Modeling the Impacts of a Tailings Dam Failure at the Pebble Mine

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Cameron Wobus
Ryan Spies
Bill Szafranski
Dave Albert
James DePasquale
Overview

- The Pebble Mine Draft EIS dismisses the risk of a tailings dam failure, despite clear risks
- To fill this gap, we developed a hydrologic model to evaluate the potential impacts of a tailings dam failure
  - We used software that has been used by the mining industry for similar studies
  - We developed failure scenarios based on site specific and historical data
  - We used a sensitivity analysis to bracket potential outcomes
- In all scenarios, a tailings dam failure would directly impact hundreds of miles of anadromous waters
What is a Tailings Dam?

Highland Valley Copper Mine, Logan Lake, British Columbia, Canada

Image 2: Mccosker Contracting Ltd: http://www.mccoskers.com.au
Pebble Tailings Storage Facilities (TSFs)
Recent Tailings Dam Failures

Brumadinho, Brazil, 2019

Samarco, Brazil, 2015

Mt. Polley, BC 2014 (Knight Piésold design)

“Dams designed with downstream construction methods are less likely to fail than dams using centerline construction methods, especially under seismic shaking (ICOLD 2018).”

“The centerline construction method was selected for the bulk TSF north embankment to limit the footprint and volume of materials required for construction”

- Pebble Mine Draft EIS, p. 4.27-73
Draft EIS is Misleading about Failure Probability

“The probability of a full breach of the bulk or pyritic TSF tailings embankments was assessed to be extremely low”

- DEIS p. 4.27-72

“[a full tailings breach was] ruled out as remote during the 20-year operational life due to likelihood of successful detection and intervention”

- FMEA, October 2018
Draft EIS Did NOT consider a TSF failure

Breach Volume Released vs Tailings Storage Facility Capacity

- **Obs Breach Event**
- **PLP BTN Rico Est Breach**
- **EIS Bulk Tailings "Pipeline Rupture"**
- **Power (\(V_f\) Rico (2008))**

**Rico (2008) Equation**

\[ y = 0.354x^{1.008} \]

**Pebble TSF North**

\(~10,000\)
Our Goals and Approach

• Simulate the spatial extent of impacts in the event of a tailings dam failure at the Pebble Mine
• Develop scenarios based on historical TSF failures
• Use modeling framework consistent with prior industry practice (e.g., Knight Piesold, 2014; TetraTech, 2015)
• Examine results in the context of impacts to salmon habitat
~125 miles to Dillingham
Breach Scenario Simulations

Model runs explored a range of breach scenarios:

- Tailings volume released
  - Rico et al. (2008) → 41% release
  - Low estimate → 10% release
  - High estimate → 60% release
- Duration of breach event
  - Varied from 6hr to 96hr
  - Influences peak discharge rate
- Max sediment concentration
  - Varied from 35%-50%
  - Influences flow properties
Result: 24-hour Breach, 50 hr simulation
Sensitivity: Total volume released

Breach Volume Comparison

10% breach volume (green)
  • Inundated Area: 60.9 mi$^2$

60% breach volume (orange)
  • Inundated Area: 110.3 mi$^2$
Sensitivity – Duration of Breach (11 hr)
Sensitivity – Duration of Breach (96 hr)
24-hour Breach: Larger Model Domain

Edge of Model Domain

208 River Miles

Bristol Bay

Llianenna Lake
Larger Model Domain: 24-hour Breach

Model extends from TSF to Nushagak-Mulchatna Confluence

- ~45% of tailings are deposited within the model floodplain
- ~55% of tailings flow past the model boundary
Anadromous Waters Affected – 24 Hour Event

Tailings would directly impact >219 miles of anadromous waters
Potential impacts to the fishery

- Deposition of fine-grained tailings in spawning habitat could decrease emergence success (e.g., Chapman, 1988; Kondolf, 2000)
- Leaching of metals from tailings could create acute or chronic toxicity to salmonids


Long-term impacts

“Unrecovered tailings that are exposed to oxygen could generate acid on a timescale of years to decades...acid and heavy metals that accumulate in streambed sediments, wetland soils, or isolated waterbodies could impact water quality on a timescale of decades.”

- Pebble DEIS, page 4.27-65

“Recovery of a massive release, especially one that reaches flowing water, would be extremely difficult.”

- Pebble DEIS, page 4.27-65
“The only common factor in all major TSF failures has been human error, including errors in design, construction, operations, maintenance, and regulatory oversight.”

- Pebble DEIS, p. 4.27-71
Questions

Cameron Wobus, PhD: cwobus@lynkertech.com
Ryan Spies, MS: rspeis@lynkertech.com
Bill Szafranski, MS: bszafranski@lynkertech.com