Seattle-Tacoma International Airport

Third Runway High Wall Design

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Airports Conference
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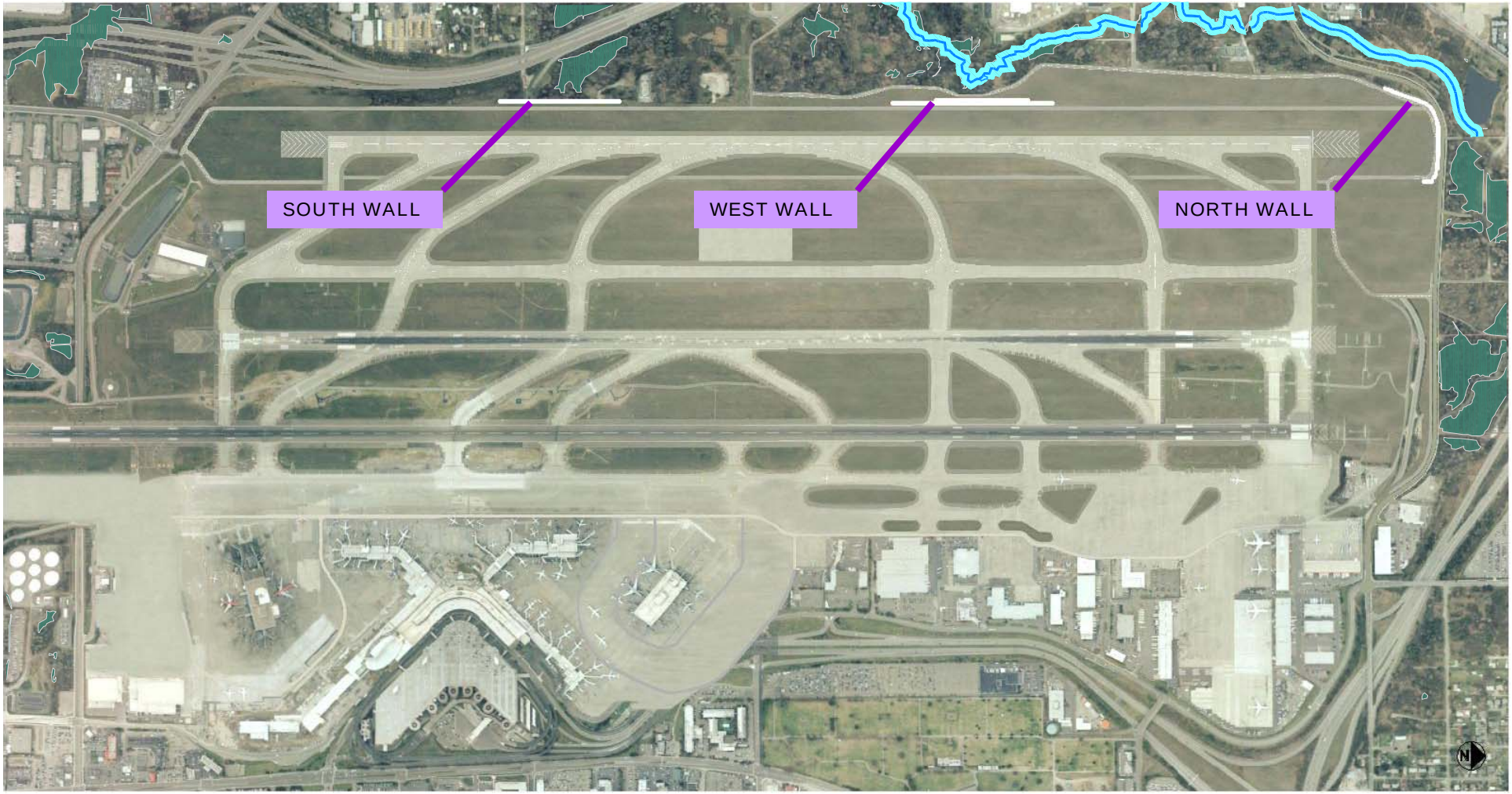
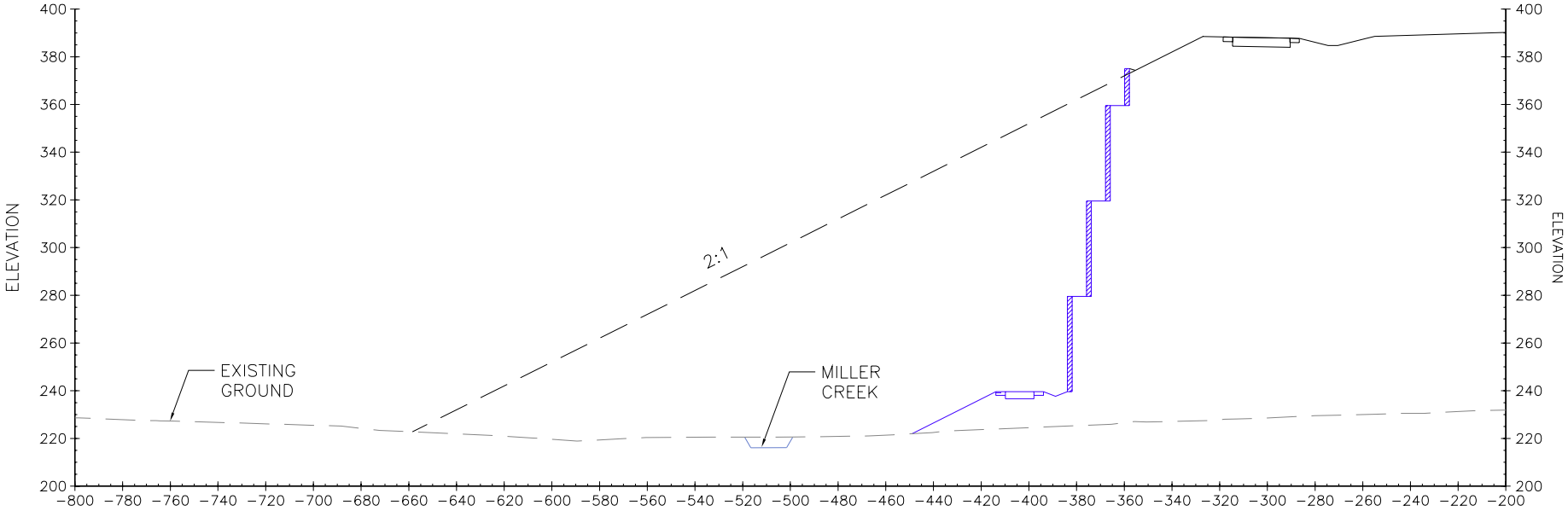
Third Runway and Wall Design



