newgold™ Rainy River	Document Number: OMS-4000-DT00-MAN-0007.001	Status: Approved	Date: 2022-Sep-30
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OMS-4000-DT00-MAN-0007.001

Rainy River Mine

Operation, Maintenance and Surveillance Manual

Tailings and Water Management Facilities

Part I – General

September 2022

Version 2022-1

Review and Revision History

The OMS Manual shall be, at a minimum, reviewed annually and following any significant changes at the site to assess if the document is representative of the current condition and operation of the dam at the time of the review. Changes of this degree would include introduction of new surveillance equipment, and monitoring processes, changes in key personnel, engineering design, water management plan, or tailings deposition plan etc. Revisions to the manual should be undertaken within six months of changes and minimum of one per year. It is the responsibility of the Tailings Dam Engineer to initiate the OMS review.

The review team and approval record are given in Table 1. The version history of the OMS Manual is shown in Table 2.

Table 1 - Review Team

Role	Name	Company/ Department	Position	Signature	Date
Updated By(1)	Winston Ding	Capital Projects	Tailings Dam Engineer	<original signed by>	Oct 14, 2022
Reviewed by	Travis Pastachak	Capital Projects	Capital Projects Manager	<original signed by> Travis PastacPak (Oct 14, 2022 11:15 CDT)	Oct 14, 2022
	Gord Simms	Mine Operations	Mine Manager	<original signed by>	Oct 17, 2022
	Garnet Cornell	Environment	Environment Superintendent	<original signed by>	Oct 25, 2022
	Derek McKinnon	Site Service	Maintenance Superintendent	<original signed by> Derek Mckinnon (Oct 25, 2022 16:53 CDT)	Oct 25, 2022
	Calvin Boese	SRK	Interim Engineer of Record	<original signed by> Calvin Boese (Oct 25, 2022 20:15 MDT)	Oct 25, 2022
	Michael Dabiri	SRK	Interim Engineer of Record	<original signed by>	Oct 31, 2022
Approved by	Mohammad Taghimohammadi	Mill	Mill Manager	<original signed by>	Oct 31, 2022

(1) This update would not be able to complete without team effort. Thanks for the input from Caroline, NGI Environment; Renee, NGI Community and support from NGI Mill, Mine Ops and Site Service.

Table 2 - Revision Summary

Revision Number	Details of Revision	Date of Issue	Comment
Rev. A	Issued for Internal Review	February 28, 2022	Completed on Mar.14, 2022
Rev. B	Issued for EOR Review	May 1, 2022	Completed on June 13, 2022
Rev. 0	Issued for Use	September 30, 2022	

Acronyms and Abbreviations

Term	Definition
BCR1	Biochemical Reactor #1
BCR2	Biochemical Reactor #2
CDA	Canadian Dam Association
CQA	Construction Quality Assurance
DSI	Dam Safety Inspection
DSR	Dam Safety Review
ECA	Environmental Compliance Approval
EDF	Environmental Design Flood
EDMS	Electronic Document Management System
EMRS	East Mine Rock Stockpile
EOR	Engineer of Record
EPRP	Emergency Preparedness and Response Plan
IDF	Inflow Design Flood
LRIA	Lakes and Rivers Improvement Act
MECP	Ministry of the Environment, Conservation and Parks
MNDM	Ministry of Northern Development, Mines, Natural Resources and Forestry
MRP	Mine Rock Pond
NAG	Non-Acid Generating
NGI	New Gold Inc.
NOWL	Normal Operating Water Level
OMS	Operation, Maintenance, and Surveillance
PAG	Potential-Acid Generating
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PTTW	Permits to Take Water
RASCI	Responsible, Accountable, Supportive, Consulting, Informed
RRM	Rainy River Mine
SOP	Standard Operating Procedure
TDE	Tailings Dam Engineer
TDT	Tailings Dam Technician
TMA	Tailings Management Area
TSS	Total Suspended Solids
WDP	Water Discharge Pond
WMP	Water Management Pond
WMRS	West Mine Rock Stockpile
WTP	Water Treatment Plant
MAC	Mining Association of Canada
ECCC	Environment and Climate Change Canada
MMER	Metal Mining Effluent Regulations
CEAA	Canadian Environmental Assessment Act

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1. Introduction

1.1. Objective

The objective of this document is to provide procedures for the operation, maintenance, and surveillance (OMS) at the New Gold Inc. (NGI) Rainy River Mine (RRM), located near Emo, Ontario. This OMS Manual (the Manual) also serves as a reference for the safe operation of tailings and water management facilities.

1.2. Manual Structure and Revision

The Manual has been separated into "Parts" based on the functions and consequence classification of the structures. Those parts are listed as below:

- PART 1: GENERAL
- PART 2: TMA – Tailings Management Area contains PAW (Process Affected Water) and tailings solids.
- PART 3: WMP – Water Management Pond contains the treated water
- PART 4: MRP – Mine Rock Pond, an extreme consequence structure, contains the contacted water including the open pit water.
- PART 5: SEDIMENT CONTROLS – A serial of small, low to high consequence structures contain the contacted water.
- PART 6: FRESHWATER DIVERSIONS – A serial structures that collect, store, divert freshwater.
- PART 7: WATER DISCHARGE – Site-wide pipelines and pumps for water discharge
- PART 8: EPRP – Emergency Preparedness and Response Plan for site-wide tailings and water management facilities.

This is Part 1: General, of the manual. It describes the basic site conditions, overall facility conditions and common process of the Manual.

RRM is in the ongoing construction/operation stage of the life cycle of a mine. The Manual shall be a living document reviewed and updated annually at a minimum or following any significant changes on site in order to reflect the current condition of the tailings and water management facilities. The changes include, but not limited to at this stage:

- Changes to the milling process, and or mining methods,
- Design of annual TMA dam raise,
- Update of tailings management plan including deposition plan,

- Modification to existing water management facilities or procedures,
- Change of mine closure plans,
- Changes in personnel or roles referred to in the Manual, and
- Other changes that need to be addressed prior to next scheduled review of the Manual.

Revisions to the Manual have been undertaken by NGI's RRM teams. It is the responsibility of the Tailings Dam Engineer to initiate the regular review of the Manual in a timely manner. The review team and approval record are given in signature page of the Manual. The revision history of the Manual is shown in Table 1-1.

Table 1- 1: OMS Manual Revision History

Document Number	Date	Comments	Prepared by
OMS-4000-DT00-MAN-0001	Mar. 2016	Final for Pre-Production	AFW
OMS-4000-DT00-MAN-0002	Mar. 2017	AC, for Operation	AFW
OMS-4000-DT00-MAN-0002.002	Jul. 2017	01, for use for Pre-Production	AFW
OMS-4000-DT00-MAN-0003	Aug. 2017	Updated based on ITRB comments and MNRF conditions for MRP and Cell 2 and 3	NGI
OMS-4000-DT00-MAN-0004	Nov. 2018	Annual review and update including ITRB comments	NGI
OMS-4000-DT00-MAN-0005	Jan. 2019	Split to parts	NGI
OMS-4000-DT00-MAN-0006	Feb. 9, 2021	2021 Issued for Review	NGI
OMS-4000-DT00-MAN-0007	2022	• Change of tailing dam team • Stage 4 dam raise • 2022 Issued for Review	NGI

1.3. Regulatory Requirements

The Manual was prepared pursuant to the MAC guidelines for *Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities* (MAC, 2021, Version 2.1).

Numerous Federal and Provincial environmental approvals are required to construct, operate, and eventually reclaim the sites. Key Provincial legislation related to the RRM includes:

- Ontario Water Resources Act.
- Environmental Protection Act.
- Endangered Species Act.

- Mining Act.
- Public Lands Act and Planning Act.
- MNDMNRF Lakes and Rivers Improvement Act.
- Canadian Dam Association (CDA) guidelines.

The Ministry of Natural Resources and Forestry (MNRF) historically provided oversight and permitting for the TMA dams at RRM. Regulatory oversight for mining dams (defined as offline structures) in Ontario transferred to MNDMNRF (Ministry of Northern Development, Mines, Natural Resources and Forestry) in 2021. In addition to transferring regulatory oversight, changes to the Ontario mining act stipulate that offline mining structures follow the Canadian Dam Association (CDA) guidelines for mining dams.

From the Federal perspective, the Fisheries Act and the associated Metal Mining Effluent Regulation are the primary regulatory instruments related to the RRM.

The primary approval(s) for construction of the various tailings and water management facilities at RRM are as follows:

- Work Permits from Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF), under the Lakes and Rivers Improvement Act (LRIA).
    - These permits approve the design of the dams and appurtenances, in accordance with the provided design drawings and report.
    - LRIA approvals are generally required for each annual dam raising campaign.
- Discharge of effluent (e.g., from the TMA, Tailings Management Area of RRM) is governed by the Environmental Compliance Approvals (ECAs) for Industrial Sewage Works issued under the Environmental Protection Act by the Ontario Ministry of the Environment Conservation and Parks (MECP).
    - The ECAs dictate the quality and quantity of effluent allowed to be discharged to the environment as well as other measures intended to ensure the environment is protected, as well as the overall design of the facility.
- A Closure Plan has been filed with the MNDMNRF under the Mining Act, which describes the planned development and operation of the RRM, the proposed approach to closure of the RRM, and outlines the associated financial assurance related to closure aspects.
    - This Closure Plan will be amended as required, such as any changes to the proposed operation of the TMA, or other changes to the RRM.
    - The Closure Plan primarily focuses on the physical and chemical stability of the site post-closure or during a temporary shutdown scenario.

- Planning to date has assumed long term cover of the potentially acid generating (PAG) tailings to inhibit oxidation.

In addition to these and other regulatory approval requirements, several commitments were made regarding the RRM through the Federal and Provincial environmental assessment processes. These commitments are maintained and tracked by the Environmental Department as the Rainy River Mine Commitments Registry.

1.4. Policy and Commitment

New Gold is committed to excellence in management of tailings by adopting internationally recognized standards and the MAC guidelines. A copy of the New Gold Tailings, Heap Leach and Waste Rock Facilities Management Policy is provided in Appendix A. Although there is not a heap leach facility at the RRP, it is included in the corporate commitment for other New Gold sites which have heap leach facilities.

New Gold is committed to working with local communities of interest (COI) including municipalities, neighbors, and Indigenous communities. The Rainy River Project Commitments Registry is available to all employees on the Environmental Department SharePoint site.

1.5. Supporting Document and Document Control

Controlled Documents are kept on the Document Control site on SharePoint in the "Controlled Documents" library and monitored by the site Document Control Specialist. This library is accessible to all New Gold employees.

All drawings from the original Engineer of Record (EOR) AMEC Foster Wheeler (AMECFW) are kept in the "AMEC E&I Drawings" library on SharePoint and on InEight Document Teambinder, which is New Gold's electronic document management system (EDMS).

All documents and drawings from the current EOR, BGC Engineering (BGC), are kept on InEight Document Teambinder. At the time of writing, BGC is transitioning out of this role. SRK is the interim EOR.

The supporting documents for this revision of the Manual are listed in Table 1- 2. Each revision as contains its own list of supporting documents.

