

Wetlands Treatment of Mine Drainage at Antamina Mine



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Introduction

- 500 Mt Tucush Waste Dump started in 2004
- Wetlands selected for passive treatment of expected neutral mine drainage
- Construction completed in early 2006
- This presentation will:
 - Overview design and construction aspects
 - Present early performance data

Site Location



Antamina Mine

- Copper-Zinc-Molybdenum Mine
- El. 4200 m in Peruvian Andes



Tucush Wetlands Treatment System

- Wet season design flow = 115 L/s
- Dry season flows supplemented with seepage waters from tailings facility



Tucush Waste Dump – 2005



Tucush Waste Dump – Ultimate Configuration



Expected Dump Water Quality

Key Parameters

- Zn – 0.8 mg/l
- Mo – 0.3 mg/l
- Ammonia – 7.5 mg/l

Wetlands Treatment

Wetlands treatment selected for:

- Expected neutral pH dump drainage
- Low operational costs
- Long-term sustainability

Tucush wetlands are unique because:

- It may be the highest wetland ever built
- Few treatment wetlands in South America
- *Built pro-actively in advance of potential problem loadings from the dump*

Basic Elements of Treatment System

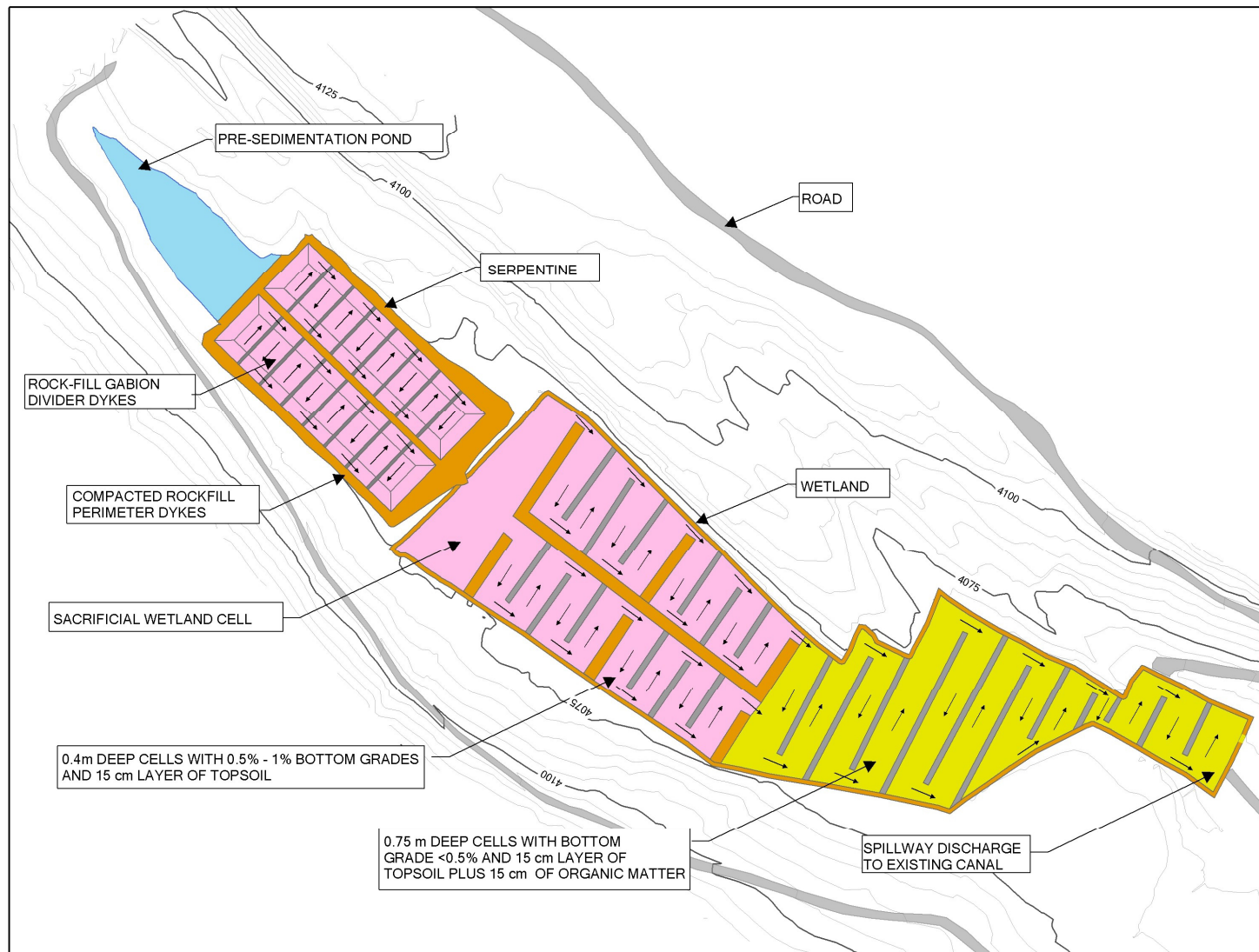
Sediment Control

- Pre-sedimentation pond
- Serpentine sedimentation channel

Wetlands

- 4.2 Ha divided into two treatment sections
- Aerobic cells promoting ammonia removal
- Anaerobic cells for removal of metals and sulphate
- Retention time = 2 – 5 days

