

Risks and Impacts from a Tailings Dam Failure at the Proposed Pebble Mine

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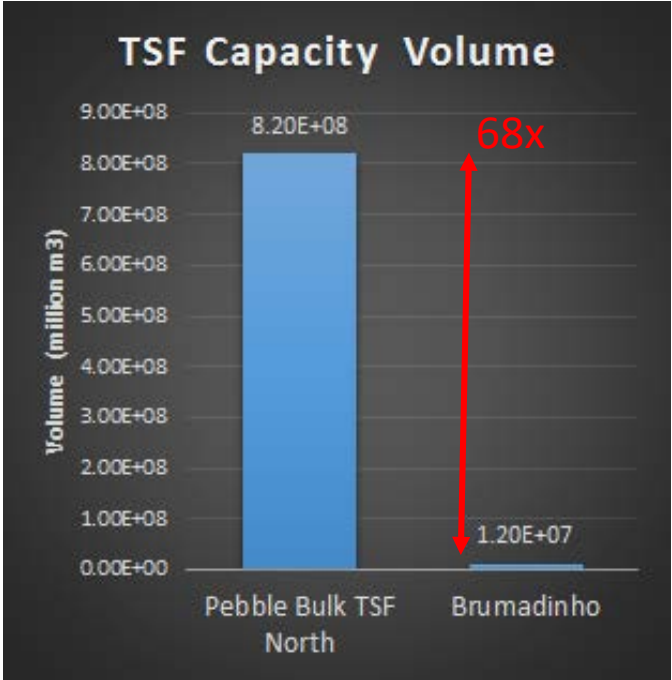
Overview

- The Pebble Mine Draft EIS dismisses many environmental risks, including the risk of a tailings dam failure
- We reviewed these risks and used a hydrologic model to simulate the potential impacts of a tailings dam failure
 - We developed failure scenarios based on site specific and historical data (in contrast to analysis in USACE/AECOM FMEA report)
 - We used a sensitivity analysis to bracket potential outcomes
- In all scenarios, a tailings dam failure would directly impact hundreds of miles of salmon habitat
- A tailings spill could also place human lives at risk



Recent Tailings Dam Failures

Brumadinho, Brazil, 2019



Recent Tailings Dam Failures

Mt. Polley, BC 2014



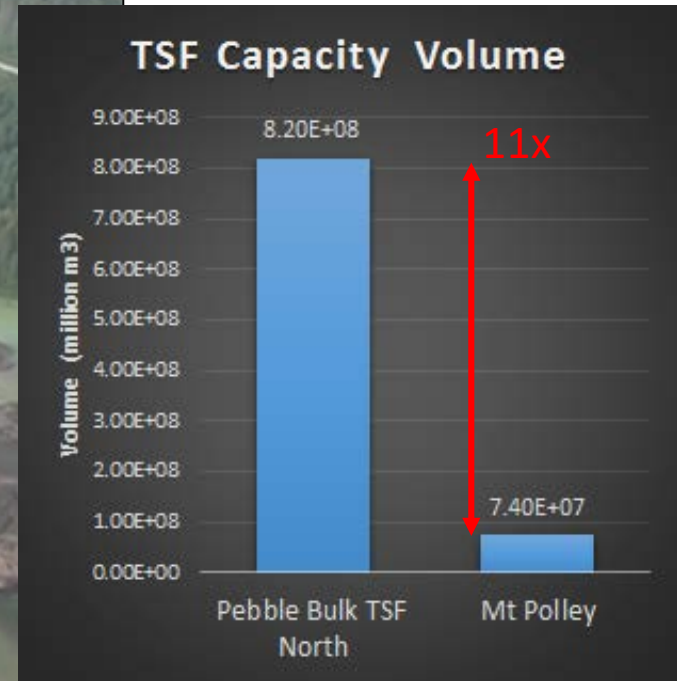
Independent Expert Engineering Investigation and Review Panel

Report on Mount Polley Tailings Storage Facility Breach

CONCLUSIONS

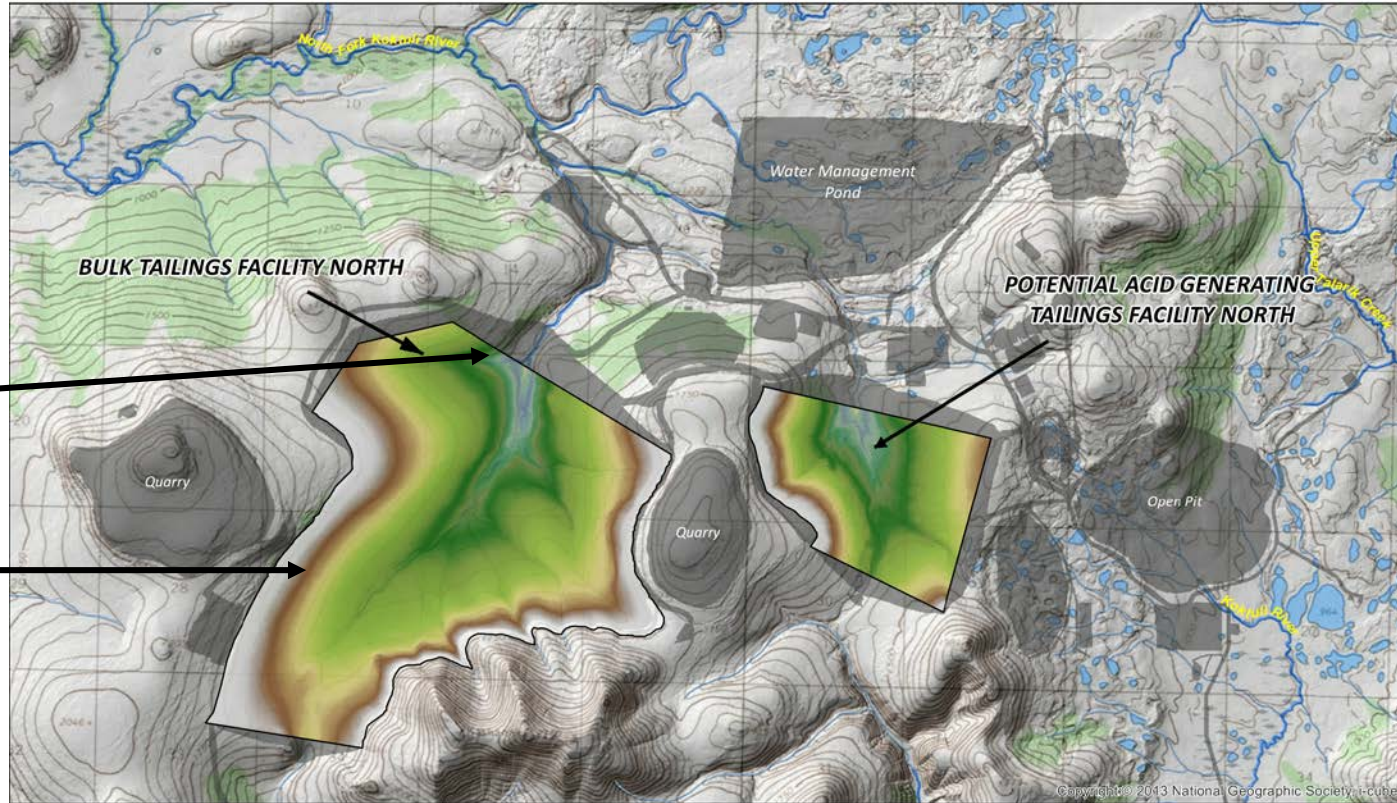
The Panel concluded that the dominant contribution to the failure resides in the design. The design did not take into account the complexity of the sub-glacial and pre-glacial geological environment associated with the Perimeter Embankment foundation. As a result, foundation investigations and associated site characterization failed to identify a continuous GLU layer in the vicinity of the breach and to recognize that it was susceptible to undrained failure when subject to the stresses associated with the embankment.