Table 1- 2: Supporting Documents for 2022 Update

Facility	Document Title	Consultant	Document Number
TMA	TMA 2021 Design Basis	BGC	BGC-4910-DT00-RPT-0023.002
TMA	Tailings Deposition Plan and Dam Raise Schedule-2021 Update	BGC	BGC-4910-DT00-RPT-0007.003
TMA	TMA Stage 4 Raise Detailed Design	BGC	BGC-4910-DT00-RPT-0026.001
Stockpile Pond	Stockpile Pond Seepage Mitigation Design	BGC	BGC-2580-DT00-RPT-0003.001
Site-Wide	2021 RRM Dam Safety Review	SRK	SRK-4910-DT00-RPT-0001.001
Site-Wide	2022 Instrumentation Thresholds for TMA and Water Management Dams	BGC	BGC-4910-DT00-MEM-0030.001
Site-Wide	TMA and Water Management Dam Instrumentation Report- May 2021 to November 2021	BGC	BGC-4910-DT00-RPT-0032.001

2. Roles and Responsibilities

2.1. Organization Chart and Individual Responsibility

An organization chart identifying the parties involved with the management of the tailings and water management facilities at the RRM and the chain of command is presented in Figure 1- 1. Key staff for the owner, consultants, and external advisors are included. Responsibilities for named individuals are presented in Table 2-1

2.2. Training Requirements

Training will be provided to employees to ensure responsible personnel are competent. The RRM, in conjunction with the EOR, will provide training on the use of the Manual, and the Standard Operating Procedures (SOPs). It will be the responsibility of the managers to ensure all responsible parties have undergone the mandatory trainings. Table 2- 2 outlines mandatory training requirements.

The mandatory training on SOPs is related to technical procedures and occupational health and safety.

2.3. OMS Activity Tracking and Reporting

Specific critical tasks are detailed by using RASCI Charts (Responsible, Accountable, Supportive, Consulting, Informed). These are reviewed annually. A list of developed RASCI charts is summarized below and provided in Part 2 of this Manual.

- TMA Tailings Discharge & Pipe Relocation.
- TMA Geotechnical Instrumentation.
- Tailings & Water Line Inspections.

As part of quality management, the OMS activities must be carried out according to the available SOPs by the responsible and or supportive personnel. The results of OMS activities should be reported to the accountable and responsible personnel in a mutually agreed timely manner.

2.4. Occupational Health and Safety

The conduct of OMS activities can present unique occupational health and safety challenges. Health and Safety Department of the RRM is responsible for developing SOPs and providing trainings including refresher to mine personnel as discussed in Section 2.2.

Refer to Health & Safety Management Plan developed by Health and Safety team for details.

Table 2- 1: Responsibilities for Named Individuals

Role	Name/ Alternative	Company/ Department	Responsibilities	Phone #	Email
Chief Executive Officer & President	Renaud Adams	NG Corporate	• Has responsibility for the corporate "Tailings, Heap-Leach and Waste Rock Facilities Management Policy" (Included as Appendix A). • Ultimate responsibility for the entire operation including dam safety	<personal information removed>	Renaud.Adams@newgold.com
Chief Operating Officer & Executive Vice President	Patrick Godin	NG Corporate	• Provides corporate accountability for the operations of Rainy River Mine (RRM)	<personal information removed>	Patrick.godin@newgold.com
RRM General Manager	Suresh Kalathil	NG Corporate	• Has accountability for tailings management • Provide support for the implementation of tailings and water management plan • Ensure resources are available for the management of water quality and effluent release • Ensure that all dam design and operation meet the Canadian Dam Association Dam Safety Guidelines • Submit annual dam safety reports to the chief inspector	<personal information removed>	Suresh.Kalathil@newgold.com
Mill Manager	Mohammad Taghimohammadi	NG Mill	• Owner of the TMA • Accountable for the safe operation of TMA • Review and approve OMS Manual for Mill-owned facilities	<personal information removed>	Mohammad.Taghimohammadi@newgold.com
Mill Operation Superintendent	Jody Roussy Bradley Simms	NG Mill	• Responsible for TMA operation	<personal information removed>	Jody.Roussy@newgold.com Brad.simms@newgold.com
Mill Supervisors	Leonard Cochrane James Carlson	NG Mill	• Responsible for inspecting tailings facilities and pipelines	<personal information removed>	Leonard.cochrane@newgold.com James.Carlson@newgold.com
Mill Maintenance Superintendent	Norman Hillier (Scott)	NG Mill	• Accountable for maintenance of the TMA, and related infrastructure	<personal information removed>	Scott.hillier@newgold.com
Electrical Supervisor	Darcy Mosbeck Gabriel McMahon	NG Mill	• Responsible for maintenance of pumps, electrical housing, and other electrical requirements	<personal information removed>	Darcy.Mosbeck@newgold.com Gabriel.mcmahon@newgold.com
Mechanical Supervisor	Erik Sinclair	NG Mill	• Responsible for maintenance of pumps, and other mechanical requirements	<personal information removed>	Erik.sinclair@newgold.com
Site Service Superintendent	Derek McKinnon	NG SS	• Accountable for operations fleet and dewatering maintenance	<personal information removed>	Derek.McKinnon@newgold.com
Site Services Supervisor	Jay Albright Chris Woods	NG SS	• Responsible for maintenance, relocation of HDPE pipelines	<personal information removed>	Jay.Albright@newgold.com Chris.Woods@newgold.com

Error! Reference source not found.: Responsibilities for Named Individuals Continued

Role	Name/Alternative	Company/ Department	Responsibilities	Phone #	Email
Environment Superintendent	Garnet Cornell/ Caroline Winks	NG Environment	• Accountable for regulatory compliance	<personal information removed>	Garnet.Cornell@newgold.com carolyn.winik@newgold.com
Water Resource Engineer	Vacant	NG Environment	• Responsible for monitoring and reporting water balance and pond levels. • Responsible for communicating requirements of maintaining water balance. • Responsible for compliance testing and sampling. • Responsible for the quantity and quality of water discharge when needed.		
Mine Manager	Gord Simms	NG Mine Operations	• Accountable for supplying ore to the mill • Accountable for supplying required/available rock (NAG/PAG) for TMA construction	<personal information removed>	Gord.simms@newgold.com
Capital Projects Manager	Travis Pastachak/ Kristin Kowalski	NG Capital Projects	• Accountable for all Capital Projects • Accountable for TMA construction • Accountable for the establishment of a change management system.	<personal information removed>	Travis.Pastachak@newgold.com kristin.kowalski@newgold.com
Tailings Dam Engineer (TDE)	Winston Ding	NG Capital Projects	• Accountable for the integrity of the tailings facilities. • Responsible for liaising with the EOR, Operations, Planning, Regulatory affairs, social performance, and environment teams. • Responsible for the monitoring system and communication of the results to the EOR, including performance reviews. • Responsible for development, maintenance, training and application of the OMS manuals and EPRP's. • Implement training programs for tailings and water management activities. • Implement the surveillance, inspection, monitoring and maintenance plan as outlined in the OMS manual. • Implement inclusion of QPO's (and/or TARP's) for operational and maintenance activities in the OMS. • Report to the Accountable Executive regarding the status and performance of the dams. • Provide the EOR with operating, surveillance, and monitoring data in a timely manner. • Advise the EOR of potential modifications to the dams, pond water management, surveillance, site conditions and/or instrumentation, and include the EOR in the decision process related to any substantial modifications.	<personal information removed>	Winston.Ding@newgold.com
Tailings Dam Technicians (TDT)	Taha Nadeem Paulo Gamez	NG Capital Projects	• Responsible for instrument data acquisition. • Responsible for data reduction and reporting using current tools and procedures until migration to GIS is completed. • Responsible for instrument maintenance including instrument raise. • Report data and instrument issues to TDE. • Support new instrument installation. • Support other OMS activities assigned by TDE.	<personal information removed>	Taha.Nadeem@newgold.com Paulo.gamez@newgold.com
Project Coordinators	Brent McFarlane Jason Bell	NG Capital Projects	• Coordinate contracts and projects related to dam construction	<personal information removed>	Brent.McFarlane@newgold.com Jason.Bell@newgold.com
Construction Superintendent	Garry Noga	NG Capital Projects	• Generally responsible for upstream and downstream buttress construction on the TMA	<personal information removed>	Garry.Noga@newgold.com
Surveyor	Zak Wallace Jessica Ricklefs	NG Capital Projects	• Provides survey support for construction team. • Responsible for survey of tailings beach elevations. • Develop as-built drawings, supported by Tulloch.	<personal information removed>	Zak.Wallace@newgold.com Jessica.Ricklefs@newgold.com

Error! Reference source not found.: Responsibilities for Named Individuals Continued

Role	Name	Company/ Department	Responsibilities	Phone #	Email
Consultants					
Interim Engineer of Record (EOR)	Calvin Boese/ Colin Boese Michael Dabiri/ Samantha Barnes	SRK	• Preparing a consolidated design basis report for the TMA and water management dams. • Designing and design reporting for subsequent TMA dam raises and other appurtenant works related to the TMA or water management dams. • Completing construction and performance reviews. • Responsible for deviance accountability reporting. • Responsible, with the RTFE/delegates, for construction record reporting. • Support the RTFE with development of the OMS manual. • Complete tasks to achieve the requirements of the responsibilities.	<personal information removed>	cboese@srk.com/ colinboese@srk.com mdabiri@srk.com/ sbarnes@srk.com
TMA Construction Contractor	Varies	Varies	• Generally responsible for TMA core and filter construction, including abutments.		
Survey and Drafting Support	Jason Tremelling	Tulloch Engineering	• Provides QA survey services • Provides drafting support as required	<personal information removed>	Jason.Tremelling@tulloch.ca
Independent Technical Review Board (ITRB)	Bryan Watts Leslie Smith Stephen Day	Varies	• Review of the design, construction, risk assessments, governance systems and other risk management matters that can affect the TMA and water management structures, ensuring that the required expertise and skill sets are involved. • Review of the adopted external loading design criteria and measures to reduce the risk of failure of existing structures to as low as reasonably practicable. • Review of the alternatives analysis, design, construction, risk assessments, governance systems and other risk management matters that can affect the TMA and water management facilities. • Review the TMA Design Basis Report. • Determine the frequency of DSR.	<personal information removed>	bwatts@bdwconsultingvan.com sday@srk.com lsmith@eos.bc.ca

Table 2- 2: Mandatory Training Requirements

Mandatory Trainings	Chief Executive Officer	Senior VP Operations	General Manager	Mill Manager	Mill Supervisor	Mill Maintenance Superintendent	Electrical Supervisor	Mechanical Supervisor	Mobile Maintenance Manager	Site Services Superintendent	Environment Manager	Water Resource Engineer	Mine Manager	Capital Projects Manager	Construction Manager	Tailings Dam Engineer	Tailings Dam Technician	Project Coordinator	Construction Superintendent	Surveyor & Drafting Support	Engineer of Record	TMA Construction Contractor
OMS – Part 1, General	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
OMS – Part 2, TMA				X	X	X	X	X		X	X	X		X	X	X	X				X	X
OMS – Part 3, WMP				X	X	X	X	X		X	X	X			X	X	X				X	
OMS – Part 4, MRP				X	X	X	X	X		X	X	X			X	X	X				X	
OMS – Part 5, Sediment Controls				X	X	X	X	X		X	X	X			X	X	X				X	
OMS – Part 6, Freshwater Diversion										X	X	X			X	X	X				X	
OMS – Part 7, Water Discharge				X	X	X	X	X			X	X			X	X	X				X	
OMS – Part 8, EPRP	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X		X	X
ENV-SOP-0001, Spill Reporting				X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	X	
ENV-SOP-0008, Water Elevation Survey				X								X			X				X	X		
MIL-BCR-SOP-0004, BCR 2 Operation				X	X						X	X										
MIL-CND-SOP-0009, Line Inspections				X	X					X					X	X				X		
MIL-GEN-SOP-0043, Switching Pumps				X	X																	
MIL-WTP-SOP-0002, Response to Upset				X	X	X																
MIL-WTP-0010, Nitrification Cell Op.				X	X																	
MIL-WTP-SOP-0014, Bio. Treatment Op.				X	X																	
CST01-4340-M03-0001.001 WTP Op & Maintenance Manual				X	X	X	X	X														
SAF-SOP-0008, Risk Assessment and MOC		X	X	X	X	X	X	X		X	X	X		X	X	X		X	X		X	X
SAF-SOP-0011 Incident Management Procedure	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X
SAF-SOP-0045 Working Around Water					X					X	X	X			X	X	X	X	X	X	X	X
Multi DAM SOPs Reading Geotech Instruments																X	X	X	X	X	X	
Dam Safety Inspection			X	X						X	X	X		X	X	X	X	X	X		X	

3. Site Baseline Conditions

3.1. Site Location and Tenure

The site is in the Township of Chapple, approximately 70 km by road northwest of Fort Frances in Northwestern Ontario. New Gold has 100% interest in the lands forming the RRM through direct ownership or option agreement, however surface rights are not owned throughout the site boundary.