Retaining Walls - 2005

135 Foot High West Wall

West Wall & Miller Creek Section



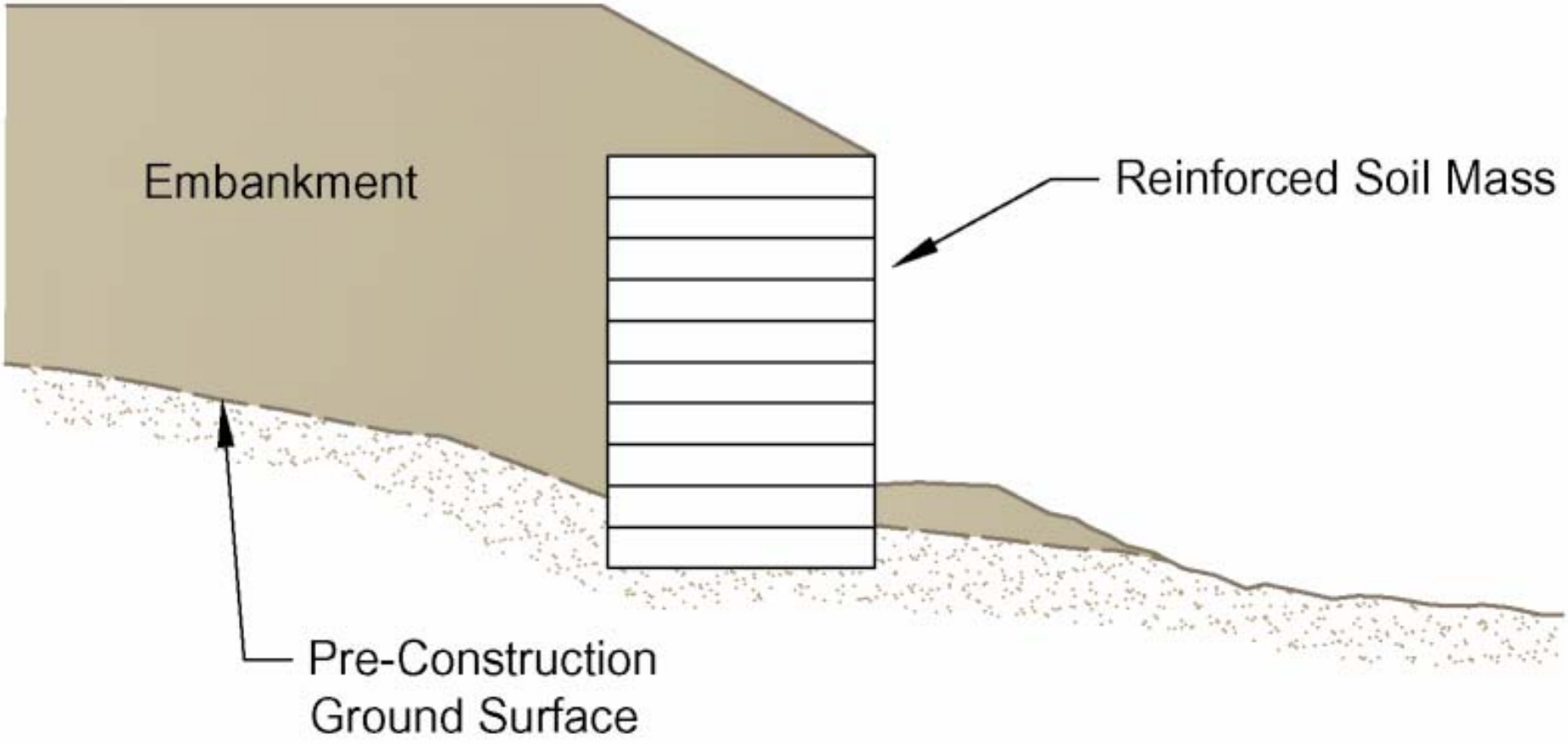
Evaluating Alternatives

- Screened over 60 configurations
- Performed risk analysis four alternatives
- Selected tiered MSE wall
  - Most cost effective wall type
  - Seismic stability
  - Demonstrated performance
  - Most environmentally acceptable