<http://www.mining.com/tailings-breach>



Pebble Tailings Storage Facilities (TSFs)

PROPOSED TAILINGS STORAGE FACILITIES FOR THE PEBBLE MINE - CURRENT PROPOSAL



Dam Height = 545ft



Capacity = ~328,000 Olympic swimming pools



Proposed Mine Location



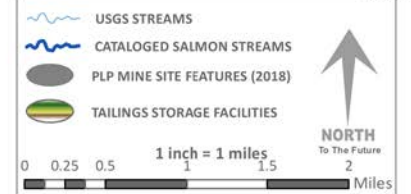
TAILINGS STORAGE VOLUME AND AREA

BULK TAILINGS FACILITY NORTH

Elevation 1750 Ft/533.4 M
 Volume (Feet): 30,111,425,568 ft³
 Volume (Meters): 852,660,618 m³
 Area (SQ MI): 4.22sqmi
 Area (SQ KM): 10.93 sqkm

POTENTIAL ACID GENERATING FACILITY NORTH

Elevation 1650 Ft/502.9 M
 Volume (Feet): 7,275,113,568 ft³
 Volume (Meters): 206,008,275 m³
 Area (SQ MI): 1.24 sqmi
 Area (SQ KM): 3.22 sqkm



V 2/25/2019



PLP's Proposed tailings dam uses inferior 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

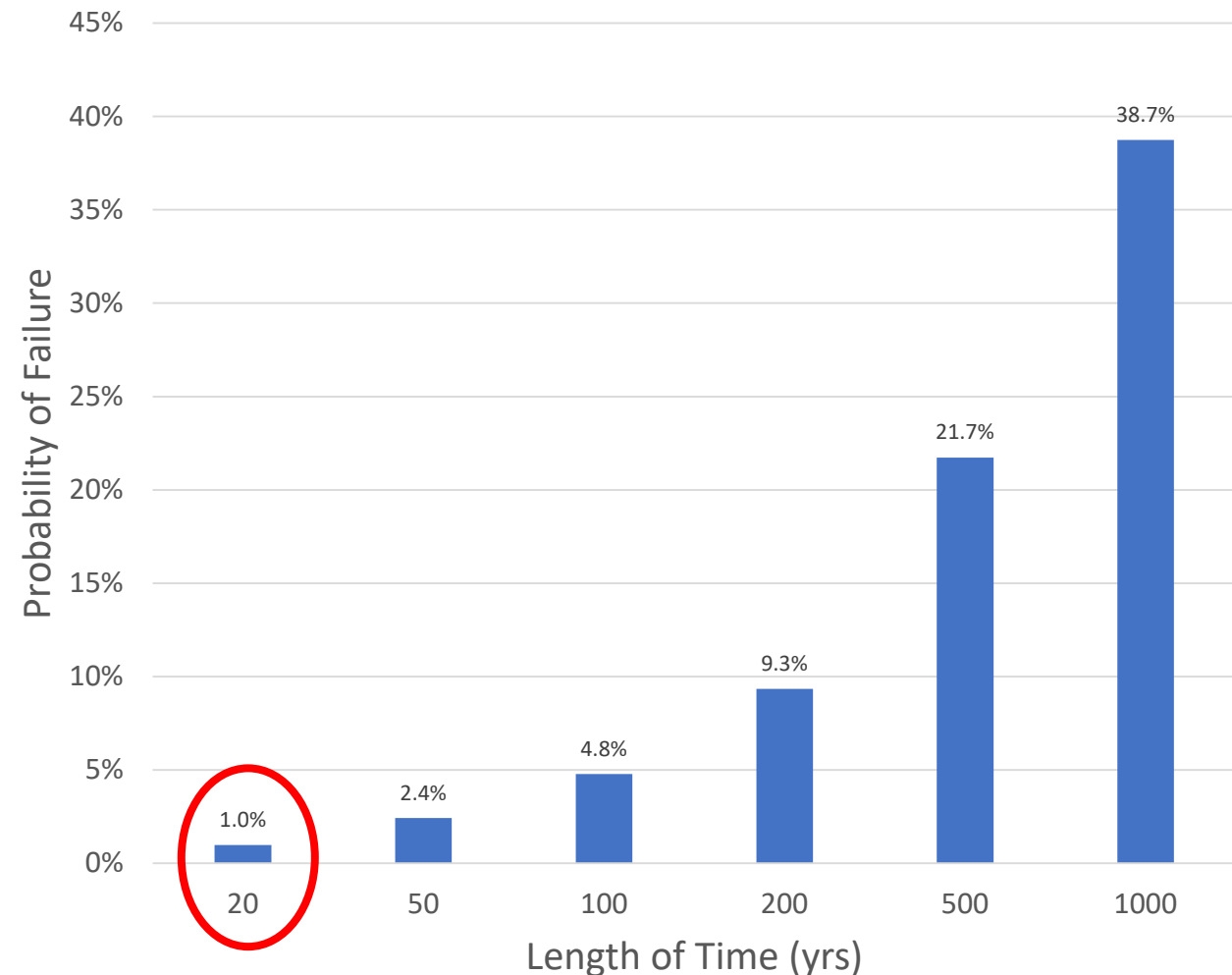
“The probability of a full breach of the bulk or pyritic TSF tailings embankments was assessed to be extremely low”