The RRM is located within lands used by Indigenous Groups for traditional and ceremonial purposes. NGI has regulatory requirements and/or bipartisan agreements to engage with the communities including, but not necessarily limited to those listed in Section 3.9: Communities of Interest (COI).

Road access to the site is by provincial Highway 600 and Highway 71 and Korpi Road (east access road). A site location map is provided in Figure 3-1. The mine is serviced by local municipal infrastructure.

Refer to Land Use Management Plan developed by NG Environment for details.

3.2. Climate and Climate Change

During the summer months (April to October), the climate of the RRM area is affected by warm, moist air systems from the Gulf of Mexico interacting with dry air masses from central Canada. During the winter months (November to March), extended periods of clear, cold weather are a result of cold, dry Arctic air masses flowing from the north.

Based on 1981 to 2010 Canadian Climate Normal data from the Barwick weather station approximately 30 km south of the RRM site, daily temperatures range from as low as -21.1°C in January to as high as 25.2°C in July, with recorded extremes of -49.0°C and 36.5°C. Daily average mean temperatures are below 0°C from November to March.

The mean annual precipitation is 710 mm (rain and snow) with the majority being rainfall. Monthly mean rainfall ranges from 30 mm to 125 mm in the summer months, and monthly mean snowfall ranges from 190 mm to 370 mm in the winter months (Environment Canada,

2020). Pond evaporation occurs from May until October with a cumulative annual evaporation of approximately 540 mm.

Average annual precipitation for the 1951-1980 period was 656 mm. Climate change projections published by https://climatedata.ca suggests that under a high emissions scenario, this is projected to be 6% higher for the 2021-2050 period, 5% higher for the 2051-2080 period and 10% higher for the last 30 years of this century.

3.3. Topography and Geology

The area has been influenced by several cycles of glaciation and in some areas is overlain by glacial deposit thicknesses up to 40 m. At the mine site, the stratigraphic sequence (upwards starting from the lowest elevation above bedrock) consists of:

- Whiteshell Till, sand and gravel
- Wylie Formation, glaciolacustrine silts and clays
- Whitemouth Lake Till, glaciolacustrine silty clay
- Brenna Formation, glaciolacustrine silts and clays
- Poplar River Formation, fluvial sand
- Sherack Formation, glaciolacustrine.

In general, the controlling units for stability are the Whitemouth Lake Till and high plasticity faces of the Brenna Formation. A detailed description of the site geology is provided in the sitewide geological model report (BGC, September 10, 2019). A description of the Rainy River TMA foundation characterization is provided by BGC (BGC, October 29, 2021a). The Wylie Formation, WML Till, and the Brenna Formation contain swelling clay minerals with possible coarse-grained intervals. This heterogeneity in permeability and hydraulic conductivity affects pore pressure response at depth.

The RRM site is underlain by bedrock comprising the Wabigoon sub-province of the Superior Province of the Precambrian Shield. The Wabigoon sub-province is characterized by Archean metavolcanic bedrock with plutonic rock intrusions and northwest-trending diabase dikes estimated to be of Proterozoic age.

3.4. Hydrology and Hydrogeology

The RRM site on the north side of the Pinewood River is drained by four small creek systems, which include from east to west: Clark Creek (Teeple Drain), West Creek, Marr Creek and Loslo Creek (Cowser Drain). Major portions of the Clark Creek, Marr Creek and

Loslo Creek basins have been overprinted by RRM developments, principally the TMA and mine rock stockpiles. West Creek is currently diverted around the pit and flows to Loslo Creek via the West Creek Diversion.

Regional groundwater flow is generally towards the west in the Pinewood River watershed. Artesian conditions within the shallow bedrock and Pleistocene lower granular deposits are common along the stream corridors.

3.5. Groundwater Quality

Groundwater quality is typical calcium magnesium-bicarbonate type water with most sampling points having total dissolved solids exceeding 500 mg/L. Sampling of groundwater since 2007 has indicated metal concentrations above application guidelines. Then-EOR, AFW defined the threshold limit for each metal in in the 2016 contingency plan for groundwater according to the guideline B-7 of the MOEE groundwater Management Activities (1994a), since that year just Arsenic, Lithium, magnesium, manganese and strontium consistently exceed the threshold limit in several wells.

3.6. Biodiversity

Refer to Biodiversity Management Plan developed by NG Environment for details.

3.6.1 Fish

The fish community proximal to the RRM is dominated by baitfish and forage fish species with sportfish (e.g., Walleye and Northern Pike) in the lower Pinewood River below the Pinewood Pumphouse. Presently the lower reaches of Marr and Loslo Creek remain fish bearing after the headwaters have been cut off by the TMA construction. West Creek and Clark Creek are former tributaries to the Pinewood River and have been offset for by the Clark Creek and West Creek Diversion structures which are offsetting habitat and support all life history stages of baitfish and forage fish species.

The freshwater diversions are fish bearing waters and subject to protection under numerous permits and legislation e.g., Fisheries Act. Cowser Drain (Loslo Creek) and the Pinewood River are also fish bearing. Water quality discharges into these areas must meet MNDMNRF and ECA permit requirements. The discharge threshold limits are set to avoid fish damage. ECA requested weekly samples during discharge for mercury, sulfate and ammonia, if the criteria were not met, NG cannot discharge to the environment, affecting the water balance and TMA operations subsequently.

3.6.2 Vegetation

The RRM is within Ecoregion 5S (Agassiz Clay Plain) and there are no published "Significant Wildlife Habitat Ecoregion Criteria Schedules" for this ecoregion. Aspen-Birch hardwood forest is the dominant (46.6 %) forest type proximal to the mine, followed by coniferous swamp / wetland (29.4 %). Agricultural lands are present across 8% of the area proximal to the mine, primarily along roads and in areas of well drained clays. No records of rare vegetation communities or rare plants were identified during the Environmental Assessment.

Based on the ecoregion, the growing season length is 180-190 days with mean annual temperatures of 1.5 to 3.0 ºC. The frost-free period is ~125 days from mid-May to mid/late September (Ministry of Agriculture; 1976-2005).

3.6.3 Wildlife

Key wildlife aspects influencing the OMS manual include the presence of:

- Species at risk including but not limited to Eastern Whip-poor-will and Bobolink which require consideration of limits of disturbance, timing of works, noise mitigation and dust management
- Snapping turtles, for which measures must be taken to prevent them entering the TMA, process water and water treatment facilities
- Migratory birds requiring noise mitigation measures, reduced light pollution, timing windows on clearing, deterrents to prevent use of the TMA and monitoring for use of the TMA
- Deer, which along with other wildlife require that a fence is to be constructed around the active tailings deposition areas
- Bear, which along with other wildlife need to be managed through controlling wildlife-human interactions including reporting, no harassing of wildlife, no fishing or hunting on the mine site, speed restriction and waste management to exclude wildlife.

3.7. Seismic Setting

The seismic setting of the RRM is described in BGC-4910-DT00-RPT-0019-001. RRM is located within the stable Canadian Shield region within the North American Plate, which has a relatively low level of seismic activity.

Based on a catalog of historical seismicity from the National Earthquake Database (NRCan 2018), 341 earthquakes were recorded within 200 km of RRM since 1985, 247 of which were less than magnitude M 2.0, and none greater than magnitude M 3.2. The nearest earthquake occurred 35 km from the mine. The estimated peak ground accelerations associated with the 1:2,475 and 1:10,000-year seismic events are 0.05 g and 0.11 g, respectively, for overburden conditions corresponding to the 2003 National Earthquake Hazards Reduction Program (NEHRP) site classification system Site Class D (Stiff Soil).

3.8. Other Hazards

Beyond earthquake, other natural hazards to the RRM are limited to weather related hazards e.g., flooding, drought, extreme cold or high winds and forest fires. Other natural hazards e.g., volcanic activity, subsidence, avalanches, and landslides are not expected to affect the mine given surrounding geology and topography. Responses to natural hazards are considered as part of the site EPRP. Potential natural hazards relating to the OMS are discussed here and refer to EPRP for the preparedness and response plans to the hazards.

- Forest Fire: there is potential for forest fires to affect operations of the mine, with the cycle in the RRM being 63 to 210 years.
- Pit Slope Failure: could be caused by flooding or slope instability. Modelling of the 1:100-year flow in the Pinewood River would result in the Pinewood River cresting adjacent to the pit between elevations 347.35 m. A proposed flood protection berm will provide protection during potential ice jams in the Pinewood River.
- Flooding: there is potential for flooding, and associated rainfall to affect operations of the mine. Design of the dams and diversion structures has considered these events. Results of flooding leading to a potential need to discharge additional water is offset by the increased assimilative capacity of the receiving environment at the permitted 1:1 discharge ratio in Pinewood River at EDL1.
- The water treatment capacity of water treatment facility including BCR 1 has a limit of flow up to 24,000 m^3/day through the WTP without it overflowing. In a wet year, this water treatment capacity may not be sufficient and result in storing too much water in TMA which is a possible operation constraint.
- Drought: drought conditions may result in a reduction in water availability for processing and discharge. Drought conditions for processing is mitigated through the design of the WMP and water storage structures. In the event of 5th percentile low flow fall, only 1.53 Mm^3 could be discharged. However, this is managed through capacity in the TMA, WMP and water treatment. Water balance model is regularly updated and reviewed by RRM management.

3.9. Community of Interest

NGI continues to inform and consult Communities of Interest which include:

- Local Indigenous communities of Big Grassy River First Nation, Anishinaabeg of Naongashiing, Ojibways of Onigaming First Nation, Naotkamegwanning First Nation, Naicatchewenin First Nation, Rainy River First Nations, Buffalo Point First Nation, and the Sunset Country Métis community (as represented by Métis Nation of Ontario Region 1 Consultation Committee), Mitaanjigamiing First Nation, Couchiching First Nation, Lac La Croix First Nation, Nigigoonsiminikaaning First Nation, Seine River First Nation, Northwest Angle #33 First Nation, Northwest Angle #37 First Nation and Anishinabe of Wauzhushk Onigum (in accordance with consultation requirements and/or communication protocols established through Agreements as modified over the life of the project).

  Those local indigenous communities can be found in the attached Figure 3-2: Treaty 3 Map.

- Site neighbours.
- Local townships which include Township of Chapple and Morley Township.

Where formal agreements are not in place, consultation and notification continue to occur, consistent with regulatory requirements.

Refer to Community Management Plan developed by NG Rainy River Community team for details.

