Bear Creek Dam Seismic Stability

2016 NW Hydro Forum

Eugene, Oregon

May 2016

Outline

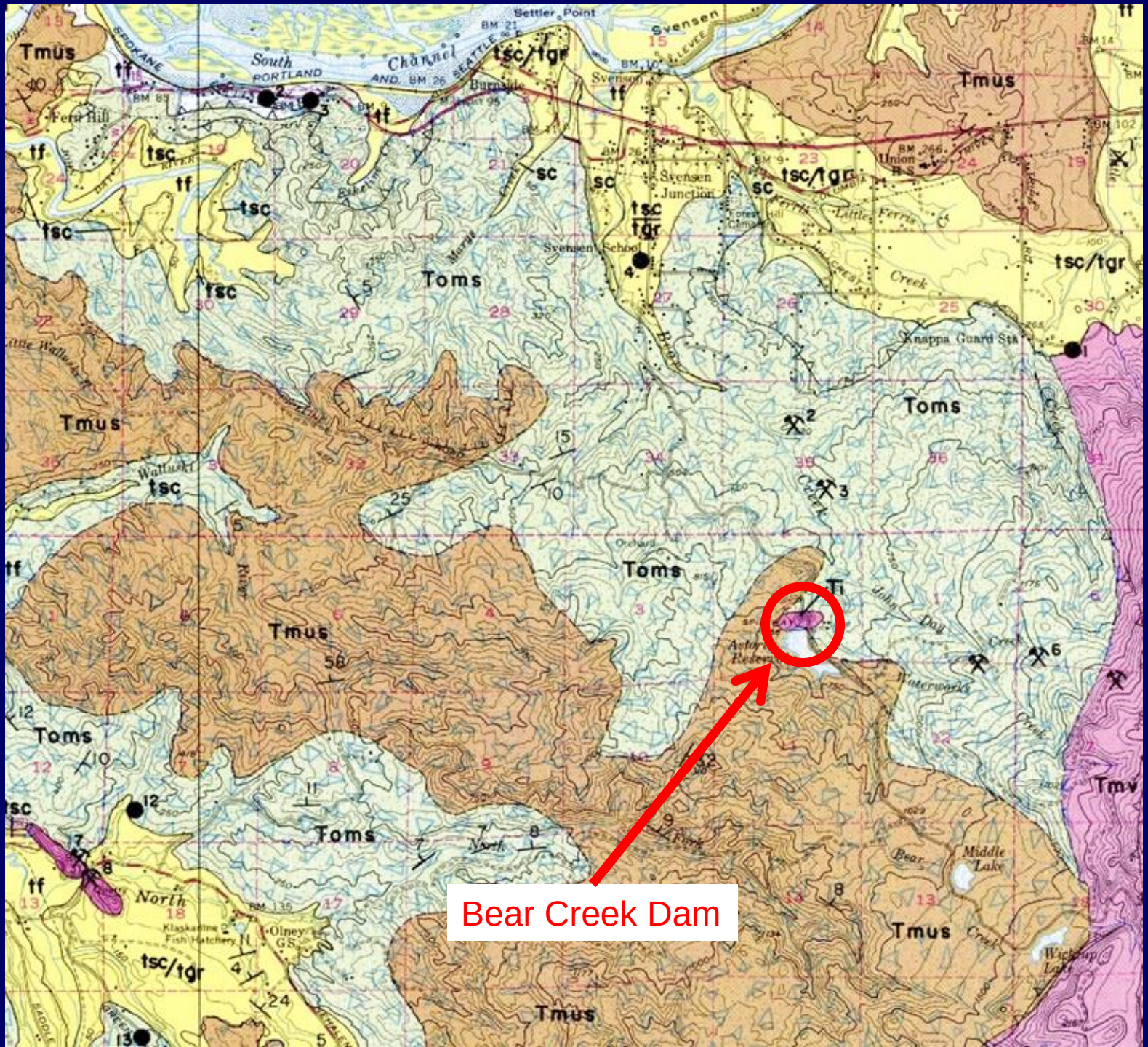
- Background on project
- Project objectives
- Dam geologic model
- Analysis methods & results
- Conclusions
- Lessons learned