- 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

Probability of "1 in 2000" event over time

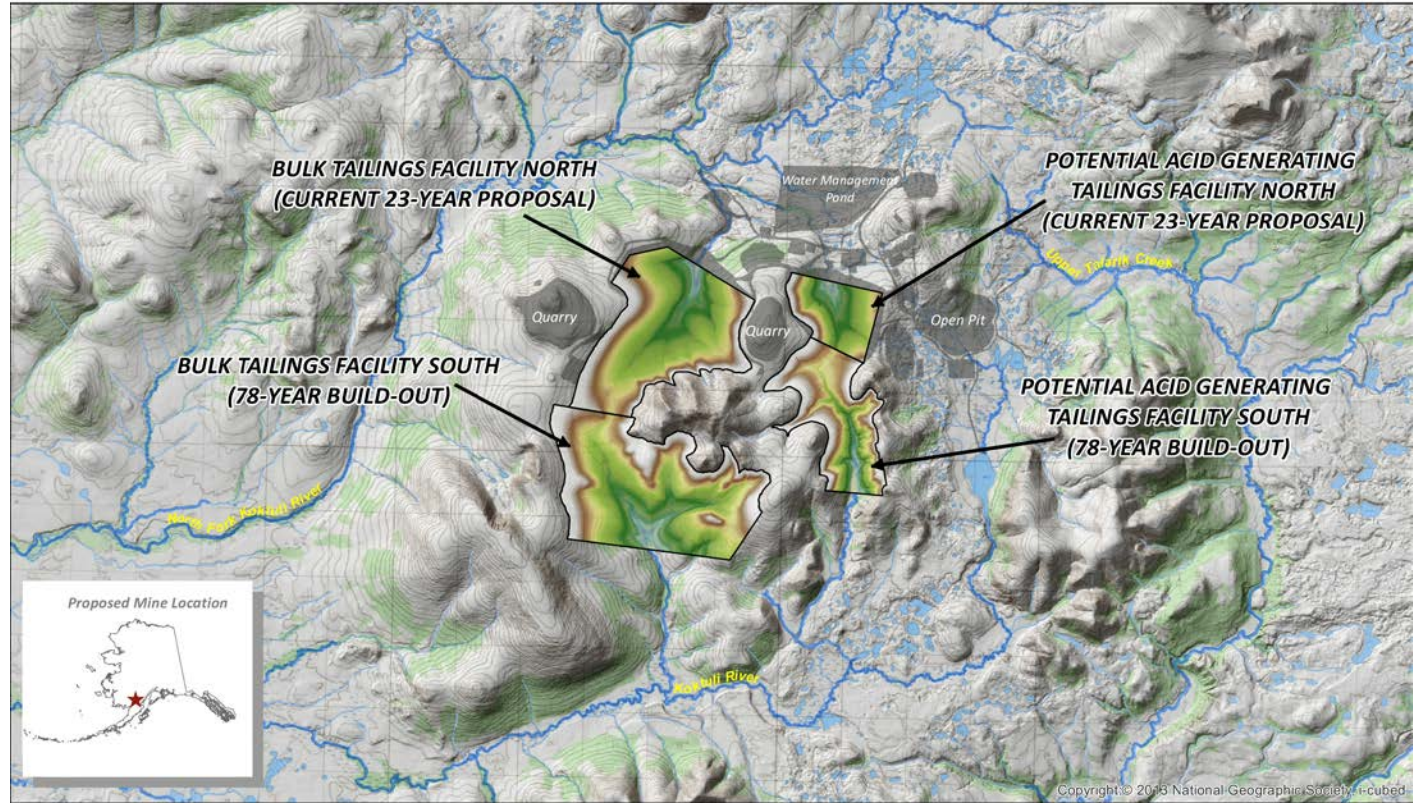


Tailings Storage Facilities (TSFs) – Full Buildout

“Based upon the economic assumptions made in the 2011 [Wardrop] assessment, the EIS mine plan...is likely to have a strongly negative net present value (NPV)”

- Letter from Richard Borden, Midgard Environmental Services LLC, to Shane McCoy, USACE (March 28, 2019)

PROPOSED TAILINGS STORAGE FACILITIES FOR THE PEBBLE MINE - CURRENT PROPOSAL AND POTENTIAL 78-YEAR BUILD-OUT



TAILINGS STORAGE VOLUME AND AREA

BULK TAILINGS FACILITY NORTH	BULK TAILINGS FACILITY SOUTH	POTENTIAL ACID GENERATING FACILITY SOUTH	POTENTIAL ACID GENERATING FACILITY SOUTH
Elevation 1750 Ft/533.4 M	Elevation 1875 Ft/571.5 M	Elevation 1650 Ft/502.9 M	Elevation 1650 Ft/502.9 M
Volume (Feet): 30,111,425,568 ft ³	Volume (Feet): 62,653,234,176 ft ³	Volume (Feet): 7,275,113,568 ft ³	Volume (Feet): 14,263,831,728 ft ³
Volume (Meters): 852,660,618 m ³	Volume (Meters): 1,774,142,021 m ³	Volume (Meters): 206,008,275 m ³	Volume (Meters): 403,906,735 m ³
Area (SQ MI): 4.22sqmi	Area (SQ MI): 5.26sqmi	Area (SQ MI): 1.24 sqmi	Area (SQ MI): 2.31 sqmi
Area (SQ KM): 10.93 sqkm	Area (SQ KM): 13.62 sqkm	Area (SQ KM): 3.22 sqkm	Area (SQ KM): 5.98 sqkm