4. Facility Characteristics

4.1. Facility Overview

The components of the RRM relative to the scope of the OMS include various tailings and water management facilities. They are grouped as:

- Tailings Management Facility
  - Tailings Management Area (TMA)
    - South Dam
    - West Dam (Dam 4 and Dam 5)
    - North Dam including an emergency spillway
    - North Ring Road, the natural topographic highs
    - Tailings Pond (Cell 1, Cell 2, and Cell 3. Merge to one cell in Stage 4)
    - Decant Pond, part of the tailings pond in the SW corner
  - TMA ancillary structures include
    - Seepage and Runoff Collection Ditches and Sumps (four sumps for South Dam, three sumps for North Dam, one sump for West Dam constructed in early 2022)
    - North Catchment Area Diversion including ICS (Inflow Control Structure) at Loslo Creek and a sump and ditch at Marr Creek
    - Tailings Pipeline System (Mill to TMA including a booster station)
    - Reclaim Water Pipeline System (Decant Pond to Mill)
    - Water Transfer Pipeline (TMA to Lime WTP)
- Water Management Facilities
  - Process Water Management
    - Water Management Pond (WMP) including WTT (Water Treatment Train)
      - WMP Dam 1 including a spillway
      - WMP Dam 2
      - WMP Dam 3
      - Settling Pond Dam
      - WTT (Nitrification Cell, BCR #1 and Lime WTP)
      - Seepage and Runoff Collection Ditches and Sumps (Sump 1 for Dam 1 & 2, Sump 2 for Dam 3)

        - Water Management Pipeline System
    - Freshwater Management
        - Marr and Loslo Creek Diversion Ditches
        - Clark Creek Diversion
            - Clark Creek Pond and Dam
            - Clark Diversion Ditches
            - Teeple Creek Pond and Dam
            - Teeple Diversion Ditches
        - West Creek Diversion
            - Stockpile Pond and Dam
            - Stockpile Pond Diversion Ditches
            - West Creek Pond and Dam
            - West Creek Diversion Ditches
    - Sediment Control / Contact Water Management Structures
        - Water Discharge Pond and Dam (WDP), BCR #2 and Constructed Wetland (CW)
        - East Mine Rock Stockpile Pond and Dam (MRP)
        - West Mine Rock Stockpile (WMRS)
            - Sediment Pond 1 and Dam including diversion ditch
            - Sediment Pond 2 and Dam including diversion ditch
            - Sediment Pond 3 and Dam including two sumps and diversion ditch
        - Plant Site Ponds
            - North Runoff Pond, technically a sump
            - South Runoff Pond and Dam
- Utilities
    - Power to the plant site is provided by 230 kV transmission lines that are connected to Hydro One northwest of the site at a Switching Station.
    - The main 230 kV Substation is located near the concentrator building to provide power to the process equipment via underground supply lines. Power to the remainder of the site is provided by a network of overhead power lines fed from the main substation; and
    - Site telecommunications and Process Control are distributed via fiber optic lines.

Figure 4- 1 to Figure 4- 5 presents the plan view of the faculties based on the RRM GIS Base Map dated August 8, 2021.

4.2. Facility Design and Construction

4.2.1. Summary of Facilities

- Summary of the RRM dam characteristics is presented in Table 4- 1.
- Summary of the RRM pond characteristics is presented in Table 4- 2.

Table 4- 1: Summary of Dam Characteristics

Purpose & Facility	Dam Name	Type of Dam	Construction Stage	Crest Elev. (m)	Max. Dam Height (m)	Dam Length (m)	Crest Width (m)	Slopes (_H:1V)	Spillway Invert Elev. (m)	Spillway Width (m)	Normal Freeboard (m)
Tailings Management Dams											
Tailings Management Area (TMA)	North Dam	Central core	Stage 4	373.6 (Stage 3) 375.1 (Stage 4) 379.1 (Ultimate)	12	3388	30.25	9:1 (U/S) 13:1 (D/S)	371.8 (Stage 3) 373.3 (Stage 4)	20	1.8
	South Dam				22	3585	30.25	4:1 (U/S) 22:1 (D/S)			
	West Dam 4				12	965	32.25	4:1 (U/S) Flat (D/S)			
	West Dam 5				12	881	32.25	9:1 (U/S) 8:1 (D/S)			
	TMA Cell 1	Rockfill & Liner	Final	371.5	12	1470	10	11:1 (D/S)	370.5	8	Varies
	TMA Cell 2	Central core		366.5	10.5	860		11:1 (D/S) 11:1 (U/S)	364.7		
Contact Water Management											
Water Management Pond (WMP)	WMP Dam 1	Homogeneous clay fil	Final	371.5	4.2	850	10	4.0	370.5	8.4	3.6
	WMP Dam 2			371.5	9.5	800	10	5.5			
	WMP Dam 3			371.5	13.3	750	10	9.2			
	Settling Pond Dam			371.5		550	5	4.0	n/a		3.6
Mine Rock Pond	Mine Rock Pond Dam	Central core	Final	360.2	13.0	1655	10	11.0	358.9	80	3.4
Freshwater Diversion											
Clark Creek Diversion	Clark Creek	Homogeneous clay fill	Final	380.25	4.0	285	6	5.5	379.9	6	1.3
	Teeple Road	Homogeneous clay fill	Final	379.0	7.0	465	6	6.0	378.7	6	0.5
West Creek Diversion	Stockpile Pond Dam	Central core	Final	375.5	9.8	380	6	6.5	372.3	20	3.2
	West Creek	Central core	Final	364.9	8.9	750	10	7.9	360.9	8	3.9
Purpose & Facility	Dam Name	Type of Dam	Construction Stage	Crest Elev. (m)	Max. Dam Height (m)	Dam Length (m)	Crest Width (m)	Slopes (_H:1V)	Spillway Invert Elev. (m)	Spillway Width (m)	Normal Freeboard (m)
Tailings Management Dams											
Tailings Management Area (TMA)	North Dam	Central core	Stage 4	373.6 (Stage 3) 375.1 (Stage 4) 379.1 (Ultimate)	12	3388	30.25	9:1 (U/S) 13:1 (D/S)	371.8 (Stage 3) 373.3 (Stage 4)	20	1.8
	South Dam				22	3585	30.25	4:1 (U/S) 22:1 (D/S)			
	West Dam 4				12	965	32.25	4:1 (U/S) Flat (D/S)			

Purpose & Facility	Dam Name	Type of Dam	Construction Stage	Crest Elev. (m)	Max. Dam Height (m)	Dam Length (m)	Crest Width (m)	Slopes (_H:1V)	Spillway Invert Elev. (m)	Spillway Width (m)	Normal Freeboard (m)
	West Dam 5				12	881	32.25	9:1 (U/S) 8:1 (D/S)			
	TMA Cell 1	Rockfill & Liner	Final	371.5	12	1470	10	11:1 (D/S)	370.5	8	Varies
	TMA Cell 2	Central core		366.5	10.5	860		11:1 (D/S) 11:1 (U/S)	364.7		
Contact Water Management											
Water Management Pond (WMP)	WMP Dam 1	Homogeneous clay fil	Final	371.5	4.2	850	10	4.0	370.5	8.4	3.6
	WMP Dam 2			371.5	9.5	800	10	5.5			
	WMP Dam 3			371.5	13.3	750	10	9.2			
	Settling Pond Dam			371.5		550	5	4.0	n/a		3.6
Mine Rock Pond	Mine Rock Pond Dam	Central core	Final	360.2	13.0	1655	10	11.0	358.9	80	3.4
Freshwater Diversion											
Clark Creek Diversion	Clark Creek	Homogeneous clay fill	Final	380.25	4.0	285	6	5.5	379.9	6	1.3
	Teeple Road	Homogeneous clay fill	Final	379.0	7.0	465	6	6.0	378.7	6	0.5
West Creek Diversion	Stockpile Pond Dam	Central core	Final	375.5	9.8	380	6	6.5	372.3	20	3.2
	West Creek	Central core	Final	364.9	8.9	750	10	7.9	360.9	8	3.9
Sediment Control											
Water Discharge Pond	Water Discharge Pond Dam	Homogeneous clay fill	Final	355.2	2.2	350	6	4.0	354.2	5	1.0
Mine Rock Stockpile	Sediment Pond #1	Central core	Final	354.0	3.8	1750	6	4.0	353.7	60	0.8
	Sediment Pond #2	Homogeneous clay fill	Final	348.2	5.2	1460	6	4.0	348	115	2.2
	Sediment Pond #3	Central core	Final	345.7	1.0	344	6.4	4.0	345.0	30.3	0.7
Plant Site Ponds	North Runoff Pond	None - excavated	n/a	365.0	3.4 (internal)	n/a	4.0	2-3	n/a	n/a	n/a
	South Runoff Pond	Homogeneous clay fill	Final	363.5	6.5	420	4.0	4.0	362.9	40.0	0.6

Table 4-2: Summary of Pond Characteristics

Purpose & Facility	Dam/Pond Name	Catchment Area (km^2)	Inflow Design Flood (event/flow)	Peak IDF Inflow (m^3/s)	Peak IDF Water Level (m)	Peak IDF Outflow (m^3/s)	Minimum Freeboard Available (m)	Environmental Design Flood (event/volume)	Normal Operating Water Level (m)	Impounded Volume to NOWL (m^3)	Maximum Operating Water Level [2] (m)
Tailings Management Area (TMA)	TMA North	10.5	Summer PMF, based on 12-hour PMP (530 mm)	622	372.6	22.2	1.0 m above IDF level for 4:1 dam slope. Maintain a minimum of 0.4 m crest elevation above tailings surface.	100-year 30-day storm (320 mm)	371.3 (Stage 3) 372.8 (Stage 4)	Varies, to an ultimate storage capacity of 71.3 Mm^3 (tailings and water)	371.8 (stage 3) 373.3 (Stage 4)
	TMA South										
	TMA West (Dam 4)										
	TMA West (Dam 5)										
	TMA Cell 1										
	TMA Cell 2[3]							100-year 24-hour	371.3 (Stage 3)		
Water Management Pond (WMP)	WMP Dam 1	1.1	Summer PMF, based on 24-hour PMP (586 mm)	199[1]	371.1	Not specified. Estimated to be 6-7 m^3/s	Not available. Estimated to be 0.8 to 1.2 m	100-year 30-day storm (320 mm)	369.7	5,200,000	370.5
	WMP Dam 2										
	WMP Dam 3										
	Settling Pond			Not specified							
Mine Rock Pond	Mine Rock Pond	5.34	Summer PMF, based on 24-hour PMP (586 mm)	228	359.	Not available	0.29 m (designed to be overtopped, as maximum wave height is 0.78 m)	100-year 30-day storm (320 mm)	356.8	603,000	358.9
Clark Creek Diversion	Clark Creek	Not available	100-year 24-hour rainfall (127 mm)	14.3	379.9	4.7	Not provided. 0.1 m available (designed to be overtopped)	No EDF. Ponds store freshwater	378.78	Not available	None specified
	Teeple Road	Not available		5.2	378.9	4	Not provided. 0.1 m available (designed to be overtopped)	No EDF. Ponds store freshwater	378.5	Not available	None specified
West Creek Diversion	Stockpile Pond	1.37	Summer PMF, based on 24-hour PMP (516 mm)	89.8	Not specified	86.7	Not specified	No EDF. Ponds store freshwater.	372.2	93,700	None specified
	West Creek	Not available		201	364.5	188	0.4 m (available)	No EDF. Ponds store freshwater.	361.0	156,000	None specified
Water Discharge Pond (WDP)	Water Discharge Pond	Not available	Not specified	Not available	Not specified	Not available	Not specified. Approximately 1.0 m normal freeboard available	Not available	354	Not available	354.2
Mine Rock Stockpile	Sediment Pond #1	1.55	100-year, 24-hour storm (127 mm)	17.8	353.99	13.6	Not specified. 0.21 m total freeboard available	25-year 24-hour storm (110 mm) without pumping, or 25-year 30-day rainfall (24 mm) with pumping	352.7	167,000	353.7
	Sediment Pond #2	Not available	Regional Storm Event (Timmins Storm), flow not specified	Not available	Not specified	Not available	Not specified. 0.2 m total freeboard available		347.2	290,000	348
	Sediment Pond #3	1.12	100-year, 24-hour rainfall (135 mm)	25.7	345.5	14.7	0.19 m (0.20 m available)		344.6	118,000	345
Plant Site Ponds	North Runoff Pond	Not available	1 in 10-year runoff event	Not available	Not specified	Not available	Not specified. 1.9 m normal freeboard available above NOWL.	Not specified	Not available	15,100	363.1
	South Runoff Pond	Not available	Not available	Not available	Not available	Not available	Not specified. 0.7 m normal freeboard available above spillway invert	Not available	362.8	67,830	362.8

(1) This inflow rate is understood to include outflows from the TMA Cell 2 spillway, which routed into the WMP prior to being decommissioned.
(2) Typically, equivalent to spillway invert elevation.
(3) Cell 2 and Cell 1 merge into one cell during 2022 tailings disposition.