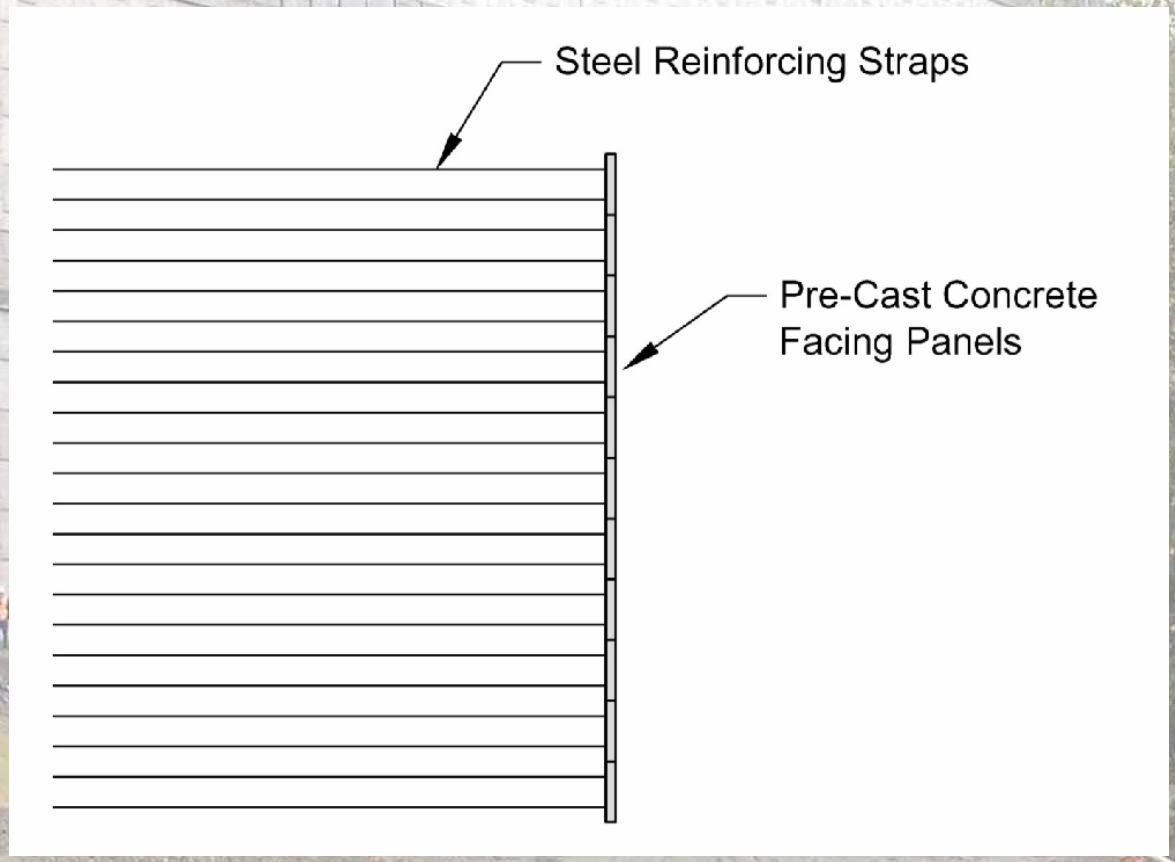
Concept Acceptance

- Worldwide search for similar walls
- Consultation with others
- Physical model of four alternatives