USGS STREAMS
CATALOGED SALMON STREAMS
PLP MINE SITE FEATURES (2018)
TAILINGS STORAGE FACILITIES

1 inch = 2 miles
0 0.5 1 2 3 4 Miles

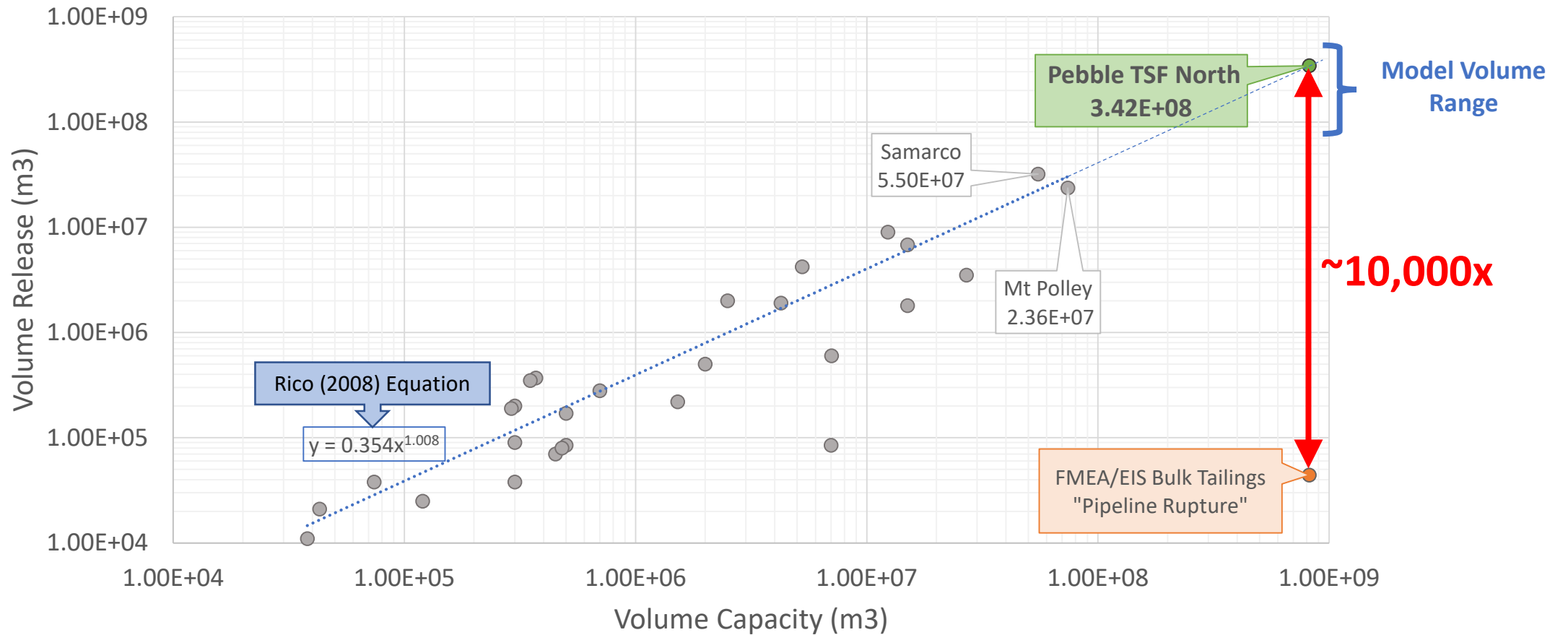
NORTH
To The Future

V 12/28/2018



Draft EIS Did NOT consider a TSF failure

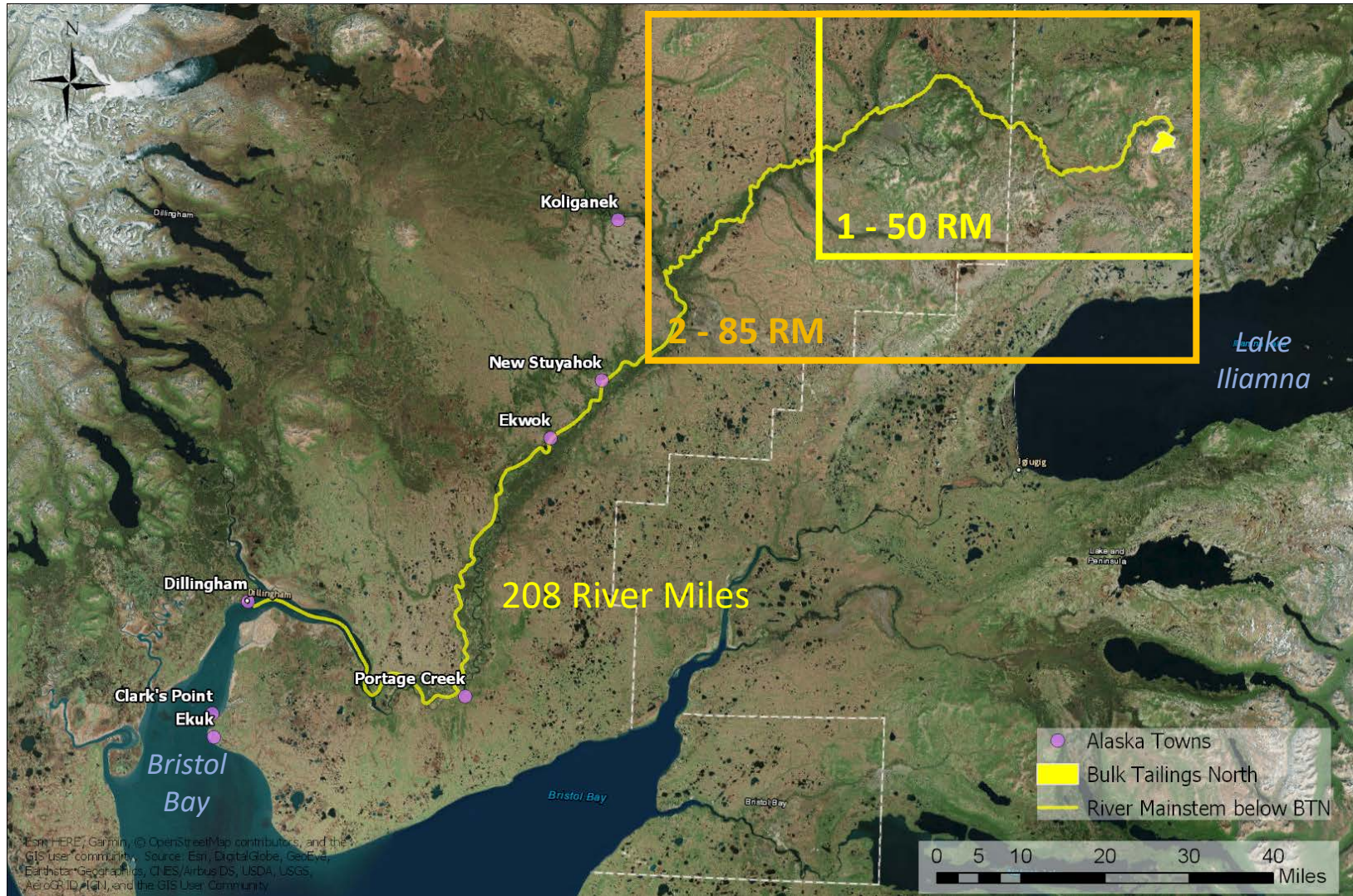
Breach Volume Released vs Tailings Storage Facility Capacity