4.2.2. Dam Consequences Classification

The current dam consequence classifications for each facility at RRM are listed in the 2020 DSI (BGC-4910-DT00-RPT-0017.001) performed by EOR except for Sediment Ponds 1 to 3. Table 4- 3 lists consequence classifications for the dam structures as provided by EOR and 2021 Dam Safety Review (DSR) consultant.

Table 4- 3: Dam Consequence Classifications (CDA Equivalent)

Facility		Dam Classification	
		EOR (BGC, 2020i)	DSR (SRK, 2021)
TMA Dams (North, West, South)		Extreme	Very High
WMP Dams (Dam 1 to 3)			
Stockpile Pond Dam			
West Creek Dam			
MRP Dam			High
Sediment Pond Dams	Dam 1	Unclassified	Low
	Dam 2		Significant
	Dam 3		Low
Clark Creek Dam		Low	Significant
Teeple Dam			
Water Discharge Dam			Low
Plant Site	South Runoff Pond Dam		High
	North Runoff Pond Dam		Declassified

4.2.3. Design Criteria

The TMA is designed to provide sufficient storage for the projected tailings storage requirements and operational pond volume.

The water management facilities are designed to collect, divert, and store surface runoff and seepage from dams, and provide water storage for mill water reclamation.

4.2.3.1. IDF

IDF (Inflow Design Flood) is designed to pass through the emergency spillway without impacting the integrity of the dam.

For the TMA, an IDF equal to the full probable maximum flood (PMF) has been selected (corresponding to the CDA "Extreme" consequence classification).

The IDF event selected corresponds to the summer PMP which is 12-hour PMP (530 mm), which results in the highest PMF peak flow.

The hydrotechnical parameters IDF event including IDF inflow, outflow and IDF water level for the TMA (Stage 3) and water management facilities are presented in Table 4- 2.

4.2.3.2. EDF

EDF (Environmental Design Flood) is the most severe flood that can be managed without release of untreated water to the environment. This volume is maintained below the emergency spillway invert.

EDF is defined as a deterministic storm event corresponding to a flood event return period of 1:100 years and 30-day duration (320mm) for the TMA.

The TMA dam raise schedule assumes that the EDF water level (EDFL, equivalent TMA spillway invert elevation) must be at or above the projected 99th percentile pond level. This would provide a minimum annual probability of discharge through the spillway of 1% or less, which is equivalent to a return period of approximately 1:100 years.

The EDF event for the water management facilities is presented in Table 4- 2.

In the technical documents, some hydrotechnical terms have not been used consistently. Max. operating water level (MOWL), spillway invert elevation and EDFL are technically the same value.

4.2.3.3. NOWL

Normal Operating Water Level (NOWL) is defined as the elevation below the EDFL to contain inflow from the EDF between the min. operating water level (corresponding to 5th percentile pond level) and the EDFL. For TMA, NOWL is approximately spillway invert elevation minus 0.5 m.

NOWL for the TMA (Stage 3) and water management facilities is presented in Table Table 4-2.

4.2.3.4. Freeboard

According to CDA 2007 Hydrotechnical Bulletin, minimum freeboard is defined as the difference in elevation between lowest elevation of the top of the dam and the maximum

still pool reservoir level that would results should the IDF occur. Min. freeboard is selected to ensure no overtopping by 95% of waves caused by the most critical wind, as dictated by the dam classification, during the IDF event.

For the TMA, the wind annual exceedance probability used for the minimum freeboard was 1:100 years, resulting in a required minimum freeboard of 1.0 m for Stage 3 (BGC-4910-DT00-RPT-0015.005) and 0.87 m for Stage 4 (BGC-4910-DT00-MEM-0023.003) above IDF level for 4H:1V upstream slope. The available minimum freeboard is 1.0 m for Stage 3 and 0.9 m to 1.0 m for Stage 4.

Normal Freeboard is defined as the difference in elevation between the lowest elevation of the top of the dam and the maximum normal reservoir operating level (MOWL), which in this case is the spillway invert. The normal freeboard ensures that the structure is protected against the most critical of the following cases:

- No overtopping by 95% of the waves caused by the most critical wind with a frequency of 1000-year when the reservoir is at its MOWL
- Thickness of the material covering the impervious core is sufficient to avoid freezing of the core in winter.

For the TMA, the required normal freeboard is 1.4 m for Stage 3 (BGC-4910-DT00-RPT-0015.005) and 0.85 to 0.99 m for Stage 4 (BGC-4910-DT00-MEM-0023.003). The available normal freeboard is 1.8 m for Stage 3 and 4.

Minimum freeboard, IDF, EDF, NOWL etc. for the TMA and water management facilities is presented in Table 4- 2. The normal freeboard for all dams is presented in Table 4- 1.

4.2.3.5. Spillway

An emergency spillway is designed to pass IDF while maintaining minimum freeboard required to accommodate wind setup and wave run-up without discharge.

TMA spillway invert elevation is 1.8 m below dam crest for the stages as shown in **Error! R eference source not found.**. The TMA emergency spillway location is maintained approximately at TMA North Dam Sta. 0+850 and Sta. 0+950 throughout remaining operations and then relocated to the TMA West Dam (Dam 4) at closure.

The geometry of spillway and the invert elevations of all dams (Stage 3 for TMA spillway) is presented in Table Table 4- 1.

4.2.3.6. Physical Stability

The stability criteria including loading conditions and minimum factors of safety adopted for the TMA design are summarized in Table 4- 4 and are in accordance with the CDA guidelines.

Dam construction is staged such that the minimum FoS (Factor of Safety) is 1.5 throughout construction and at the End of Construction for each crest raise.

The rapid drawdown scenario is assessed for the downstream slopes of the TMA West Dam (Dam 4), considering rapid drawdown of the BCR#1 pond, and for the TMA West Dam (Dam 5), considering rapid drawdown of the WMP.

Table 4- 4: Minimum Factor of Safety Adopted for TMA Design

Loading Condition	Minimum Factor of Safety	Slope
End of construction – Static	1.5 (1)	Downstream and Upstream
Full or partial rapid drawdown – Static	1.2	Downstream where applicable (2)
Pseudo-static – Seismic	1.0	Downstream and Upstream
Post-earthquake – Seismic	1.2	Downstream and Upstream

Notes:

1. For select Design Zones with unfavorable foundation conditions (see Section 4.5.2), design will also evaluate physical stability to meet an end of construction (EOC) FOS_{min} = 1.3 considering lower-bound shear strengths (see Section 4.5.3).
2. Applicable for the downstream slopes of the TMA West Dam (Dam 4) and TMA West Dam (Dam 5) with downstream BCR#1 and WMP ponds, respectively.

4.2.3.7. Seismic Design Criteria

For the TMA, an earthquake design ground motion (EDGM) with a 1/10,000 AEP (Annual Exceedance Probability) has been selected (corresponding to the "Extreme" consequence classification) (CDA, 2013).

Ground motions are discussed in greater detail in the Updated Ground Motion Evaluation Report (BGC-4910-DT00-RPT-0004.001). For the design of the TMA, it is recommended to use the Site Class D response spectrum including a PGA of 0.14 g corresponding to a 10,000 year mean return period, as well as specifying the maximum magnitude of M 6.0 for the design earthquake at a site-to-source distance of approximately 50 km.

The maximum allowable permanent seismic displacement for the TMA dams is 0.3 m, with a percentage exceedance of this threshold of 50%.

Tailings are assumed to liquefy (i.e., zero shear strength). Analyses of CPT data completed as part of TMA Stage 2 raise design indicate that the TMA foundation soils are generally considered to be non-liquefiable.

The cohesive foundation soils are assumed to undergo a 20% reduction in shear strength as result of earthquake loading.

The seismic design criteria for the water management dams are not summarized.

4.2.4. Brief Dam Construction History

Summary of the construction of RRM onsite dams and ancillary structures is referenced in Table 4- 5.

Table 4- 5: Construction Record Reports

Structure	Reference
Clark Creek Diversion System	RRP-GEO-REP-027
Water Management Ponds	RRP-GEO-REP-030
TMA Cell 1	RRP-GEO-REP-032
West Creek Diversion System	RRP-GEO-REP-028
Mine Rock Pond	RRP-GEO-REP-033
TMA Cell 2	RRP-GEO-REP-035
TMA Cell 3	RRP-GEO-REP-039
Sediment Pond 1	RRP-GEO-REP-040
Sediment Pond 2	RRP-GEO-REP-038
Water Discharge Pond	RRP-GEO-REP-037
TMA Stage 2 Raise	BGC-4910-DT00-RPT-0011
Sediment Pond 3	BGC-4460-DT00-RPT-0011
TMA Stage 3 Raise	BGC-4910-DT00-RPT-0014.001

4.3. Tailings Management

4.3.1 Tailings Characterization

4.3.1.1 Ore and Ore Processing

Type of ore: Pyrite, Pyrrhotite, Chalcopyrite

Ore processing method including reagents used: Leaching process using cyanide

Ore processing rate : 24,000-30,000 tpd

Treatments applied to tailings before transported to TMA: Inco SO2/Air detoxification of cyanide

4.3.1.2 Tailings Properties and Beach Slopes

2021 Design Basis Report (BGC, 2021, BGC-4910-DT00-RPT-0023.004) presents following tailings properties and beach slopes.

- Non-plastic, predominantly silt-sized particles
- Specific gravity: 2.78
- In-situ dry density: 1.35 t/m^3
- PAG with an expected lag time to net acidic conditions of approximately 30 years
- Metal leach from subaerial and subaqueous tailings and greater source of loading from subaerial.
- Tailings beach slope: above water: 0.5%, below water: 0.9%.

4.3.2 Tailings Production

- Mill start-up (August 9, 2017) to April 1, 2021: Actual mill production values: average 19,000 tpd (ton per day).
- April 2, 2021, to the end of mine life (June 30, 2028): Forecasted mill throughput schedule: average 26,000 tpd.

Table 4- 8 provides the schedule for the life of mine tailings production. The projected total tailings tonnage is approximately 97.6 Mt by the end of June 2028, which corresponds to an approximate volume of 72.3 Mm^3 based on a dry density of 1.35 t/m^3.

Table 4- 6: Life-of-Mine Tailings Production (1)

Description	Open Pit (incl. stockpiles)	Underground	Total
2022	9,316,450	146,966	9,463,416
2023	9,543,879	311,121	9,855,000
2024	9,195,029	659,971	9,855,000
2025	8,404,106	1,450,894	9,855,000
2026	7,992,969	1,862,031	9,855,000
2027	7,894,511	1,960,489	9,855,000
2028	5,216,358	1,784,294	7,000,652
2029		1,643,071	1,643,071
2030		1,625,515	1,625,515
2031		1,212,232	1,212,232
LOM Total:	57,563,302	12,656,584	70,219,886

(1) According to Table 16.39 (P370, NI43-101, dated March 31, 2022)

4.3.3 Tailings Distribution System

The tailings deposition plan is developed annually and in conjunction with the corresponding year's dam raise schedule. Deposition plans are available in New Gold's document control system, In Eight Team Binder. The 2021 deposition plan is the most recent available iteration of the document (Document BGC-4910-DT00-0007.003).

Tailings is transported in a slurry state with approximately 47% solid content by mass and pumped through 24" HDPE pipeline from the mill to the TMA.

Tailings pipelines sit on upstream rockfill zone, Zone 2/2A, and permanently positioned off the dam core, Zone 1/1A. Before reaching TMA, tailings pipeline should be placed in a lined collection trench.

Tailings can discharge to the TMA pond through spigots along perimeter dams and end-dumping along North Ring Road (NRR).

4.4. Water Management

Refer to the Rainy River Mine 2021 Water Management Plan (developed by NG Environment and updated in 2022) for details.

