Previous Mine Waste Disposal and ML/ARD Mitigation at Nyrstar Myra Falls

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Overview

- Introduction

- Mine Waste Disposal Facilities

- Recent Water Management Upgrades

- ML/ARD Mitigation Approaches
  - Drain systems
  - Hydraulic performance

- ML/ARD Impacts to Myra Creek
Site Location and Physical Setting

Strathcona Park Boundary

Nyrstar Myra Falls

Strathcona-Westmin Park Boundary
General Mine Arrangement

- 'Lynx WRDs'
- Lynx TDF
- WRD#6
- WRD#1 (exposed)
- Old TDF
- Lower Lynx Diversion Ditch (LLDD) [upgraded]
- Mill
- Myra Creek
- HW offices and headframe
- MC-TP4
- Flow
Conditions Prior to Seepage (ARD) Collection

Air photo from 1978

1,930 µg/L Zn (Oct 21st, 1981)

Lynx Pit

‘Waste Dumps’ (WRD#1)

Tailings discharge line

Buttle Lake (south basin)
Original Drains (1985), Old TDF

**Inner Drain**
- Two pairs of perforated pipes at different elevations
- Collects seepage and ARD-impacted groundwater
- ~30 mg/L Zn

**Outer Drain**
- Fourteen perforated pipes
- Collects impacted groundwater and flows from Myra Creek
- Valve system controls flow

**Super Pond**
- Receives drain flows and precipitation runoff
Old (Original) TDF

Reclaim Sand Area (RSA)

Area I

Area II

Old TDF, circa 2001

Amalgamated Paste Area (APA)
2003 to 2007
Lynx TDF

- Centreline embankment berm around the former Lynx Pit
- Paste (de-watered) tailings
- 2008 to 2015 (active facility)

Embarkment berm
- 60 m design height (2H:1V slope)
- Requires 2.3 Mm$^3$ of PAG rock

Tailings capacity: 2.6 Mm$^3$ or ~4.7 Mt (~50% of the Old TDF capacity)

Photo from 2014 (see Amec Foster Wheeler, 2015)
Water Management Upgrades

Photos from Geosynthetica.net (published May 7th, 2017)
Lower Lynx Diversion Ditch (LLDD) Upgrades
Tailings Inventory

30 Mt
(1966 to 2015)
No production in 2016 or 2017

- 46% Underground backfill
- 43% Old TDF
- 8% Buttle Lake
- 3% Lynx TDF
Waste Rock Inventory (Surface)

12 Mt
(1966 to 2015)
No production in 2016 or 2017

Lynx Berm
6%
WRD#6
24%
‘Lynx WRDs’
13%
Lynx Berm
57%
WRD#1

Post-closure

WRD #1

Lynx Berm
ABA Characterization of Waste Rock (Surface Samples)

Neutralization Potential Ratio, NPR

Maximum
75th Percentile
Mean
Median
25th Percentile
Minimum

PAG

Non-PAG

NPR = 2
Seepage, Mine Water, and Groundwater Quality

Note: 10-1 is historic well beneath WRD#1 (last sampled in 1982, later destroyed)
Total Zinc, µg/L

New Outer Drain (NOD)

29,250

Inner Drain

9,140

Old Outer Drain

9,400

Short Drain

6,610

Medium Drain

5,100

Long Drain

217

Myra Creek at TP4

Note: Median values indicated
Inferred Zn Plume (Current Conditions)

[NZn in groundwater, mg/L]

- <0.1
- 0.1 to 1
- 1 to 10
- 10 to 20
- 20 to 30
- 30 to 40
- 40 to 50
- >50

Low Flow

High Flow
Hydraulic Performance (NOD), May 10th, 2016 (10-0-10)

Gradient reversed

Elevation, m (above mine datum)

Chainage along Myra Creek

- Myra Creek Level
- GWL in P-Series at Outer Drain
- Monitoring Wells

 MW-C
 MW-F
 P1
 P2
 P3
 P4
 P5
 MW13-14S
 MW13-15S

T-Zn (mg/L)
MC-TP4 North: 0.032
MC-TP4 South: 0.037
Loss of hydraulic control
(more Zn to Myra Creek)
Zn Profile for Myra Creek, 2010 to 2015

Total Zinc, µg/L

Carbridge seep

Disconnected NOD

MC+800 Seep

New Outer Drain (NOD)

Old Outer Drain

Lynx Reach (no SIS until 2017)

Upper Old TDF Reach

Lower Old TDF Reach
Zn Concentrations in Myra Creek at TP4, 1981 to 2017

- No ARD interception (until 1982)
- Original under-drains (Inner Drain and Outer Drain)
- + New Outer Drain (NOD)
- + Lynx Berm

Total Zinc, µg/L

WRD#1
Zn Concentrations in Myra Creek at TP4, 1981 to 2017

- No ARD interception (until 1982)
- Original under-drains (Inner Drain and Outer Drain)
- + New Outer Drain (NOD)
- Total Zinc, µg/L

- WRD#1
- + Lynx Berm
Summary – Average Zn Loads in Myra Creek (2012 to 2016)

Zn Load in Groundwater:
- 55 t/year Zn
  - 44 t (80%) Recovered by NOD
  - 11 t (20%) in Myra Creek

45% (5.1 t/year)
- Lynx TDF Reach

45% (4.5 t/year)
- Upper Old TDF Reach

10% (1.4 t/year)
- Lower Old TDF Reach

Loads not intercepted (no SIS)
- NOD bypass
Questions or Comments?