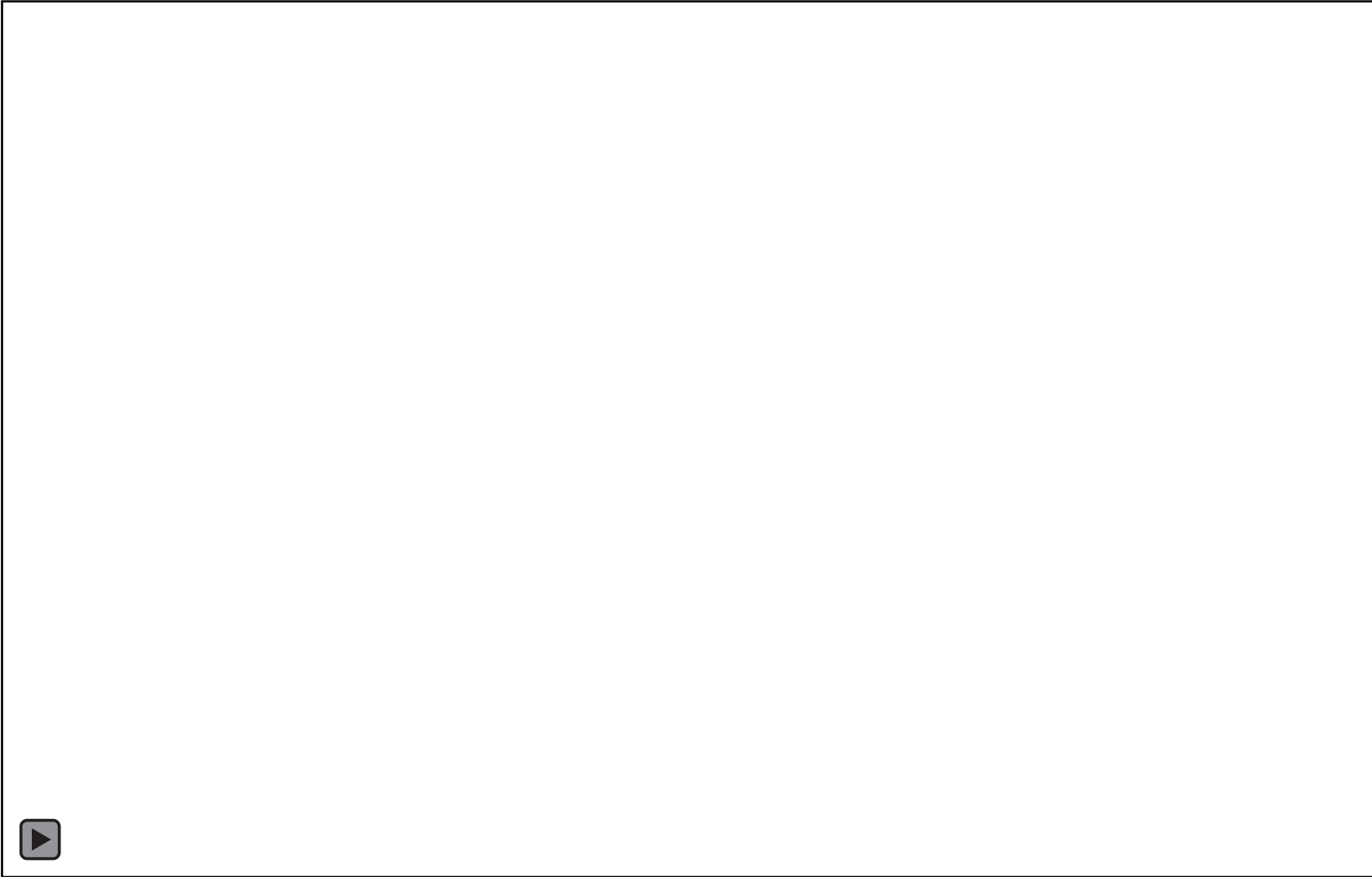
● Obs Breach Event ● PLP BTN Rico Est Breach ● EIS Bulk Tailings "Pipeline Rupture" Power (Vf Rico (2008))



