BACK RIVER PROJECT
Quality Assurance / Quality Control Plan

October 2017

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QUALITY ASSURANCE / QUALITY CONTROL PLAN

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Revision Log

Version	Date	Section	Page	Revision
1	October 2017	All	All	Supporting Document for Type A Water Licence Application, submitted to Nunavut Water Board for review and approval

Acronyms

ECCC	Environment and Climate Change Canada
INAC	Indigenous and Northern Affairs Canada
MAD	Main Application Document
MLA	Marine Laydown Area
MMER	Metal Mining Effluent Regulations
NWB	Nunavut Water Board
Project	Back River Project
QA/QC	Quality Assurance / Quality Control
Sabina	Sabina Gold & Silver Corp.
SOP	Standard Operating Procedures
SIG	Supplemental Information Guide

1. Introduction

The Back River Project (the Project) is a proposed gold project owned by Sabina Gold & Silver Corp. (Sabina) within the West Kitikmeot region of southwestern Nunavut. It is situated approximately 400 kilometres (km) southwest of Cambridge Bay, 95 km southeast of the southern end of Bathurst Inlet (Kingaok), and 520 km northeast of Yellowknife, Northwest Territories. The Project is located predominantly within the Queen Maud Gulf Watershed (Nunavut Water Regulations, Schedule 4).

The Project is comprised of two main areas with interconnecting winter ice roads (Main Application Document [MAD] Appendix A, base Figure 2): Goose Property (MAD Appendix A, base Figure 3) and the Marine Laydown Area (MLA) (MAD Appendix A, base Figure 4) situated along the western shore of southern Bathurst Inlet. The majority of annual resupply will be completed using the MLA, and an approximately 160 km long winter ice road will interconnect these sites. Refer to the MAD Appendix A, base Figures 1 to 5 for general site layout and locations. A detailed project description is provided in the MAD.

This Quality Assurance/Quality Control Plan (QA/QC Plan or Plan) sets out standard procedures for collection of surface water and groundwater samples and data in support of monitoring programs outlined in the Water Management Plan (Supporting Document [SD]-05), the Environmental Management and Protection Plan (SD-20), and the Aquatic Effects Management Plan (SD-21). The QA/QC Plan and other management plans are intended to support the Type A Water Licence Application for the Project.

The Plan was prepared following the requirements of the Supplementary Information Guidelines (SIG) for Mining and Milling MM3 and Water Works M1, issued by Nunavut Water Board (NWB 2010 a, b) and the Environmental Impact Statement Guidelines issued by the Nunavut Impact Review Board to Sabina (NIRB 2013), and in accordance with best management practices and in conformance with current Federal and Territorial statutory requirements (see Applicable legislation and Guidelines Section 3).

This plan is a living document to be updated upon changes in related regulatory requirements, management reviews, incident investigations, changes to facility operation or maintenance, and environmental monitoring results, best practice updates or other Project specific protocols once construction starts through to Project closure activities. Any updates will be filed with the Annual Report submitted under the Type A Water Licence.

The information presented herein is current as of September 2017. An update will be initiated prior to the start of construction. The Plan will be reviewed as needed for changes in operation and technology and as directed by the NWB in the Type A Water Licence or other regulatory authorization where appropriate. Completion of the updated Plan will be documented through signatures of the personnel responsible for reviewing, updating, and approving the Plan.

A record will document all significant changes that have been incorporated in the Plan subsequent to the latest review. The record will include the names of the persons who made and approved the change, as well as the date of the approval.

Sabina will maintain a distribution list providing contact details for all parties to receive the Plan including key personnel, contractors, organizations, and external agencies.

2. Scope and Objectives

The QA/QC Plan is one of the documents that forms part of Sabina's overall General and Aquatic Effects Monitoring Program for the Project. This plan has been written to meet requirements of a Type A Water Licence and applies to all Sabina projects in the Kitikmeot region.

This plan is divided into the following components:

- Applicable Legislation and Guidelines (Section 3);
- Planning and Implementation (Section 4);
- Roles and Responsibilities (Section 5);
- Field Sample Collection (Section 6);
- Laboratory Analysis (Section 7); and
- Data and Reporting Requirements (Section 8).

The objectives of the Plan are to confirm that the chemical data collected are representative, are of known quality, are properly documented, and are scientifically defensible. Data of high quality can be achieved through the collection and analysis of samples using specified standardized procedures, the use of accredited laboratories (Appendix A), and use of staff with appropriate training.

2.1 RELATED DOCUMENTS

Documents within the Application for the Type A Water Licence, which support this plan include the following:

- Environmental Management and Protection Plan (SD-20); and
- Aquatic Effects Management Plan (SD-21).