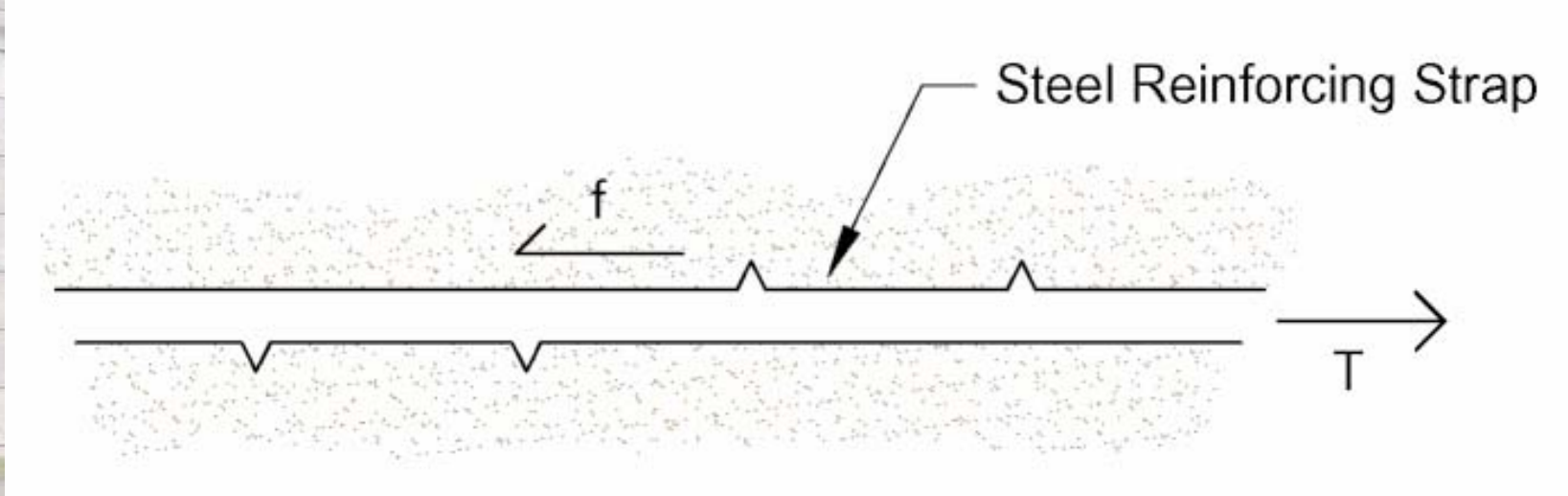
How An MSE Wall Works



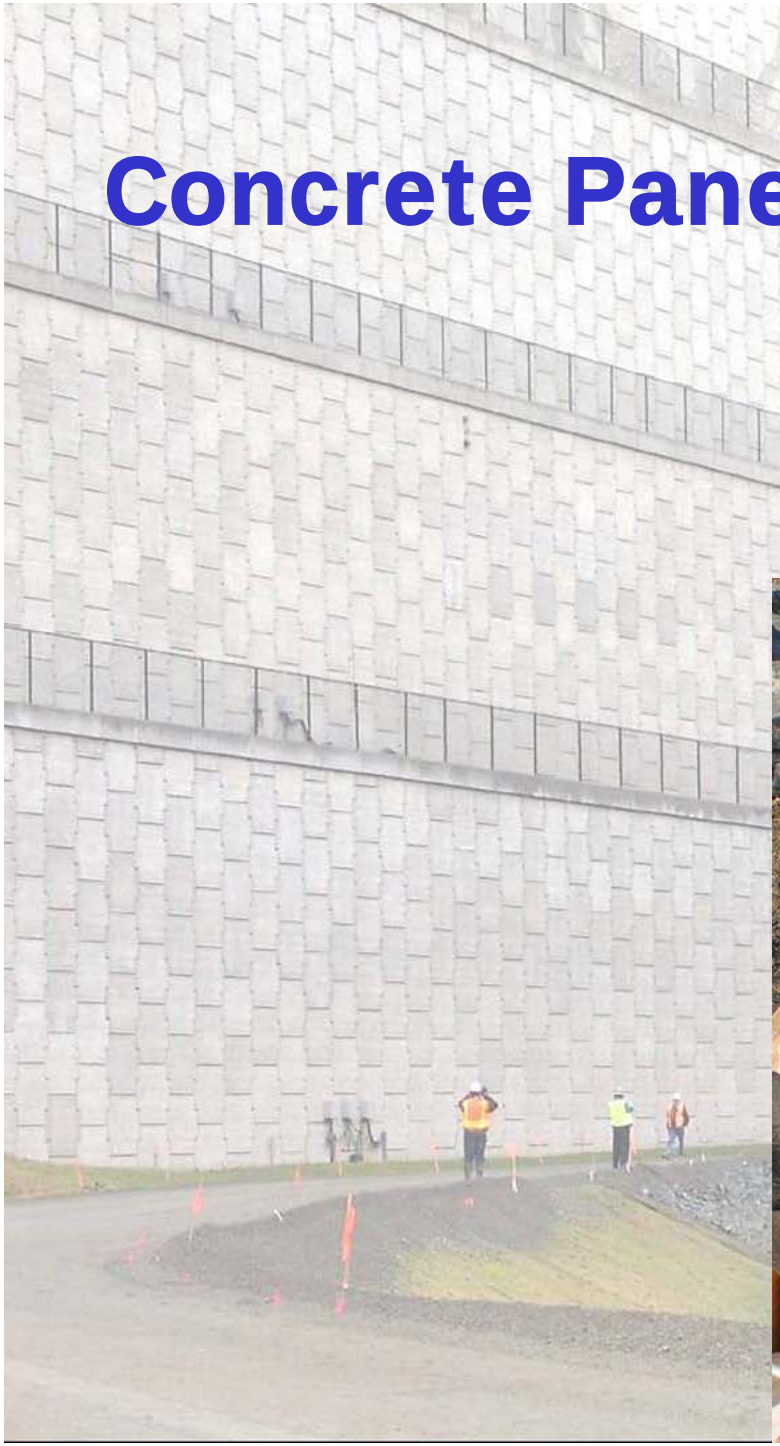
MSE Wall Components



Reinforcing Straps Use Soil Friction

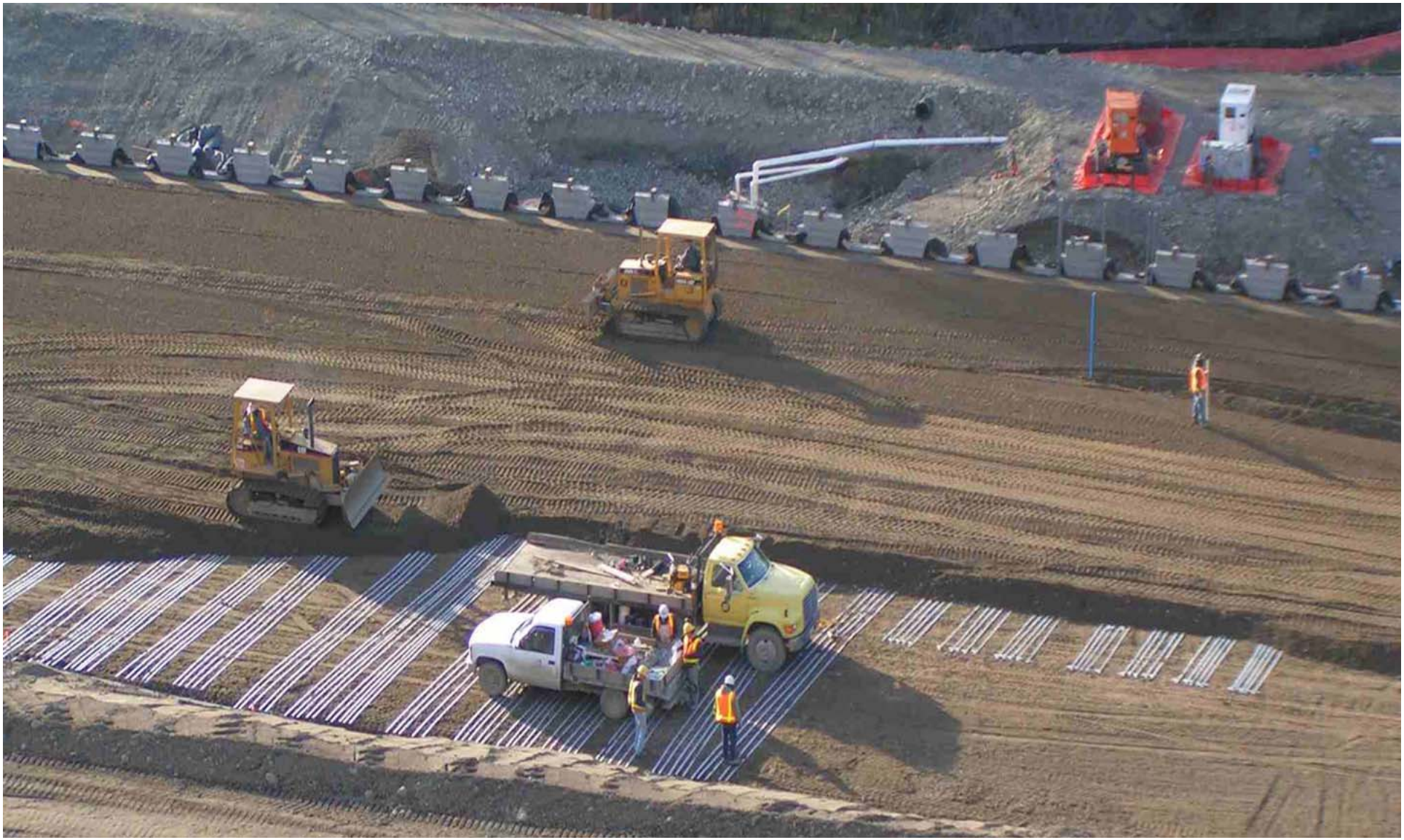


Concrete Panels and Steel Tabs



Reinforcing Straps

Compacting Fill



MSE Wall Procurement Process

- Typically design/build
- Port procured through design/bid/build
  - complex permitting issues