Study Area – Regional View



Result: 24-hour Breach, 50 hr simulation



Sensitivity: Total volume released

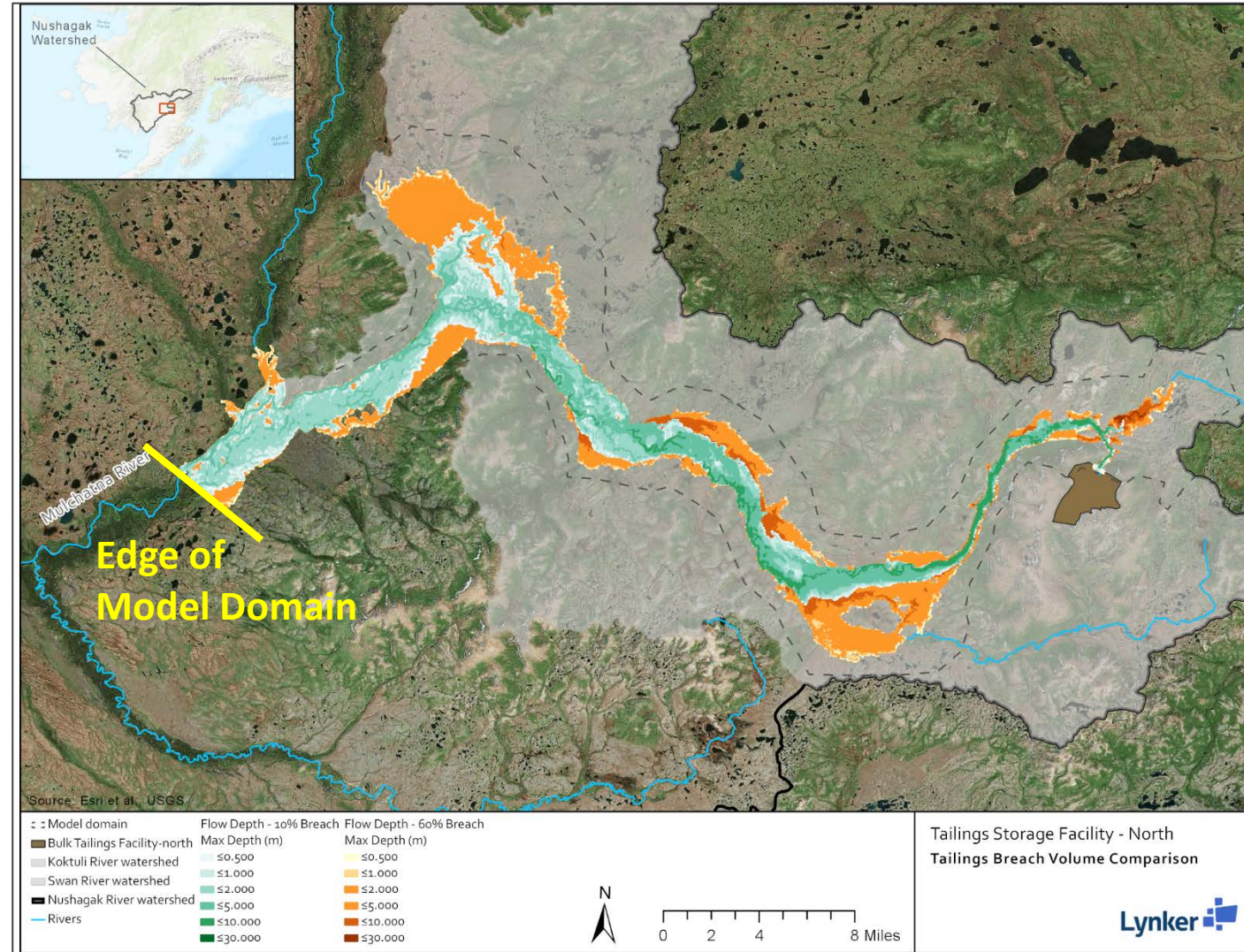
Breach Volume Comparison

10% breach volume (green)

- Inundated Area: 60.9 mi²

60% breach volume (orange)

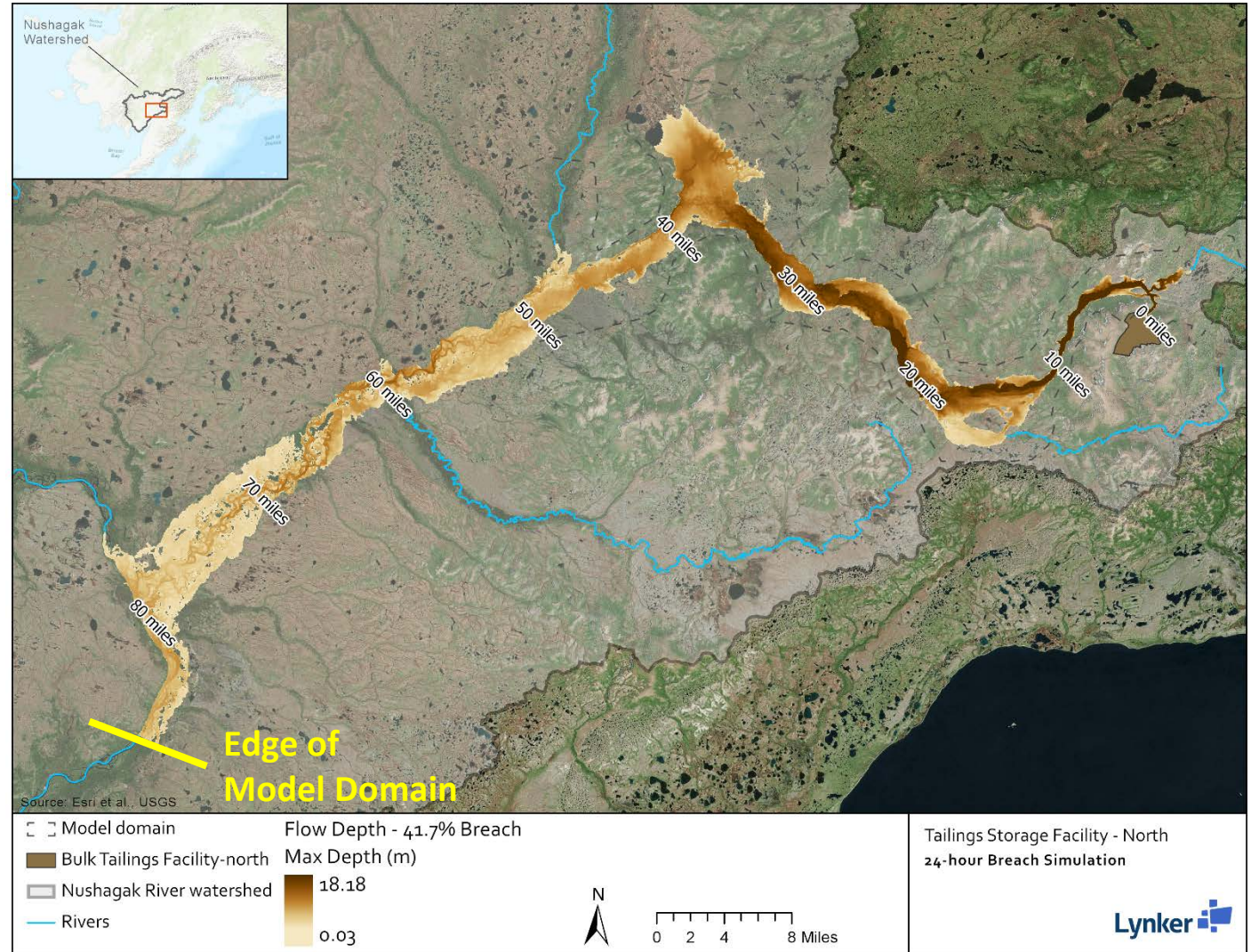
- Inundated Area: 110.3 mi²



Larger Model Domain: 24-hour Breach

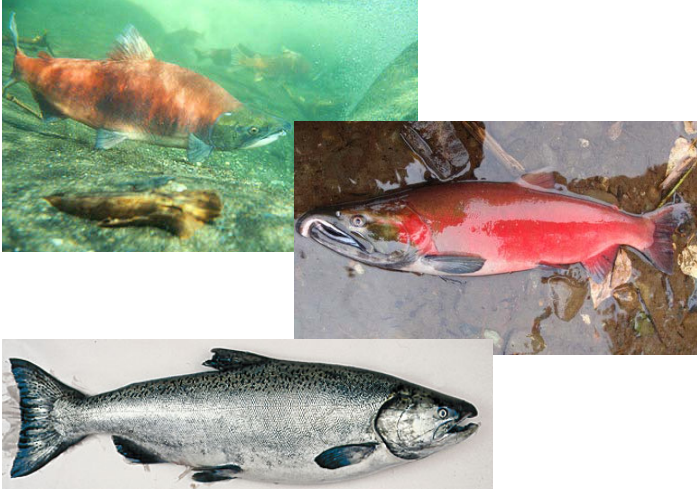
Model extends from TSF to Nushagak-Mulchatna Confluence

- ~45% of tailings are deposited within the model floodplain
- ~55% of tailings flow past the model boundary

