REHABILITATION OF THE BOUCHARD HÉBERT MINE, ROUYN-NORANDA (QUÉBEC)

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• Introduction

- Recent (pre-rehabilitation) conditions
- Waste relocation objectives

$\,\circ\,$ Waste relocation to the flooded pit – 2021 and 2023

- Neutralant dosing rates
- Mixing procedure
- Current site conditions

• Mine water management strategy

- Performance objectives
- Mine water system
- Pumping regime

o Key Findings

Site Location



General Mine Arrangement



Aerial Photo (2017) of the "Industrial Area"



Underground Mine Workings



Pit Water Balance



Waste Relocation Objectives



Key objectives:

- i. Reduce contaminant (ARD) loads to the water treatment system and
- ii. Improve water quality of precipitation runoff

Ficklin Diagram – Multiple Sites



Observed Zinc in Flows to MWCP, 2011 to 2015

Pit water – flooded completely in 2013



Note:

- Much higher (inferred) Zn concentrations in seepage and runoff from waste rock
- These flows are eliminated by relocating waste rock to the pit

2021 Waste Relocation Project

- Approximately 50,000 m³ of partially-oxidized PAG waste rock relocated to the de-watered pit in 2021
- Waste rock relocated to a maximum elevation of 289 m asl, ~1.5 m below the minimum water level in the pit
- PAG waste rock submerged underwater year-round to eliminate future ARD generation



---- 289 m asl

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Mixing Trial – Comb Bucket and Ripper Attachments



Waste rock was amended with approximately 4400 tons (t) of crushed limestone, or 35.7 kg per t in 2021

The limestone (94% CaCO₃) is added to neutralize the total <u>existing</u> acidity content of the partially-oxidized waste rock as it is released



Estimated Existing Acidity and Dosing Rate



- Total Existing Acidity (in kg CaCO₃ eq./t) = Titratable Acidity + Jarosite Acidity
 - See Jones et al. (2020) for details and methods
 - https://www.imwa.info/docs/imwa 2020/IMWA2020 Jones 38.pdf
- Titratable acidity (readily-soluble) can be estimated by titration. Jarosite acidity (poorlysoluble) can be estimated with XRD results or a strong leach extraction
- Dosing rate estimate is conservatively based on the -19 mm fraction of waste rock, which is finer than the bulk waste rock, and hence has a higher existing acidity content

Mixing and spreading amended waste rock



Mixing waste rock and limestone with comb bucket



Excavator working near the edge of the pit (Week 4)



Selected Quality Control (QC) Results



Available Neutralant for Jarosite Neutralization



Notes: Jarosite acidity represents approximately 99% of total existing acidity in limestone-amended samples, implying less than 1% titratable acidity remaining in relocated waste rock

Current Site Conditions – August 2023



Mine Water Management Strategy



Pumping Regime (from mine shaft)



Key Findings

Mine Water Management

- A strong hydraulic connection between the flooded underground mine and the backfilled pit was demonstrated during an extended pumping trial
- Pumping 1.5 to 2.0 L/s is sufficient to prevent overflows from the pit's outlet structure while water quality monitoring for precipitation runoff proceeds

Waste Relocation Program

- Comb bucket attachment for excavator allowed crushed limestone and approximately 75,000 m³ of PAG waste rock to be adequately mixed
- Mixing procedure recommended ("best management") for waste rock that is mainly sand- and gravel-sized fragments
- Future monitoring data needed to confirm reduced contaminant loads to WTP and improved water quality of precipitation runoff

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