  - significant seismic design considerations
  - High wall design experience
  - Integrated wall, civil, and geotechnical design
  - WSDOT recommendation

Procurement Process (continued)

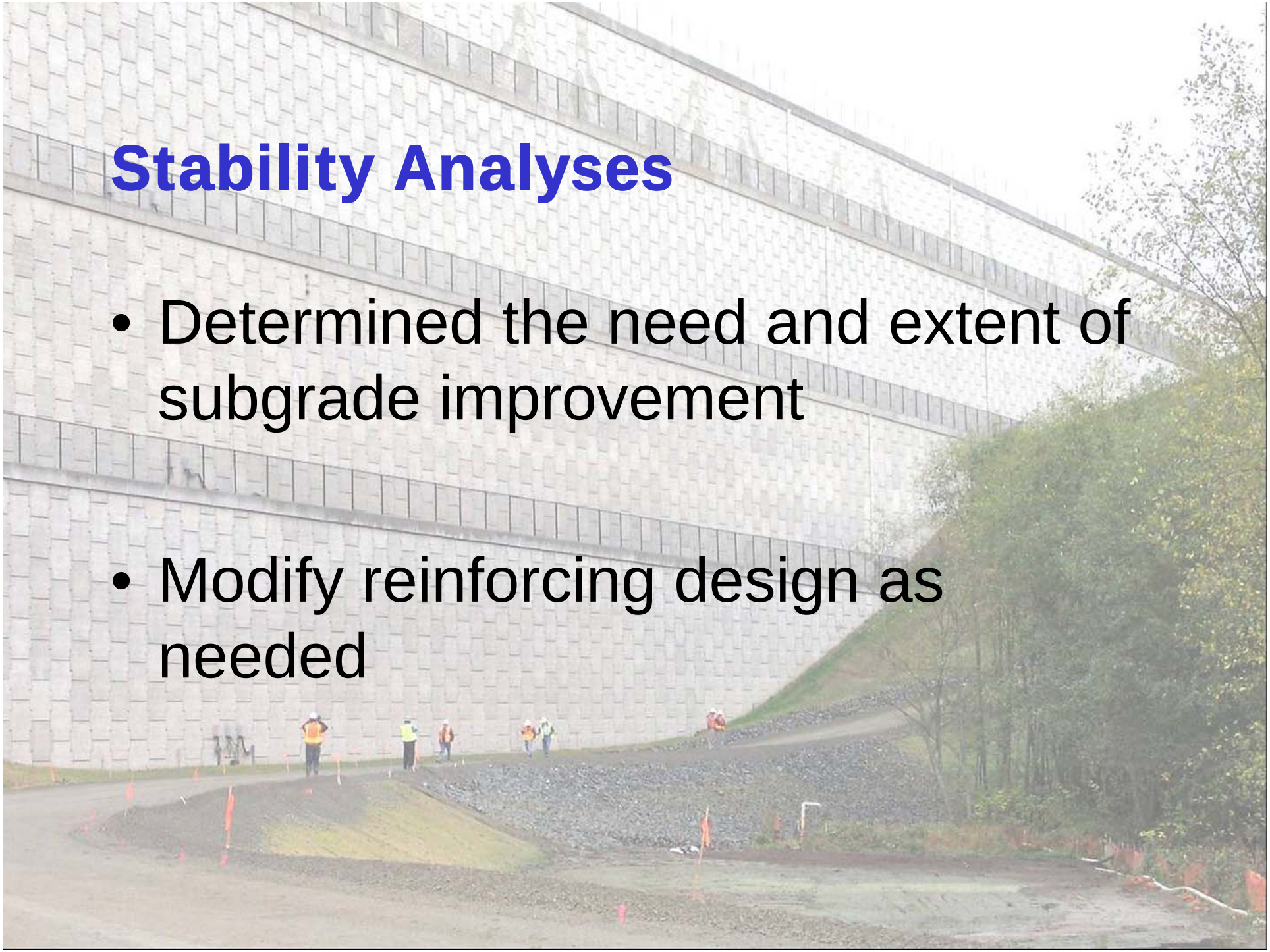
- Issued RFQ for Designer Selection
- Selected Reinforced Earth Company
  - High wall experience
  - Multiple walls completed over 90 feet
- Non-proprietary design