Plan of Treatment System



Aerobic Cells

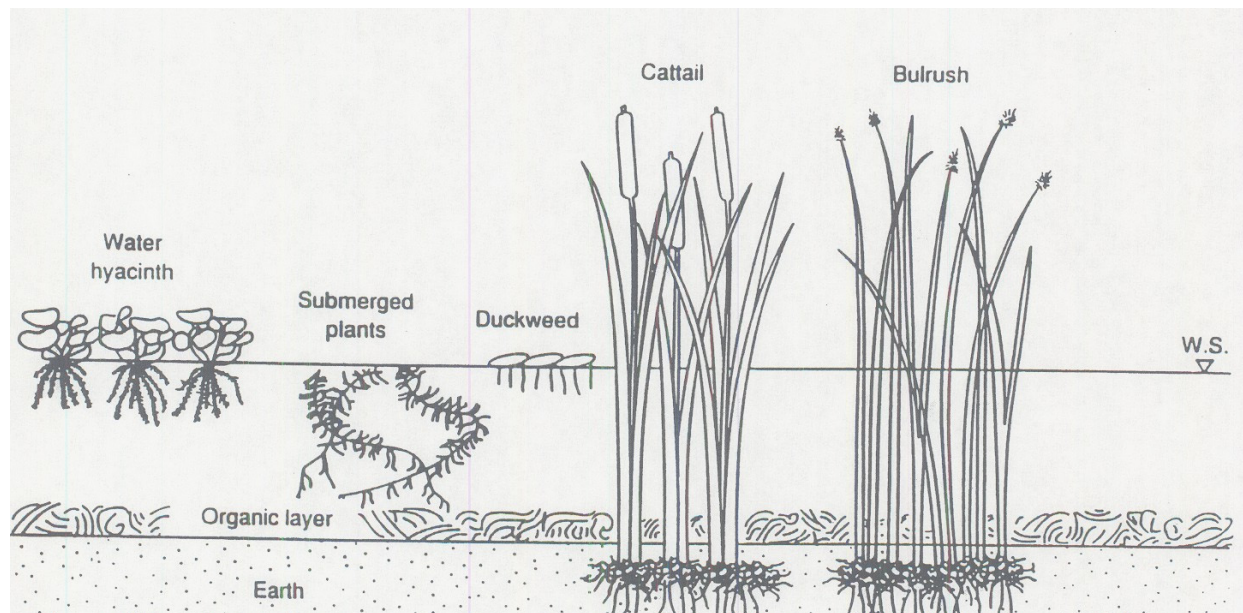
- 0.4 m water depth
- 0.5 – 1.0 % bed slope
- 15 cm of topsoil substrate in the base
- Cascading spillways between cells for aeration of water

Anaerobic Cells

- 0.75 m water depth
- $< 0.5\%$ bed slope
- 15 cm topsoil growth substrate
- 15 cm of organic matter and planted vegetation

Wetland Vegetation

- Provides substrate for microbial attachment
- Aids in filtration and adsorption
- Uptakes nutrients and metals



Wetlands Planting

- 10,500 plants harvested from Lake Pajoscochas
- Primarily bullrushes, *Scirpus californicus* & *Juncus Arcticus*
- Adapted to climate and seasonal hydrological conditions



Project Area Prior to Construction



Construction of Wetland Cells



Local Contractors Planting Wetlands



Operating Pre-Sedimentation Pond



Operating Serpentine Channel



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Aerobic Cells



Anaerobic Cells – April 2006



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Vegetation – June 2007



Fully Operational Wetlands System



Operational Performance

- Early treatment data available for 2006 and 2007
- Inflows from Tucush Waste Dump only
- Loads from waste dump are well below design allowances
- Treated water quality easily meets discharge criteria at compliance points

Initial Operational Performance in 2006

PARAMETER	DESIGN TARGET AT 40 L/s	INITIAL PERFORMANCE
Typical flow rates	40 L/s	16 – 24 L/s
Suspended solids in outflow	< 25 mg/L	7 mg/L
Dissolved Zinc removal	48%	81%
Dissolved Molybdenum removal	39%	49%
Ammonia	31%	87%

Future Work

- Ramp up flows to design of 115 L/s by addition of tailings seepage water
- Tracer test to evaluate residence time and flow path
- Continued monitoring and optimization

Gracias por su atención