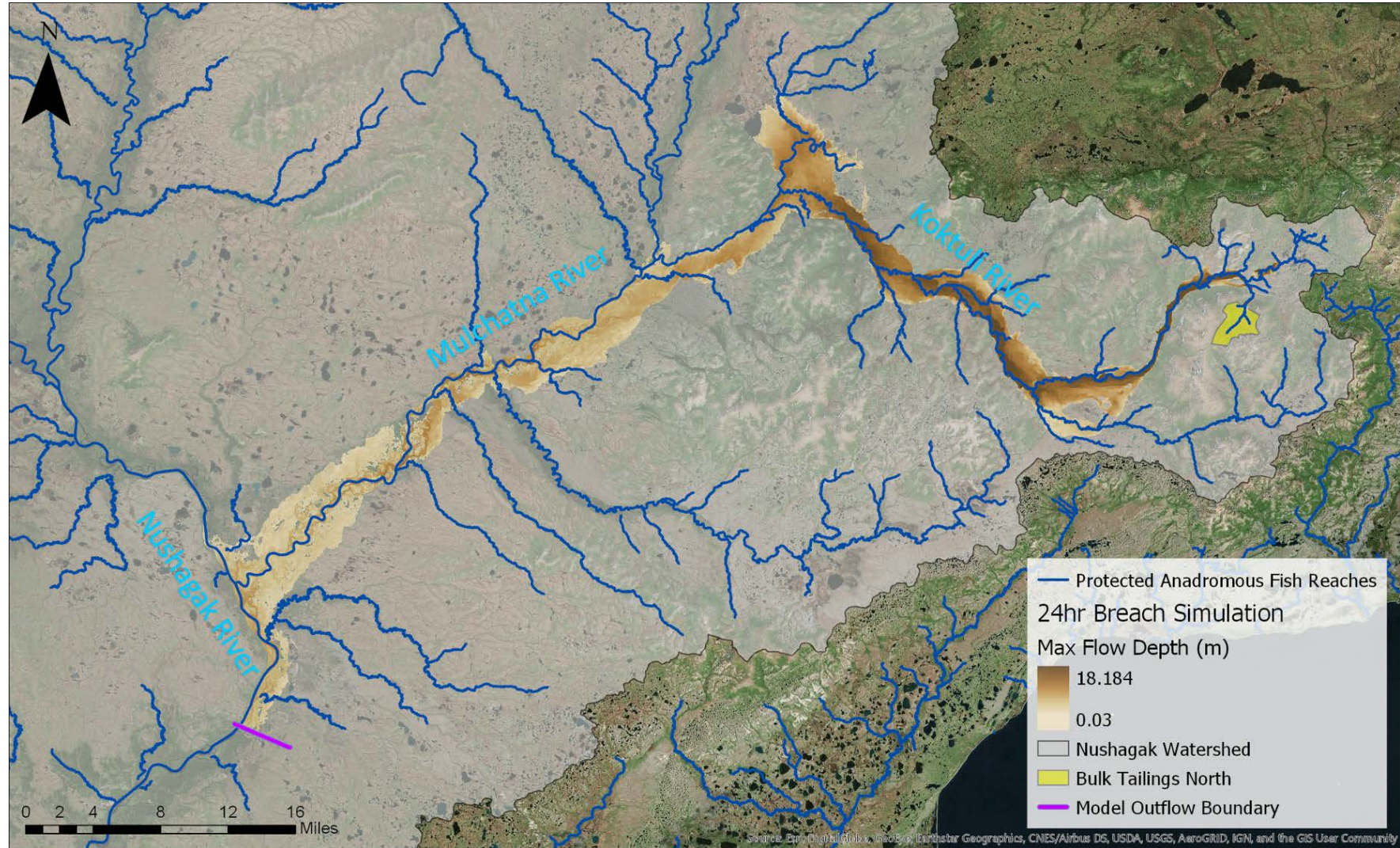


Salmon Habitat Impacts – Anadromous Waters

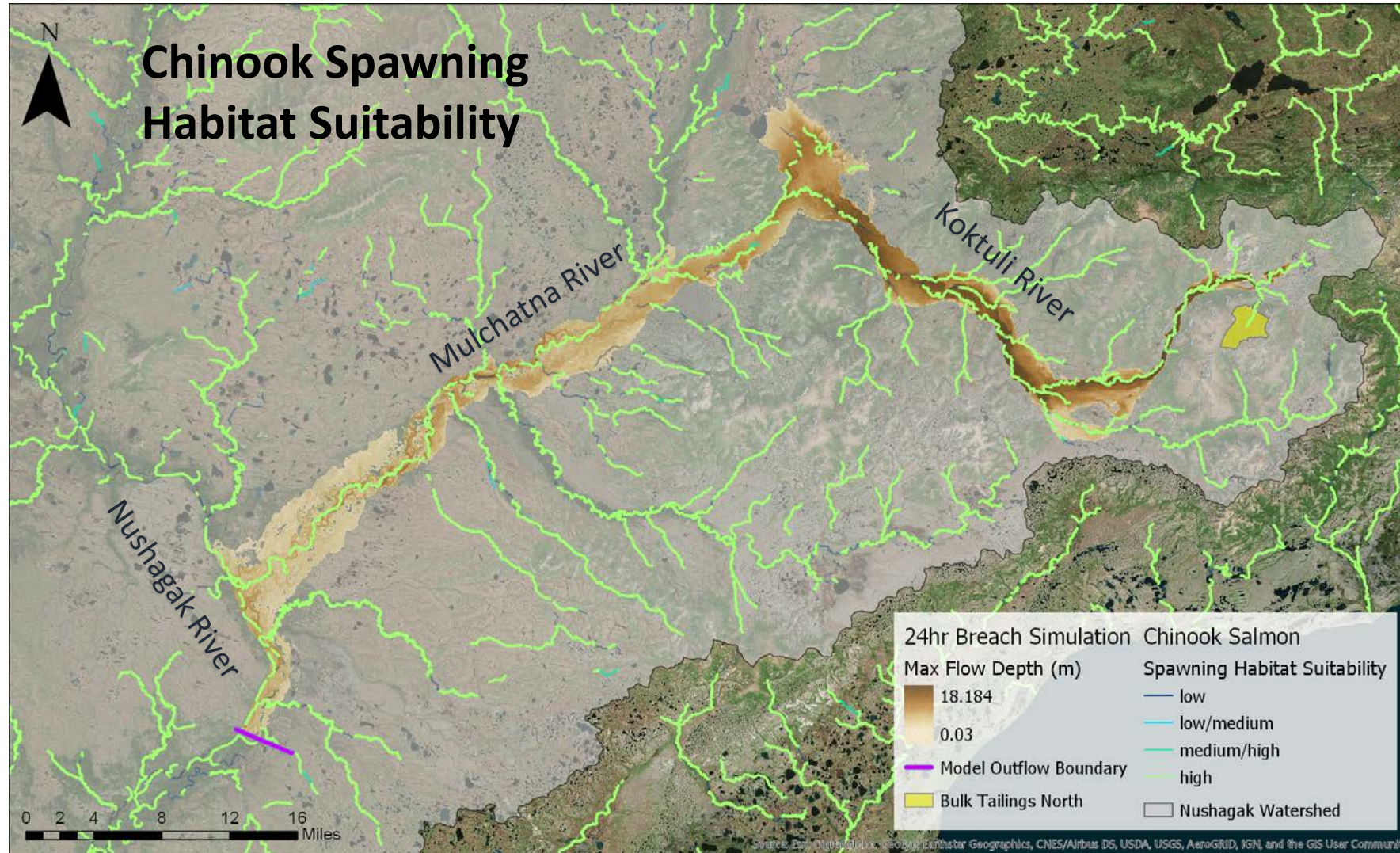
<https://www.adfg.alaska.gov/sf/SARR/AWC/index.cfm?ADFG=defs.species>