3. Applicable Legislation and Guidelines

Specific legislation, regulations, and guidelines with provisions for Quality Assurance and Quality Control includes:

- *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (Government of Canada 2002a);
- Nunavut Water Regulations (2013);
- *Fisheries Act* (Government of Canada 1985)*; and*
- the *Metal Mining Effluent Regulations* (Government of Canada 2002b).

Sabina will also be bound by the terms and conditions of its Type A Water Licence to be issued by the NWB and the Project Certificate issued by the Nunavut Impact Review Board (NIRB).

In addition, the QA/QC Plan has been developed in accordance with the Indian and Northern Affairs Canada (currently known as Indigenous and Northern Affairs Canada) 1996 '*Guidelines for Use by Class "A" Licensees in Meeting SNP [Surveillance Network Program] Requirements and for Submission of a QA/QC Plan*'. For purposes of this plan, definitions for QA and QC (INAC 1996) are as follows:

- Quality Assurance: the system of activities designed to better ensure that quality control is done effectively; and
- Quality Control: the use of established procedures to achieve standards of measurement for the three principal components of quality – precision, accuracy, and reliability.

4. Planning and Implementation

Monitoring will be the principal mechanism to provide feedback to continually gauge the effectiveness of environmental performance. Operational control is facilitated through the contractor job-specific standard operating procedures (SOPs) work instructions, on-the-job instruction, tailgate meetings where required, contract requirements, and service agreements. The effectiveness of physical operational control will be reviewed according to preventative maintenance and review procedures and schedules.

Implementation of QA/QC measures will be executed throughout all phases of the Project from Construction to Post-Closure.

5. Roles and Responsibilities

The General Manager is ultimately responsible for the success of this plan and approves all relevant policies and documents, auditing, action planning and the verification process.

The Environmental Superintendent along with his/her direct reports are responsible for the implementation of this plan including overall management of the Plan and internal reporting, as well as for auditing Project performance to ensure compliance and adaptive management.

All other Project personnel involved with QA/QC, and monitoring activities will be responsible for the effective implementation of this plan including completion of required training, and maintaining compliance with training requirements or by Sabina's SOPs and best management practices. All employees are to work in compliance with Health and Safety Laws and Regulations.

6. Field Sample Collection

For purposes of this plan, aquatic monitoring consists of three forms as follows:

- **Regulated discharge monitoring** occurs at monitoring stations specified in licenses or regulations. It includes discharge limits that must be achieved to maintain compliance with an authorization (i.e., water licence) or regulation (i.e., Metal Mining Effluent Regulations [MMER]). Enforcement action may be taken if discharge limits are exceeded for a parameter.
- **Verification monitoring** occurs at select stations across the Mine for operational and management purposes by Sabina. This type of monitoring provides data for decision making and builds confidence in the success of processes being used. There is no obligation to report verification monitoring results, although these results can be mentioned in environmental management plans (i.e., sampling to verify soil remediation in the landfarm) or annual reports (e.g., Aquatic Effects Management Plan, site annual report).
- **General monitoring** occurs at stations across the Mine and outside of the Mine. In a water licence, these stations are often monitored according to a schedule and can cover all types of monitoring (i.e., geotechnical, lake levels, etc.). This monitoring is subject to compliance assessment to confirm sampling was carried out using established protocols, included QA/QC provisions, and addresses identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the NWB.

6.1 SAMPLING LOCATIONS

Water quality monitoring will occur during the Mobilization and Construction, Operations, Closure, and Post-Closure phases. Proposed sampling stations, frequency, and parameters are listed in Appendix B of the Water Management Plan (SD-05). The stations and their requirements may be adjusted based on the requirements of the Type A Water Licence, updates to the Project management plans over the life of the mine and/or an adaptive management response. Proposed sampling stations are shown in the Water Management Plan (SD-05).

All sampling stations will have a GPS location and be landmarked. All stations will be used repeatedly with qualified personnel, using the same techniques to reduce operational error. The following sections outline the standard procedures for collection and handling of all surface water and groundwater samples.

6.2 SAMPLING EQUIPMENT

In the field, personnel will have suitable expertise to conduct surveys. All safety measures and SOP will be followed. Proper sampling gear, field instruments, and methods will be employed by personnel while in the field. Sampling information will be appropriately documented, and samples will be filtered and/or preserved (as necessary), stored in a cool environment, and shipped as soon as possible after sample collection to a qualified laboratory.

Equipment, such as the Analite NEP 160 Meter (turbidity), Oakton PCS35 Meter (pH and conductivity), and Hanna Multi-Parameter Meter (pH, dissolved oxygen and conductivity) are handheld instruments that can be used to measure field parameters as required. The instruments will be calibrated before each sample event, or as per manufacturer's schedule for optimal performance. Calibration and maintenance procedures will be followed as set out by the supplier's operation manual. Equipment and bottles will be

selected so that they do not contaminate or alter the concentrations of parameters of interest according to appropriate laboratory standards.