4.4.1 Freshwater Diversion

The Freshwater Diversion system includes:

- Marr and Loslo Creek diversion ditches

- Clark Creek diversion including the Clark Creek and Teeple dam structures
- West Creek diversion including the Stockpile and West Creek dam and diversions structures.

The freshwater diversions function to reduce inflows to the RRM and provide offsetting habitat for the loss of portions of Loslo, Marr, Clark, and West Creeks. Diversion of the non-contact runoff from these catchments and TMA pond water treatment reduces the effluent management requirements and helps reduce pressure on the water treatment plant. All structures support fish habitat except for Marr and Loslo diversion ditches.

4.4.2 Water Reclaim

The TMA provides long term containment for the tailings. The mill make-up water is reclaimed from the TMA Pond, Water Management Pond (WMP) and Mine Rock Pond (MRP) as shown in Figure 4- 7. More detail is available in the respective sections of the OMS for each structure.

The TMA dam raising schedule is divided into seven stages and has been set to ensure sufficient pond storage to satisfy mill make-up water supply and effluent management requirements. Both the WMP and MRP are constructed to final elevation.

4.4.3 Process Water Treatment

The TMA has been designed to optimize natural degradation processes, by ensuring there is sufficient time to allow for heavy metals to precipitate to low levels in the pond. The natural degradation processes are most effective during warm weather conditions when biophysical activity is optimal and are also augmented by exposure to sunlight.

Bubblers (10) throughout the WMP provides sufficient aeration to treat for ammonia and will keep the water over the WMP from completely freezing during the winter.

A schematic diagram of the Water Treatment Train (WTT) is shown in Figure 4- 8. Water treatment is provided by Water Treatment Plant (WTP), Biochemical Reactor 1 (BCR 1) and Biochemical Reactor 2 (BCR 2).

Treated surplus water is transferred to the WMP before it is discharged to the environment, predominately via Biochemical Reactor 2 (BCR2) and the Outflow Basin (OB), to the Loslo Creek confluence with the Pinewood River (EDL2). A pipeline to the Pinewood River downstream of McCallum Creek (EDL1) can also discharge water at times of higher flow and when there is insufficient flow at EDL2. BCR2 will treat for phosphates and sulphates and

residual metals. Effluents planned for discharge to the environment will meet discharge criteria or be pumped back to the WMP for further treatment.

4.4.4 Sediment Control

Sedimentation ponds have been designed to allow for the settlement of total suspended solids present in the non-contact runoff or effluent prior to discharge to the environment. Sediment Ponds 1, 2 and 3 receive runoff and seepage from the West Mine Rock Stockpile (WMRS).

5. Instrumentation

The following sections provides an overall description of the instrumentation used at site and the processes that are used. Specific instrument locations and thresholds will be discussed in detail in the relevant Parts of the OMS manual.

5.1. Types of Instruments

Instrumentation measurements, along with visual inspections, serve as the primary mechanisms for performance monitoring of the TMA and Water Management facilities.

- Slope Inclinometers (SI) – A vertical PVC pipe installed through the ground typically into bedrock that measures horizontal deformation.
- Vibrating Wire Piezometers (VWP) – A pressure transducer and polyurethane coated wire that measures the pore water pressure within the dam core and foundation clay units.
- Standpipe Piezometers – A vertical PVC pipe with a perforated or screened section for measuring water levels and collecting water samples, typically in coarse foundation units.
- Settlement Plates – A base plate is installed at some depth with a riser pipe extending to surface to measure settlement of soils.
- Magnetic Extensometers – Installed as a series of magnetic rings, either around corrugated PVC tubing or slope inclinometer casing within the foundation units to monitor vertical consolidation-induced settlement.
- Survey Monuments – A bar of steel is driven into the ground and the top of the bar is surveyed to monitor displacement.

Details are available in then-EOR's instrumentation reports (BGC-4910-DT00-RPT-00.32.001) which are produced by then-EOR twice a year for the assessment on instrument performance. Locations of the instruments can be viewed in NG's proprietary, GIS Viewer.

5.2. Data Collection and Storage

All instruments are manually collected, except for VWPs. The VWPs are connected to dataloggers which records hourly readings for the instrument. These readings are then transmitted by radio frequency to Hubs located at the Marr site or the E-House at the intersection of WD4, WD5 and Cell 1 Dam. The Hubs transmit the collected data stored in NG server as .csv files. These files are located at: \\pcs01-yag\Campbellsci\LoggerNet.

Data collection frequency including processing and submission is to provide timely instrument response to internal factors such as construction activities, tailings deposition, and external factors such as precipitation etc. All the automated data acquisition system, such as VWPs and weather station, the reading frequency is every hour. For the instruments requiring manual reading, such as

SI and settlement and displacement devices, the reading frequency is assigned in the instrumentation threshold report for TMA and water management dams by EOR. For the TMA Stage 4 construction,

5.3. Data Visualization and Reporting

While it is intended for all instruments to be integrated into the New Gold GIS web viewer, only the VWPs have been added and improvement on the data visualization has been continuously updated.

It is also intended to use GIS to assist the instrumentation data reporting. Current reporting of using Excel is going to gradually fade away in 2022.

5.4. Weather Stations

The RRM weather stations were installed at the Barron Site in September 2016, and Marr Site in 2022 and are maintained by the Environment Department.

The data collected by the Barron weather station is hosted by Campbell Scientific, and the data is updated twice per day at 09:00 and 16:00. In Q4 2020, the Barron weather station was upgraded to include an all-weather precipitation gauge, snow depth sensor, evaporation pan and newer models of existing instruments.

The Marr Site station collects wind, precipitation, and air temperature data. It can be accessed in this link: Bulletin: Rainy River Mine - Marr (weatherlink.com)

5.5. Other Instruments

Additional instrumentation to support the OMS manual and management of water includes:

- Densometer on the tailings pipeline.
- Flow meters on the Pinewood River and water management pipelines including from the Pinewood River, tailings reclaim lines, MRP line and freshwater line from the WMP.
- Pressure transducers in the WMP, Clark/Teeple Ponds. Those data have been manually downloaded every a few months.
- A pond automation project is being implemented. Water level in RRM site-wide 12 ponds excluding the sumps will be automated and reported in one GIS page.

This instrumentation provides continuous recording, which is collected during routine inspections and included.

6. Regulatory

6.1. Approval Summary

Approvals for permits as well as Environmental Assessment (EA) commitments can be found on the Environment SharePoint webpage at:

https://newgold4.sharepoint.com/sites/yag_environment/SitePages/Home.aspx

6.2. Commitment Tracking

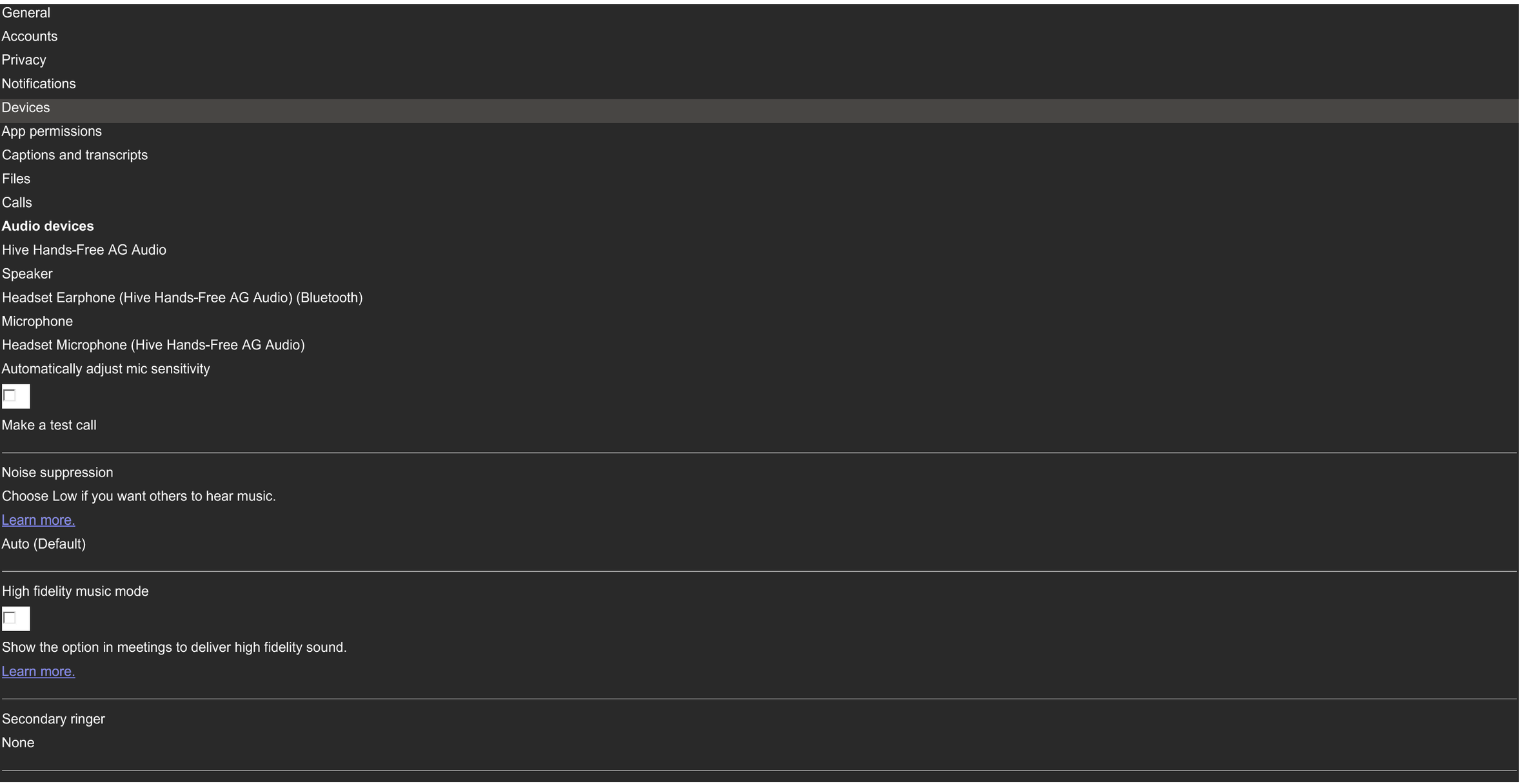
All Regulatory requirements are tracked in the Intelex software application. A link can be found on the Environment webpage

https://newgold4.sharepoint.com/sites/yag_environment/SitePages/Home.aspx

The Environmental Management System framework is found in the EMS Manual ENV-MAN-EMS-0001 draft.