Basis of MSE Wall Design

- Established Standards (AASHTO & FHWA)
- Specialized Experience
- Multiple Methods of Design Analysis
- Independent Oversight

Seismic Basis of Design

- AASHTO Design Code
- Assumed Seismic Event Consistent with Other Planning
- 475-year Return Period



Stability Analyses

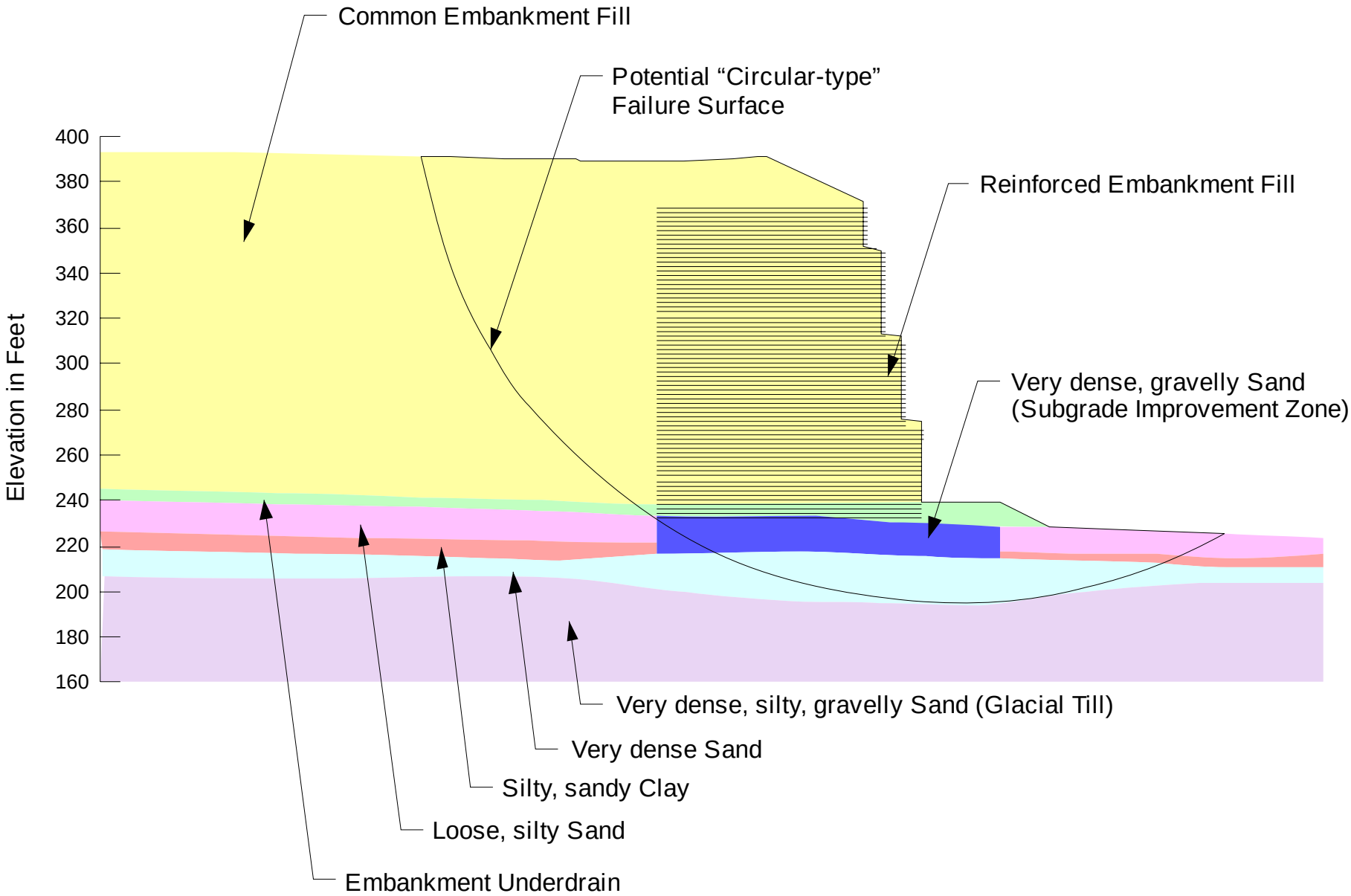
- Determined the need and extent of subgrade improvement
- Modify reinforcing design as needed

Results from Stability Analyses

Improve subgrade below wall

- loose, saturated sands.
- weak, compressible silts, clay and peat.

Stability Analyses



Improve Subgrade Without Restricting Groundwater Flow

Possible Improvement Methods

- Over-excavate & replace
- Pre-load with drains
- Dynamic compaction
- Vibrocompaction
- Jet grouting
- Deep soil mixing
- Pinch piles
- Stone Columns