Surface water samples will be collected as grab samples directly into the sampling bottles (e.g., from streams) or from prescribed depths in lakes using a standard sampling device (e.g., GO-FLO Sampling Bottle). For groundwater sampling, a pump with low-density polyethylene tubing will be used.

A filter apparatus, manual pump, and filter paper will be used to filter water for specific analyses (e.g., dissolved metals).

New laboratory supplied containers will be used for sample collection. The bottles will be either polyethylene plastic or glass, dependent on the specific parameter being analyzed.

6.3 SAMPLING METHODS AND HANDLING

6.3.1 Sampling Identification

All samples will have a unique sample identification name based on a station identifier, date, and time of collection.

All sample bottles will be identified with the sample identification and date of collection. This information will be marked on a label with a water-resistant pen and affixed to the sample bottle. Additional information (time of sampling and parameters to analyze) will be included in the analysis request that will be sent to the accredited laboratory (Appendix A).

6.3.2 Surface Water Sampling

All water quality samples will be collected by qualified personnel using suitable sampling equipment (e.g., acid-rinsed GO-FLO sampling bottle, sampling gloves).

The bottles will be pre-labelled with the required sample identification before going to the field. Surface grab samples will be collected by submerging the sample bottle to half depth of the stream. For sumps, ponds, and piped discharge points, samples will be collected below the surface of the water. For lake sampling, samples will be collected from the prescribed depth for the particular station using an appropriate sampling device (e.g., GO-FLO sampling bottle).

Sample bottles will be provided by the accredited laboratory. They will be received pre-rinsed and either precharged with preservative or pre-rinsed with vials of preservative to be added in the field by qualified technicians or biologists. If the sample bottles are not precharged with preservative, they may be rinsed three times with sample water before filling as per direction from the lab. If the sample are precharged with preservative, the bottle will be filled by using another clean bottle to avoid any release of preservative. Sometimes, a preservative is added after filling as directed by the laboratory. The bottles will be filled appropriately to allow mixing, preservative addition, and thermal expansion. Samples analyzed for dissolved parameters will be filtered through filter paper (0.45 micrometres Millipore filter) and then preserved (if required) as soon as possible after sample collection.

Water quality samples will be analyzed by an accredited laboratory (still to be selected); the detection limits used will vary depending upon if the samples are collected on-site or in a downstream receiving environment. For samples collected from downstream receiving environments, samples will be analyzed at detection limits less than aquatic life and drinking water quality guidelines.

6.3.3 Groundwater Sampling (i.e., Westbay Well)

Well Purging

A fluid purge is conducted prior to collecting a sample from the specific Zone. Purges are conducted by directing water from the specific Zone into the Westbay casing through the sampler probe (MOSDAX sampler system, probe Model 2531) connected to the measuring port. The fluid in the casing is lowered such that pressure inside the casing is around 15 m H_2O lower than the natural pressure at the specific Zone.

Groundwater Sampling

Once purging of the well is complete, a groundwater sample for laboratory analysis is collected through the measuring port at the specific Zone using the MOSDAX sampling probe. A string of four 250 mL cleaned stainless steel bottles are first vacuumed out using a vacuum pump and then connected to a leading end of a motorized cable winch. The stainless steel bottles are filled iteratively by opening and closing the sampler probe valve while sustaining zone pressure.

Upon recovery of the stainless steel bottles at surface, water is directed into the laboratory bottles using the interconnect valve. Samples are preserved as instructed by the laboratory and shipped to the laboratory in coolers with ice packs.

6.3.4 Field Duplicates and Blanks

Duplicate samples will be collected from a subset (approximately 10 to 20%) of all samples collected to quantify environmental variability and analytical consistency. Travel, equipment, and field blanks will be collected to detect potential sources of contamination. Duplicates and blanks will be collected and handled in the same manner as the other samples in the field.

Duplicates and blanks will be given a unique QC code so samples are submitted blind to the laboratory. In the field notes, there will be clear documentation of the QC code, the type of QC sample (i.e., duplicate, blank), and when and where it was collected.

6.3.5 Sample Transport

All water samples will be stored upright in sealed coolers with ice packs and preserved as specified by the laboratory. Samples will be shipped to the external laboratory as soon as possible and dedicated ground transportation to ensure arrival in a safe and timely manner. If the sample cannot be shipped the same day, they are to be stored in a refrigerator at 4°C until shipping.

A Chain of Custody form with the following information will be completed for every shipment of samples:

- company name and sampler's name;
- sample identification name;
- time and date of sampling;
- presence and type of preservative and whether the sample was filtered or not;
- requested analytical parameters for each sample;
- time and date of shipping; and
- analytical laboratory address and contact person.