FIGURES

1. Settings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Make a test call
Noise suppression
Choose Low if you want others to hear music.
Learn more.
Auto (Default)
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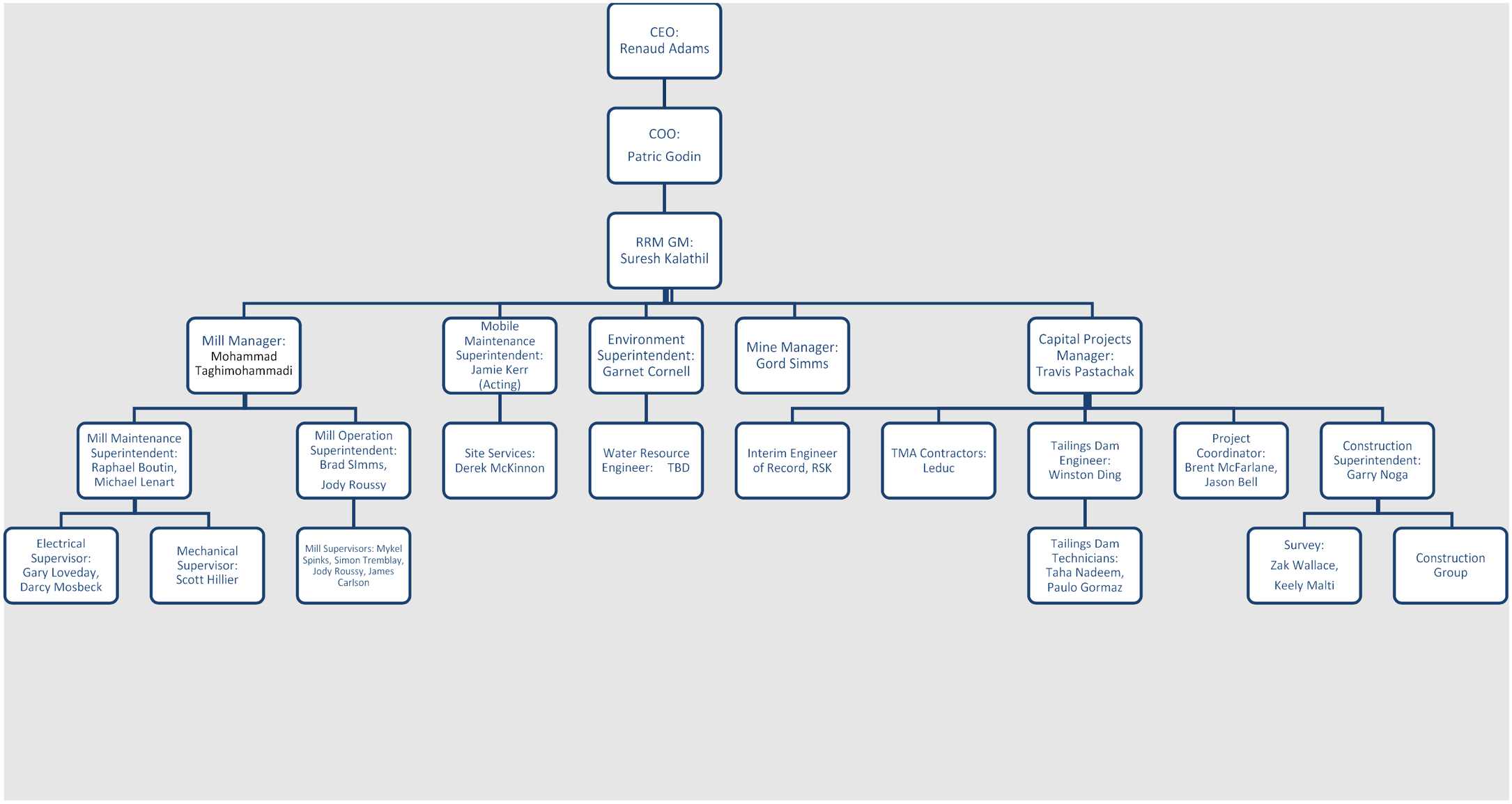


Figure 1- 1: Organization Chart for Tailings and Water Management

Figure 3- 1: Site Map (Rainy River Web GIS Viewer (newgold.net), August 2021**)**

Department:	Review Frequency:	Approval Date:	Status:	Revision:	Author:
Capital Projects	Annual	YYYY-MMM-DD	IFR	00	Winston Ding

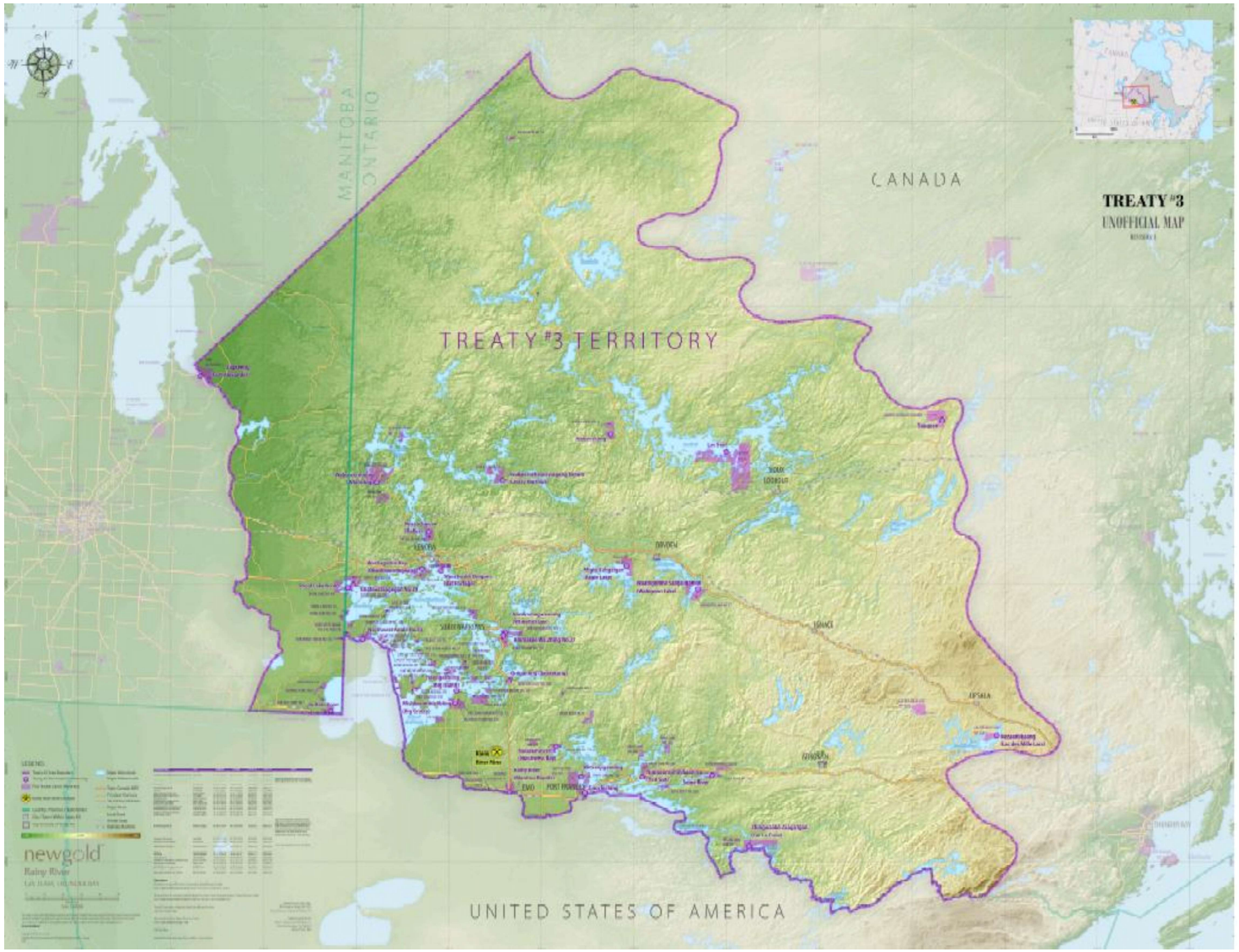


Figure 3- 2: Local Indigenous Communities in Treaty # Map

Figure 4- 1: Plan View of WMP, TMA and Associated Structure (Aug. 2021)

Figure 4- 2: Plan View of Clark Creek Division (August 2021)

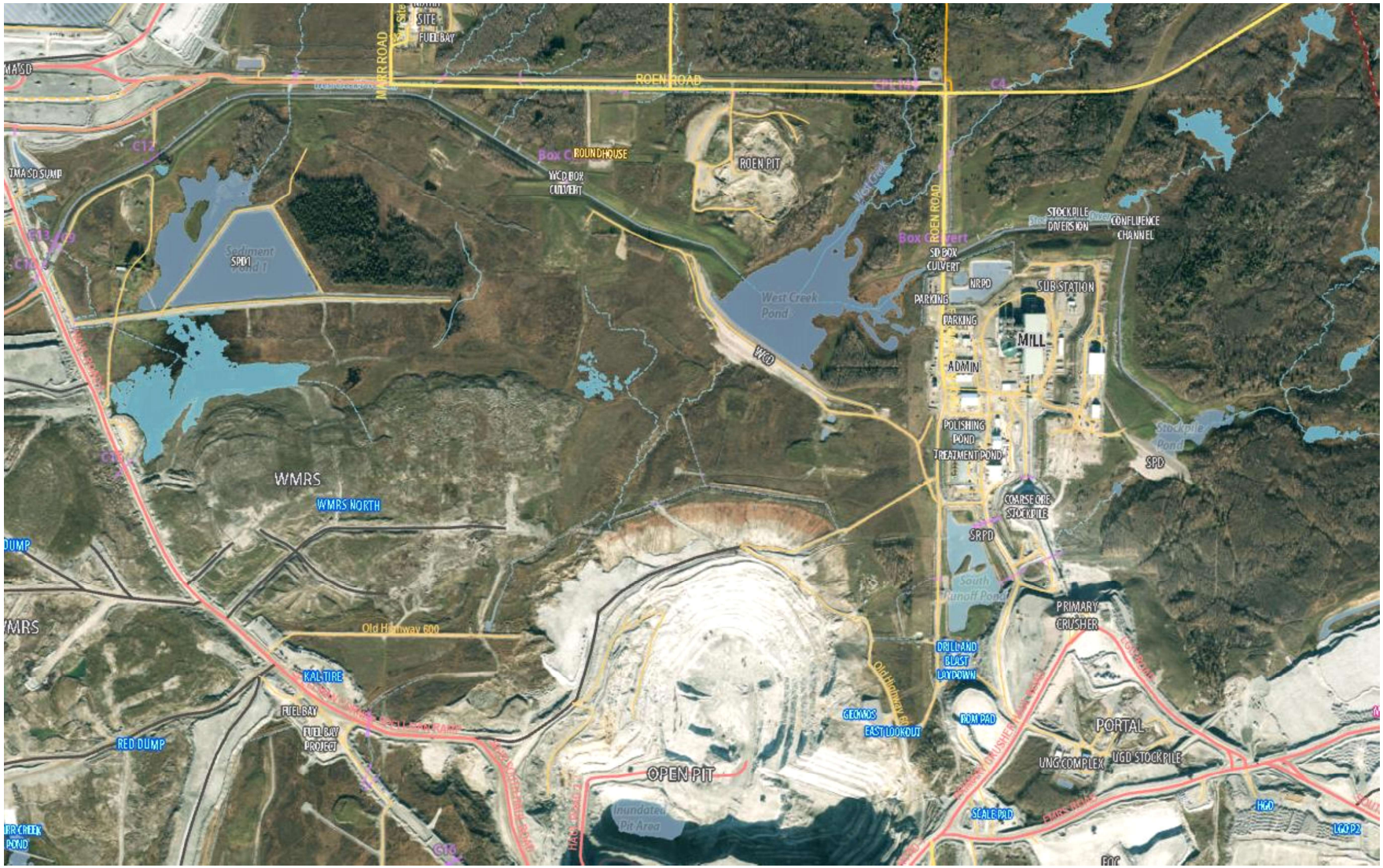


Figure 4- 3: West Creek Division and Plant Site Ponds (August 2021)

Department:	Review Frequency:	Approval Date:	Status:	Revision:	Author:
Capital Projects	Annual	YYYY-MMM-DD	IFR	00	Winston Ding

Figure 4- 4: Mine Rock Pond and Dam (August 2021)

Figure 4- 5: Sediment Controls (August 2021)

Department:	Review Frequency:	Approval Date:	Status:	Revision:	Author:
Capital Projects	Annual	YYYY-MMM-DD	IFR	00	Winston Ding