Overexcavation Removes Unsuitable Native Soils

Soft, Loose Soils Replaced with Dense Compacted Fill

Controlling Groundwater

Monitoring During Construction

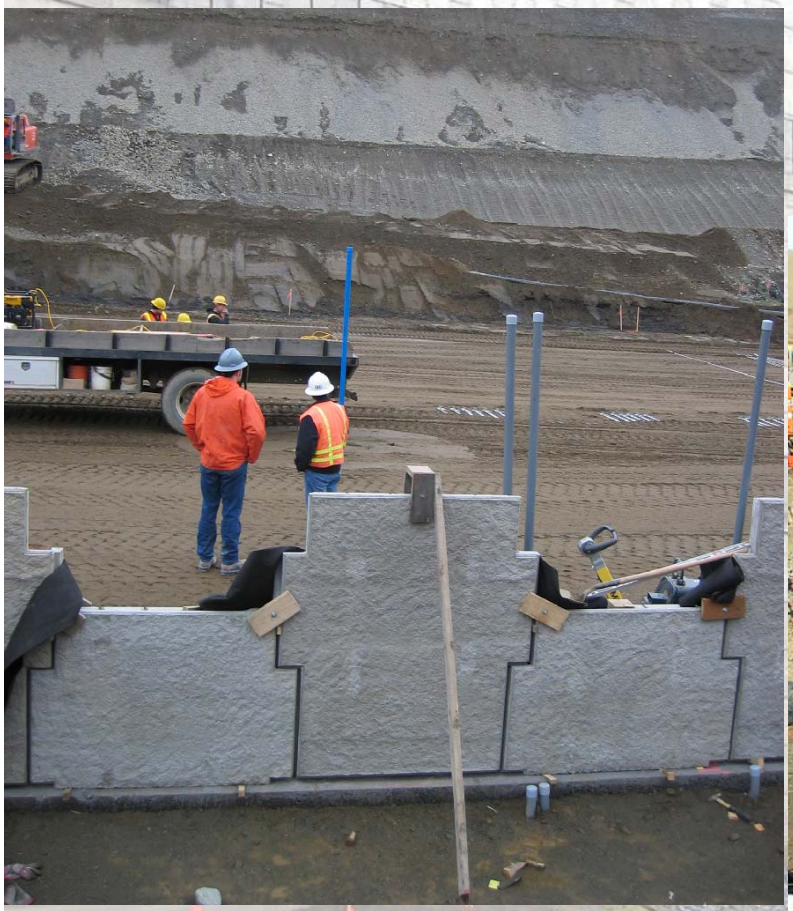
Reinforcing Straps Performance

Components Stockpiled

Finished Subgrade

January 2005 – Wall Panels Placed

January 2005 – Wall Panels Placed



February 2005

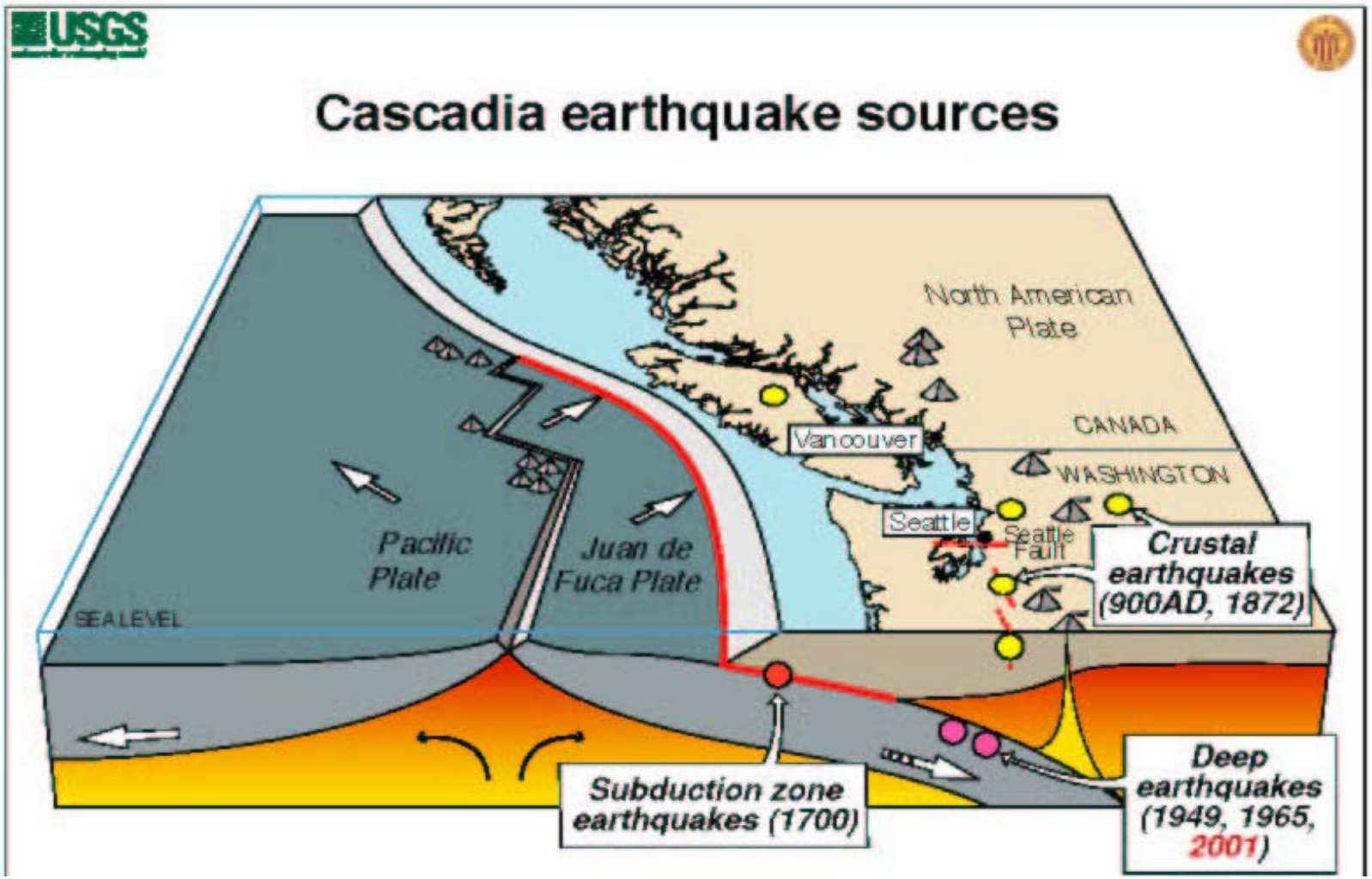
April 2005