One electronic or PDF copy will be sent by email to the laboratory; an electronic copy will be kept at the Project site for reference.

7. Laboratory Analysis

7.1 EXTERNAL LABORATORY

All analytical chemistry analyses will be performed by an accredited commercial laboratory in Edmonton or Calgary, AB; Vancouver, BC; Winnipeg, MB, or elsewhere. This ensures that samples collected meet holding time requirements for all regulatory sampling. All data from the accredited laboratories will undergo a rigorous internal QA/QC process, including the use of spiked samples and duplicate samples. Toxicity tests will be performed by accredited professionals in Edmonton or Calgary, AB; Vancouver, BC; Winnipeg, MB, or elsewhere. Testing will be conducted as stipulated by the Licence and where appropriate Environment and Climate Change Canada's (ECCC) Biological Test Methods.

7.2 INTERNAL LABORATORY

An environmental and mining site laboratory will be available on-site. The in-house laboratory will perform on-site acid rock drainage testing, as appropriate to meet the day to day requirements of waste rock management and mine operations. These results will be for observational purposes and will not meet the standards of an accredited laboratory. Quality Assurance and Quality Control sampling will be completed at an accredited facility off-site at regular intervals to verify the on-site acid rock drainage data. Additional details on waste rock management can be found in the Mine Waste Rock Management Plan (SD-08).

Any long holding time parameters (e.g., metals most anions and cations, oil and grease) will go to an outside laboratory, shipped by air, after appropriate processing and preserving.

8. Data and Reporting Requirements

8.1 DATA COLLECTION

Record keeping will be conducted by Sabina and its subcontractors. Data for all water sampling will be entered into suitable electronic databases (e.g., Microsoft Access). The data will be stored and managed either by Sabina or with the subcontractor responsible for monitoring. Data will be maintained in a format to allow for comparison between years, trend analysis, and flagging out-of-compliance samples to enhance the effectiveness of the QA/QC program.

The following data will be collected for each sample in the field and will be entered into the database by the sampler for the corresponding sampling station:

- sample identification name;
- name of sampler;
- date and time of sampling or measurement; and
- physical characteristics (pH, temperature, etc.), if required.

Upon receipt of sample results from the laboratory, the data will be entered in the database and matched to the sample identification name. The certificate of analysis for each sample from the accredited laboratory will include but will not be limited to:

- analytical methods or techniques used;
- date of analysis;
- name of the person(s)/laboratory that approved the certificate; and
- results of any analysis.

All formal documents and reports will follow version-control procedures with revision tracking and version numbers. Version control information will be required for all documents and data that are issued, and approval will be given and tracked before issue. Designated personnel will coordinate preparation, review, and distribution, as appropriate, of the data and reports required for regulatory purposes.

8.2 DATA VERIFICATION

Upon receipt of analytical results, the field blank and duplicate analyses will be verified for potential contamination and accuracy, respectively. Results will be interpreted and recommended actions will be implemented, if necessary.

8.3 EXCEEDANCE REPORTING

Any measured concentration at a sample station exceeding a regulated discharge criterion will be reported to the NWB, ECCC, Kitikmeot Inuit Association, and the Indigenous and Northern Affairs Canada (INAC) water inspector; details will be provided within 30 days of the receipt of the analysis.

These regulated discharge criteria will be outlined as stipulated in the:

- Type A Water Licence (reported to NWB, ECCC, INAC); and
- MMER (reported to ECCC through the online Regulatory Information Submission System).

In addition, results of the action plan, where required, will be reported and, where necessary, mitigation options identified within 90 days after receipt of the analyses.

9. References

Government of Canada. 1985. *Fisheries Act*. R.S.C., c. F-14; current to March 28, 2016

Government of Canada. 2002a. *Nunavut Waters and Nunavut Surface Rights Tribunal Act*. S.C. 2002, c.10.

Government of Canada. 2002b. Metal Mining Effluent Regulations. SOR/2002-222; current to November 18, 2012.

INAC (Indian and Northern Development Canada). 1996. Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "A" Licensees in Meeting SNP Requirements and for Submission of a QA/QC Plan.

NIRB (Nunavut Impact Review Board). 2013. *Guidelines for the Preparation of an Environmental Impact Statement for Sabina Gold & Silver Corp.'s Back River Project*. NIRB File No. 12MN036).

NWB (Nunavut Water Board). 2010a. Mining and Milling Supplemental Information Guideline (SIG) for Mine Development (MM3). February 2010.

NWB. 2010b. Miscellaneous Supplemental Information Guideline (SIG) for General Water Works (including crossings, flood control, diversions, and flow alterations) (M1). February 2010.

Appendix A. Lab Accredited Certificate

To be provided as an addendum upon retention of services.