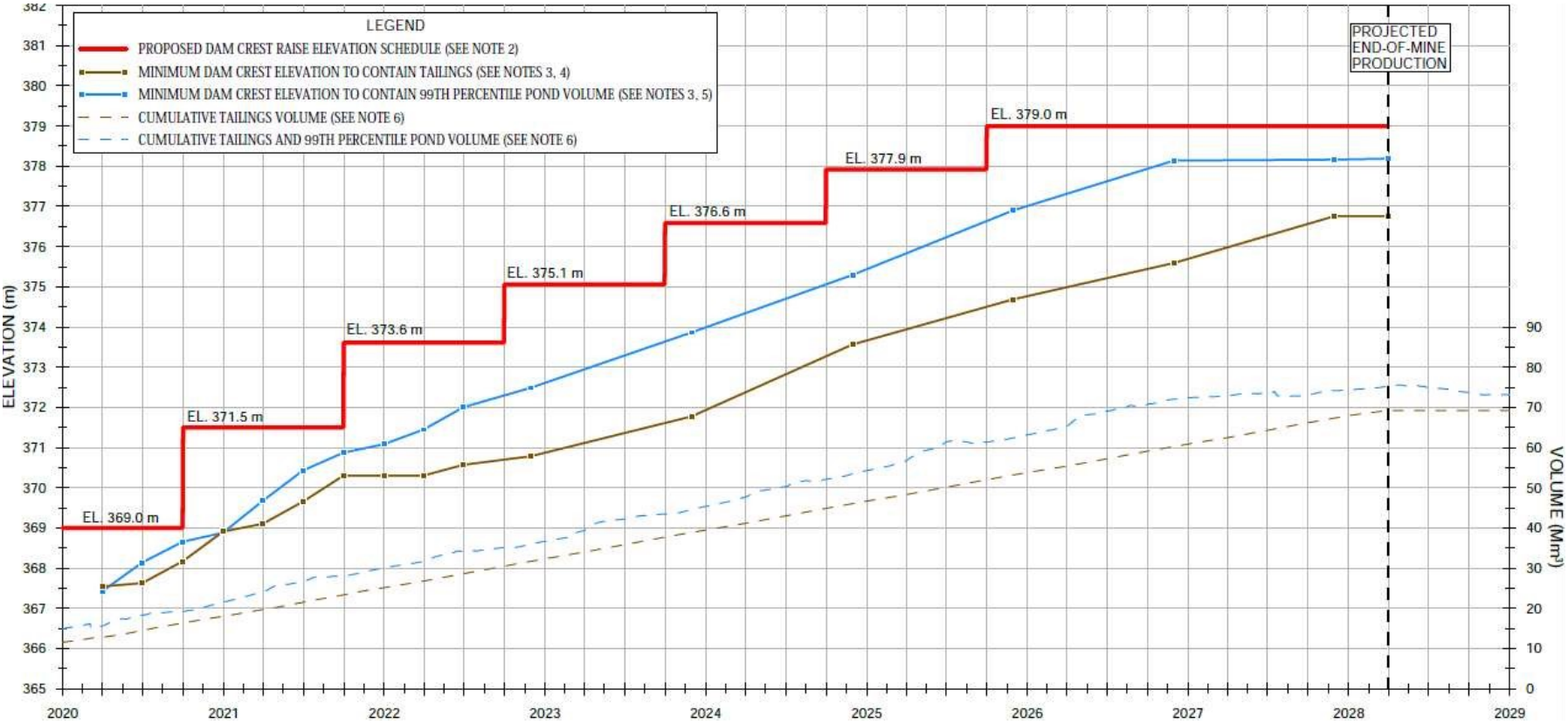


Figure 4- 6: Dam Raise Schedule (BGC-4910-DT00-RPT-0007.003)

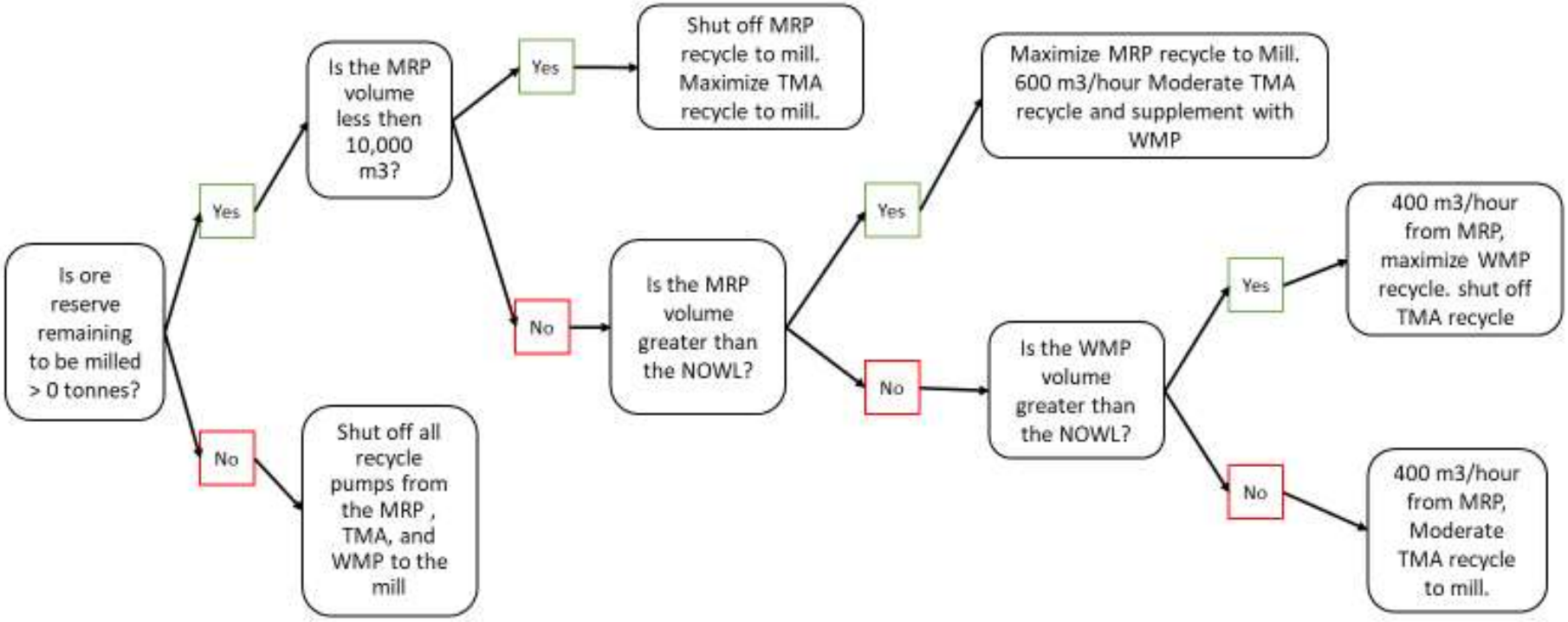
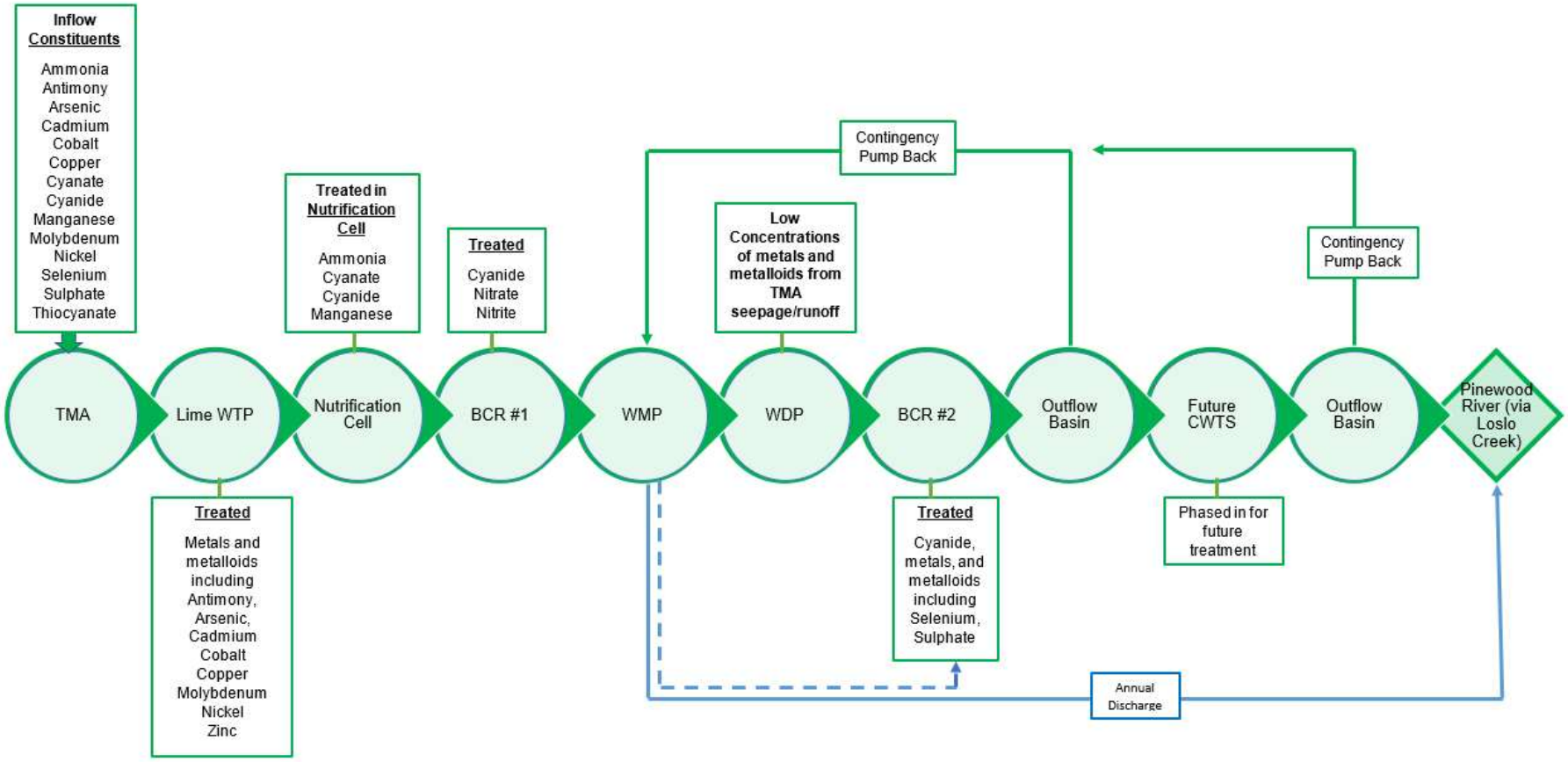


Figure 4- 7: Mill Water Reclaim Logic



Note: Constituents targeted for treatment are indicated at each treatment step in the water treatment system. Blue arrow represents annual discharge from BCR #1, while the dotted arrow represents optional bypass of the WDP. Thin green arrows represent pump back available as a contingency. Thick green arrows represent regular operation flow process. This chart is modified from the original design by Alexco and Contango in July 2019 (Rainy River Mine – Water Treatment Train Design Report, Document #053_0719_20B) to reflect the actual operation situation.

Figure 4- 8: Water Treatment Train

Appendix A

Tailings, Heap Leach and Waste Rock Facilities Management Policy

New Gold Inc. and its subsidiaries (together ''New Gold'') are committed to excellence in the management of tailings, heap leach and waste rock storage facilities. We will accomplish this by adopting internationally recognized standards including the Mining Association of Canada's Towards Sustainable Mining Tailings Management protocol wherever applicable.

New Gold makes the following commitments at all of its operations and projects:

- Identifying, assessing, and controlling risks associated with tailings, heap leach and waste rock storage facilities.
- Ensuring that all aspects of our tailings, heap leach and waste rock storage facilities comply with regulatory requirements, sound engineering practice and company standards through regular inspection, program review and external audit.
- Locating, designing, constructing, operating, decommissioning, and closing our tailings, heap leach and waste rock storage facilities so that all structures are stable and that all solids and water within the designated areas are managed to minimize or prevent possible pollution.
- Training our employees to enable them to carry out their responsibilities with regard to tailings, heap leach and waste rock storage facilities management.
- Communicating with Communities of Interest in order to take into account their concerns and considerations with regard to tailings, heap leach and waste rock storage.

New Gold believes that by adopting these commitments, the safe storage of tailings, ore and waste rock will be achieved, and future Communities of Interest will not be adversely impacted by their existence.

<Original signed by>

Renaud Adams

President and CEO