Bear Creek Dam

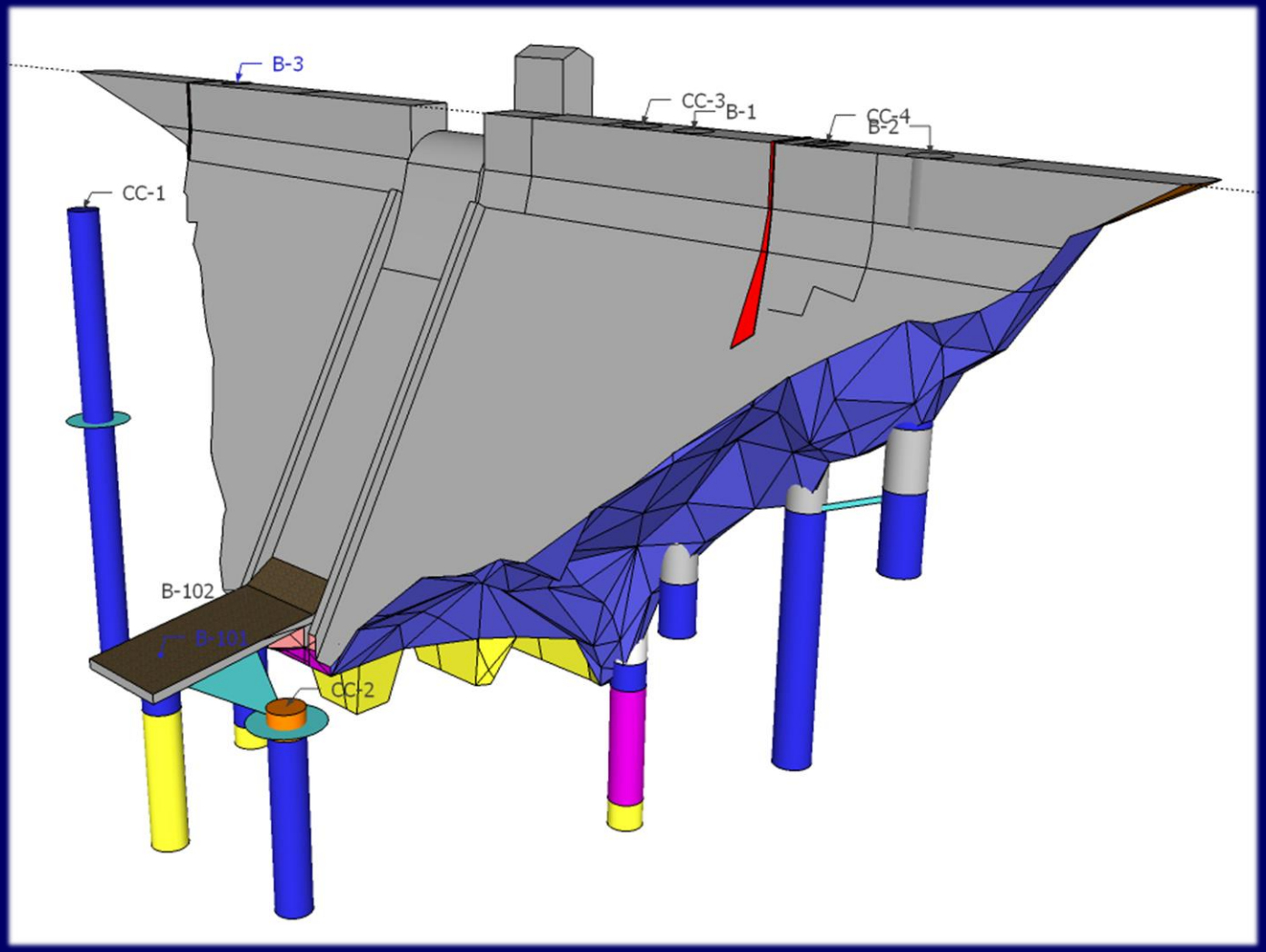
- Near Astoria, Oregon
- Constructed 1911
- Domestic water
- 90’ concrete gravity
- 280’ long
  - Only 180’ is over 20’

Background & Objectives

- Seismic Stability – CSZ Source
- Develop an accurate model
  - Previous studies used very simple model
  - Use City Engineer's field book for geometry
- Evaluate the sliding stability
  - Simple methods (limit equilibrium, Newmark)
  - Incorporate resistance from abutments