- Tailings would directly impact >219 miles of anadromous waters



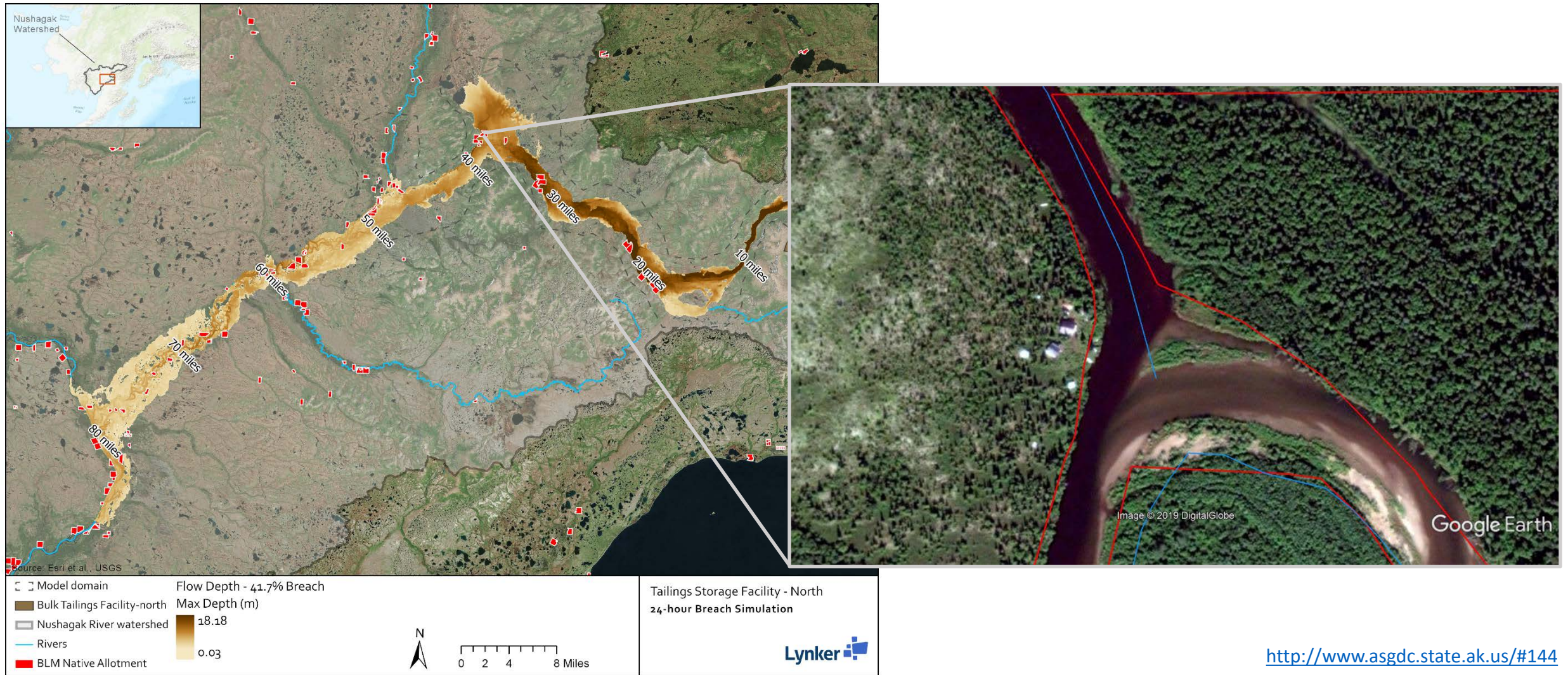
Salmon Habitat Impacts – Habitat Suitability



Woll, C., Albert, D., & Whited, D. (2012). *A Preliminary Classification and Mapping of Salmon Ecological Systems in the Nushagak and Kvichak Watersheds, Alaska.*



Potential Human Impacts – Native Allotments



“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



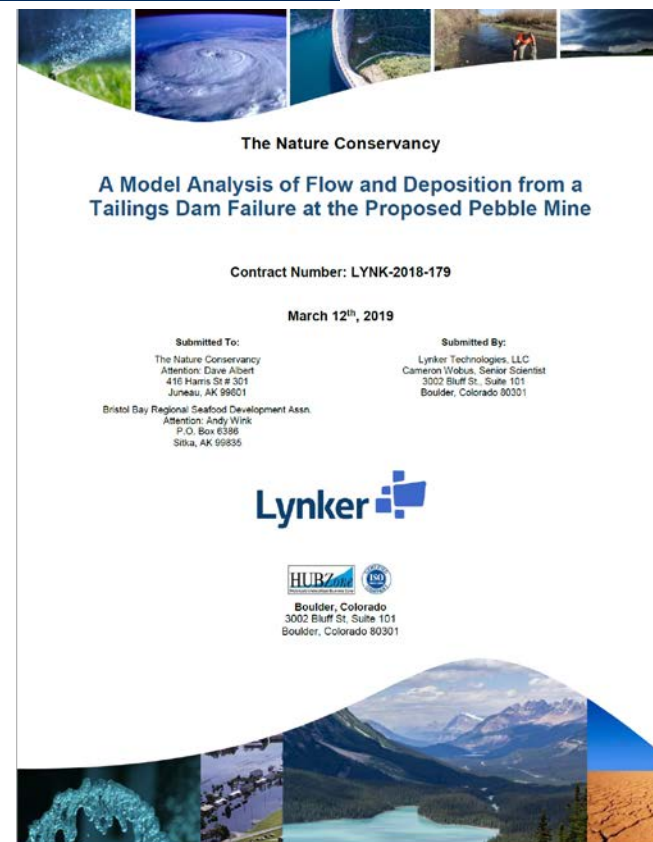


Questions

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Full Report Available at www.bbrsda.com

