaptive management components of the EMSAMP.
The close-up photograph Photo 12 – “Coarse Sediment Buildup at Staff Gauge W-21” indicates a significant buildup of coarse material within this reach of the stream channel. This buildup of material would be expected to significantly affect any flow rating curves developed for this location. The buildup of coarse sediment would make the conversion of staff gauge readings to flows unreliable. The staff gauge should be maintained as needed.		An annual maintenance program occurs at W21 during benchmark survey work. Sediment build is maintained as possible however the high energy flow environment makes this difficult during certain periods of the year. Flows are evaluated and compared to historical values on an annual basis to inform if data is unreliable.
The 2020 Annual report notes in Section 5.2.2 – Cyanide Management, that fencing would be erected to reduce Wildlife Access to the Events Pond. The 2021 Annual report notes that this fencing will be erected in 2022. As indicated in photo 24: “Eagle Pit looking West Across Eagle Creek and Dublin Gulch to Event Pond, Heap Leach Facility and ADR – dated September 29, 2022” there is no fencing erected around the pond, as of the date of the audit.		Noted. In the interim, VGC uses banger/sound cannons to deter wildlife from the events pond and Heap as well as regular inspections of the areas. In addition, the events pond contains low risk water. The Wildlife Protection Plan (WPP) placed these mitigations on the events pond in case it should be holding significant amounts of process solution at concentrations that could be toxic to animals. There has been minimal risk to date for wildlife to interact with harmful water within the Events Pond given the water quality in the pond.

Consistency with requirements, Gaps and/or Deficiencies	Recommendation	VGC Response
It was noted during the audit that some of the Management Plans are dated as much as five years ago (2017). Specifically, the current Wildlife Protection Plan is dated 2017-01, which predates the start of commercial production. As indicated in Schedule C, Part 1 of Quartz Mining License QML-0011, it states: “For greater certainty, if there is no approved plan that addresses the activity to be carried out, the activity cannot be carried out until a plan is approved for the conduct of the activity.” Based on information gathered during the audit, it was not evident that a schedule for updating Management Plans is in place that considers changes to mine operations and environmental conditions at the site.		Noted, updates will be prioritized as required and in discussion with the Department of Energy, Mines and Resources.
Photographs 18 and 19 were taken on September 28th and 29th, respectively and show the Camp Site Gasoline and Diesel Fuel Storage Area, after a small precipitation event and during a fuel delivery operation. Adjacent to the fuel handling and storage area is a water management ditch that eventually reports to the receiving environment. Site personnel have indicated that the Storage Area was constructed with a buried liner for secondary containment of the fuel storage tanks. However, due to the general slope of the surrounding area, spillage or releases from the storage tanks or vehicles being refuelled may flow to the adjacent water management ditch, and potentially to the receiving water. This risk may be greater in winter when the ground is frozen and less permeable.		Regular inspections, spill trays and lining of the area mitigate the potential for sheens or stains from migrating towards downgradient watercourses. These measures will continue to be implemented.