Bear Creek Dam

Geologic Model

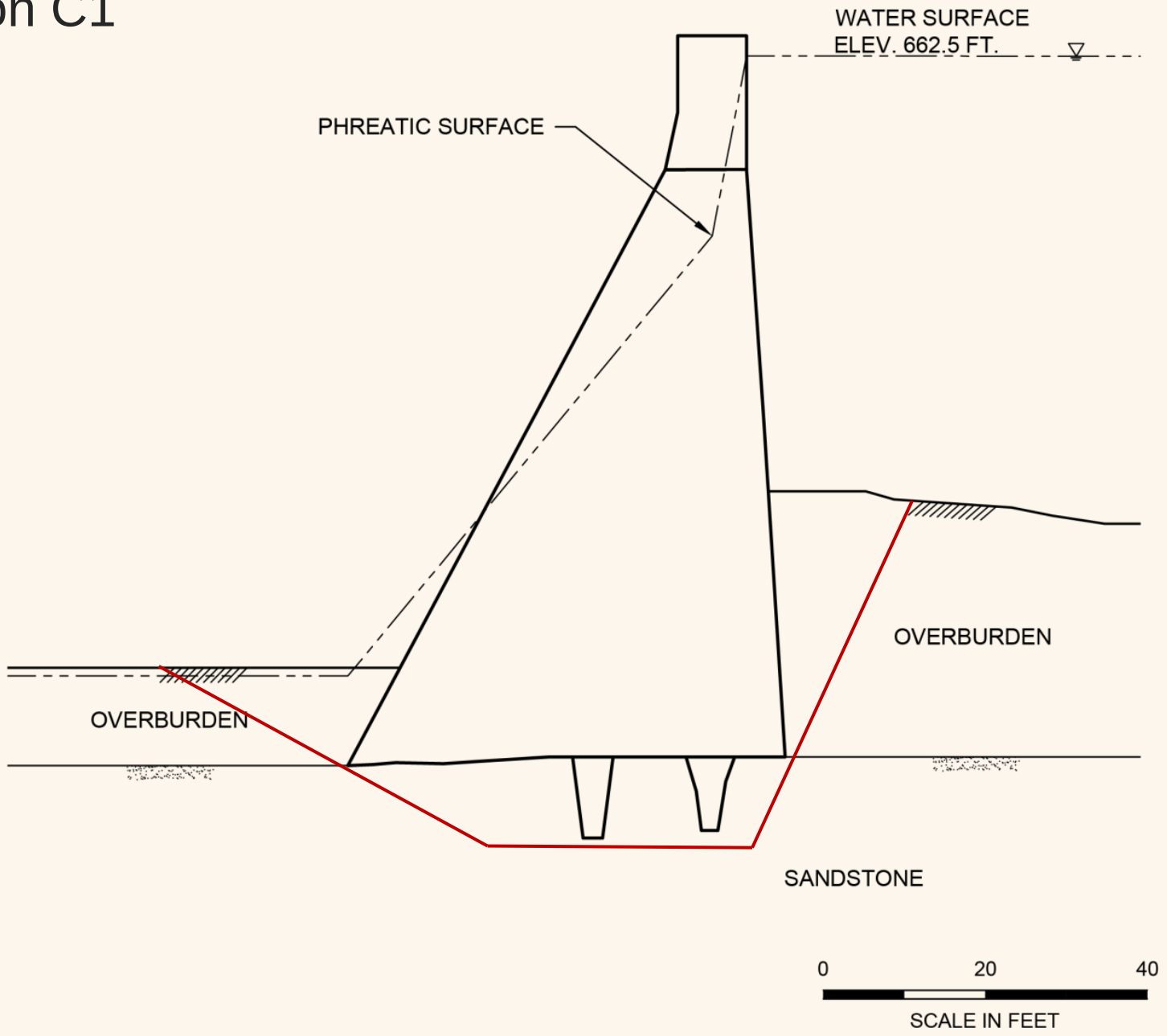


Conclusions from Model

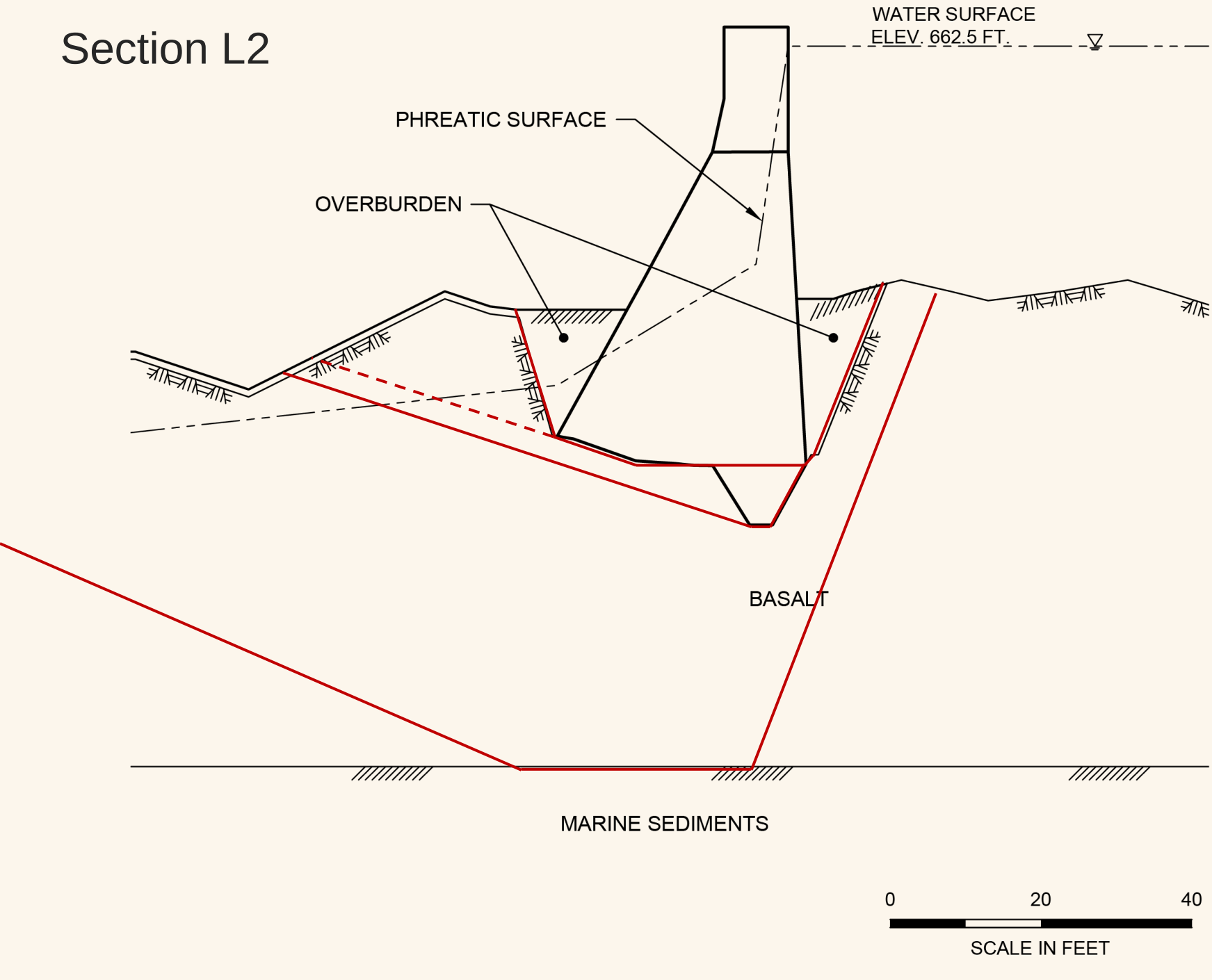
- Left abutment on strong basalt
  - Good embedment
- Center on weak sandstone
  - Poor embedment
- Right abutment on breccia
  - Poor embedment

NOTE: TOPO MAP PROVIDED BY OTAK, INC., DECEMBER 2013.

