Objective 3

Remediation

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1. Aim of Objective 3
2. What remediation options are available?
3. How are options selected?
4. A look forward for Southland
1. Aim of Objective 3

Reduce impacts to acceptable levels
Water quality targets typically set by resource consent for a discharge point from a mine site

- It is up to mine operators to decide how to meet targets

Objective 3 provides - Toolbox

- Options for mine operators to meet targets
- Method to select options
- Confidence to stakeholders that mine operators have ability to meet targets
Impacts from Mine Drainage

- AMD (acid mine drainage)
- NMD (neutral mine drainage) + trace elements
Southland

• Impacts from mining may produce AMD
  – New data to be collected in Objective 1

• Most likely water quality impact from elevated turbidity, possibly NMD with elevated trace elements
2. What Options are Available?
Upstream Control
- Preventing / minimising mine drainage through overburden management

Downstream Control
- Treatment of mine drainage using water treatment systems
Upstream Control
Overburden Management

➢ Prevent formation of AMD/NMD by removing one of the three components necessary for AMD/NMD formation
  - Sulphides, Water, Oxygen
    • Premining rock analysis and planning
    • Segregation / Isolation
    • Covers / Cementation
    • Revegetation

➢ Treat mine drainage source
  • Blending acid generating material with neutralising material
Downstream Control
Water Treatment

- **Active**
  - Continuous dosing with base or other treatment media (lime, caustic soda, soda ash)
  - Regular operation and maintenance
  - Reliable and effective but costly

- **Passive**
  - No continuous dosing with chemicals
  - Take advantage of naturally occurring chemical and biological processes
  - Not “walk away” solution
Active Systems

Simple
- Hopper
- Calcium Oxide
- Paddle Wheel

Complex
- Hydrated Lime Tanks
- Flocculent Tanks
- Bells, whistles
Passive Systems

Open Limestone Channel
Anoxic Limestone Drain
Limestone Leaching Bed
Wetlands
anaerobic, aerobic
Reducing and Alkalinity Producing System (RAPS)
3. How are options selected?
Upstream Control – Overburden Management

Potentially acid generating strata present

New Mine
- Alkaline material available
  - Blending
  - Avoidance
    - Segregation or Isolation

Existing Mine or Abandoned Mine
- Drainage enters and exits waste rock stockpile
  - Construct cover
    - Revegetate
    - Treat remaining drainage from stockpile if necessary
- No drainage enters waste rock stockpile
  - Divert drainage around stockpile
  - Alkaline material not available
    - Avoidance
      - Segregation or Isolation
Downstream Control – Water Treatment

Fe concentration high

Fe $^{3+} < 10$
DO < 2

Large flat area

Reducing System: ALD

Long narrow land area

Reducing System: VFW
Anaerobic Wetlands

Fe $^{3+} > 10$

Steep topography

Oxidising System: Diversion Well
Steep OLC
Limestone Sand Dosing

Reducing System:

Large flat area

Oxidising System:
OLC with access for dozer to break up oxides

Long narrow land area

Oxidising System:
Limestone Leaching Bed
Slag Leaching Bed

Fe concentration low

Fe $^{3+} < 10$
DO > 2

Large flat area

Reducing System: VFW
(see next slide)

Not steep topography

Oxidising System: Anaerobic Wetlands (with very long residence time)

Reducing System:
VFW (with very long residence time)
Examples of pilot trials

Water Treatment

Vertical Flow Wetland

Limestone Leaching Bed

Diversion Well

Open Limestone Channel
Pilot Trial Results
Herbert Stream

**Vertical Flow Wetland**

- Acidity
- Iron
- Aluminium
- Manganese
- Zinc

**Limestone Leaching Bed**

- Acidity
- Iron
- Aluminium
- Manganese
- Zinc

Days Since Start

0% 20% 40% 60% 80% 100%
4. A Look Forward for Southland

- Methodology for AMD/NMD prevention and treatment transferable to Southland

- Other water quality issues relevant to Southland will be added to methodology (e.g., turbidity?)
Conclusion

Objective 3 provides

Options for mine operators to meet water-quality threshold targets

Methodology to select options

Confidence to stakeholders that mine operators have ability to meet targets
A rare chance in Southland to be proactive with respect to environmental issues around mining