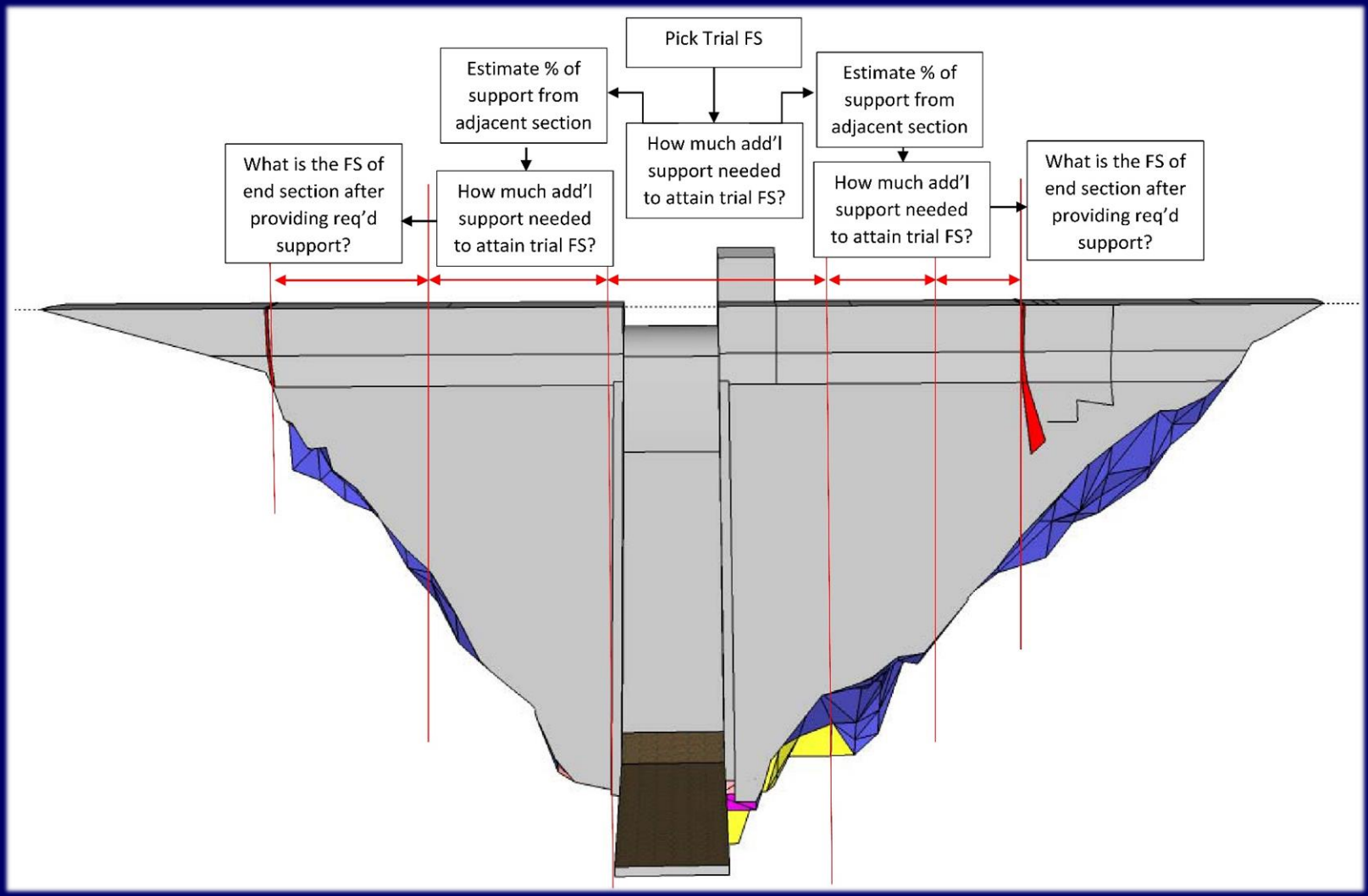
Section C1


WATER SURFACE
ELEV. 662.5 FT.
PHREATIC SURFACE
OVERBURDEN
OVERBURDEN
SANDSTONE
0
20
40
SCALE IN FEET

Section L2


WATER SURFACE
ELEV. 662.5 FT.
PHREATIC SURFACE
OVERBURDEN
BASALT
MARINE SEDIMENTS
0
20
40
SCALE IN FEET

Composite Factor of Safety



Analysis Results

Region	Composite Factor of Safety		Yield Acceleration
	Static	Seismic (k_h=0.61)	k_y (g)
Left Half of Dam	1.92	1.01	0.64
Right Half of Dam	1.18	0.52	0.09

Conclusions from Analysis

- Left abutment displacement negligible
- Right abutment may displace 20 inches
  - Based on limited subsurface data
  - Questioned breccia presence and strength
- Uncertainty of strength in right abutment has large impact on stability

Next Steps

- Refine right abutment geology
  - borings from crest
- Shear strength testing
- Reanalyze stability

Additional Borings

Lessons learned

- Geometry matters
- Good construction notes help
- Geology matters
- Simple analysis methods work
- Modeling results should match observed performance
- Question existing data

Questions?