July 2005

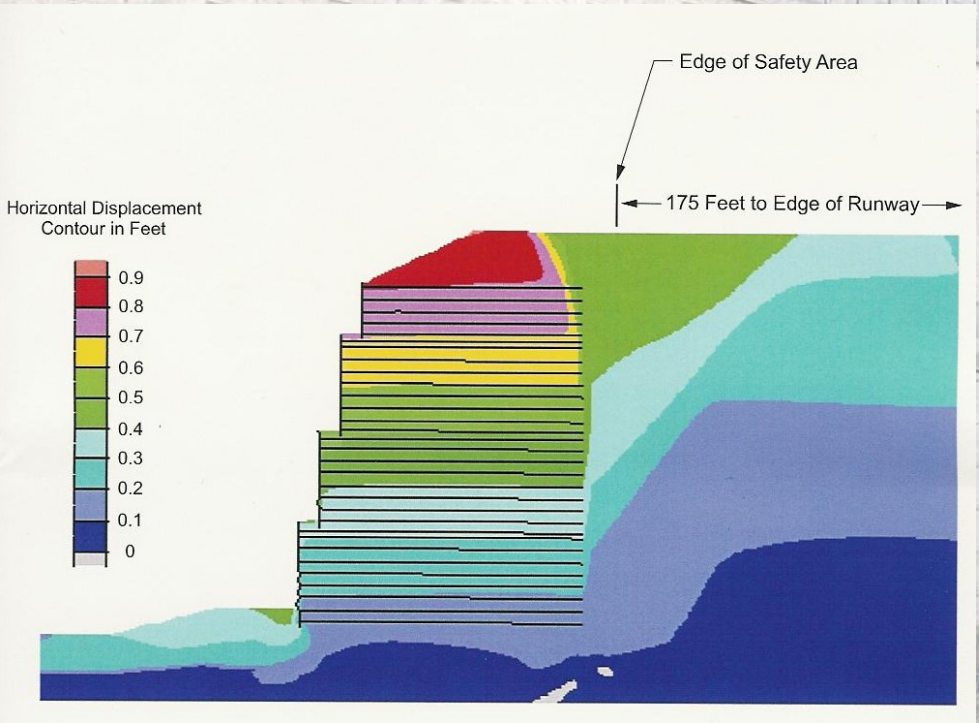
October 2005 – Wall Complete

Appendix

Seismic Event Sources

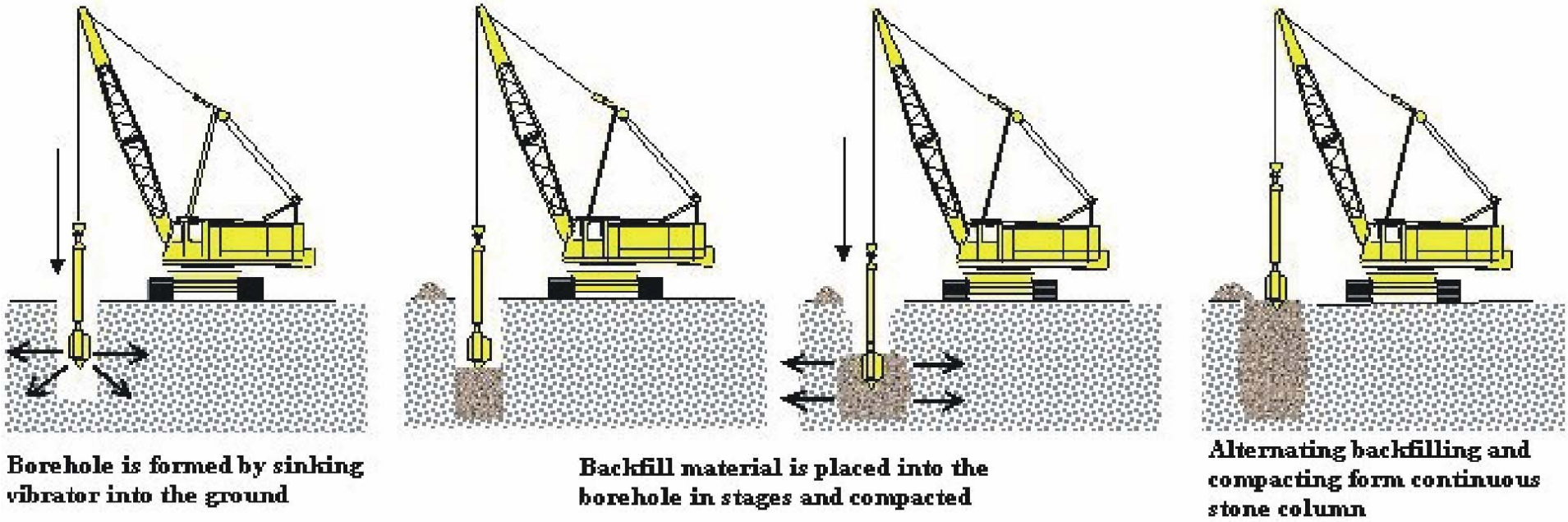


Computer Model Provided Independent Assessment of Design



- Verified that seismic displacements of the wall will be acceptable
- Verified that stresses in buried wall reinforcement would be acceptable – even for earthquake after 100 years of corrosion

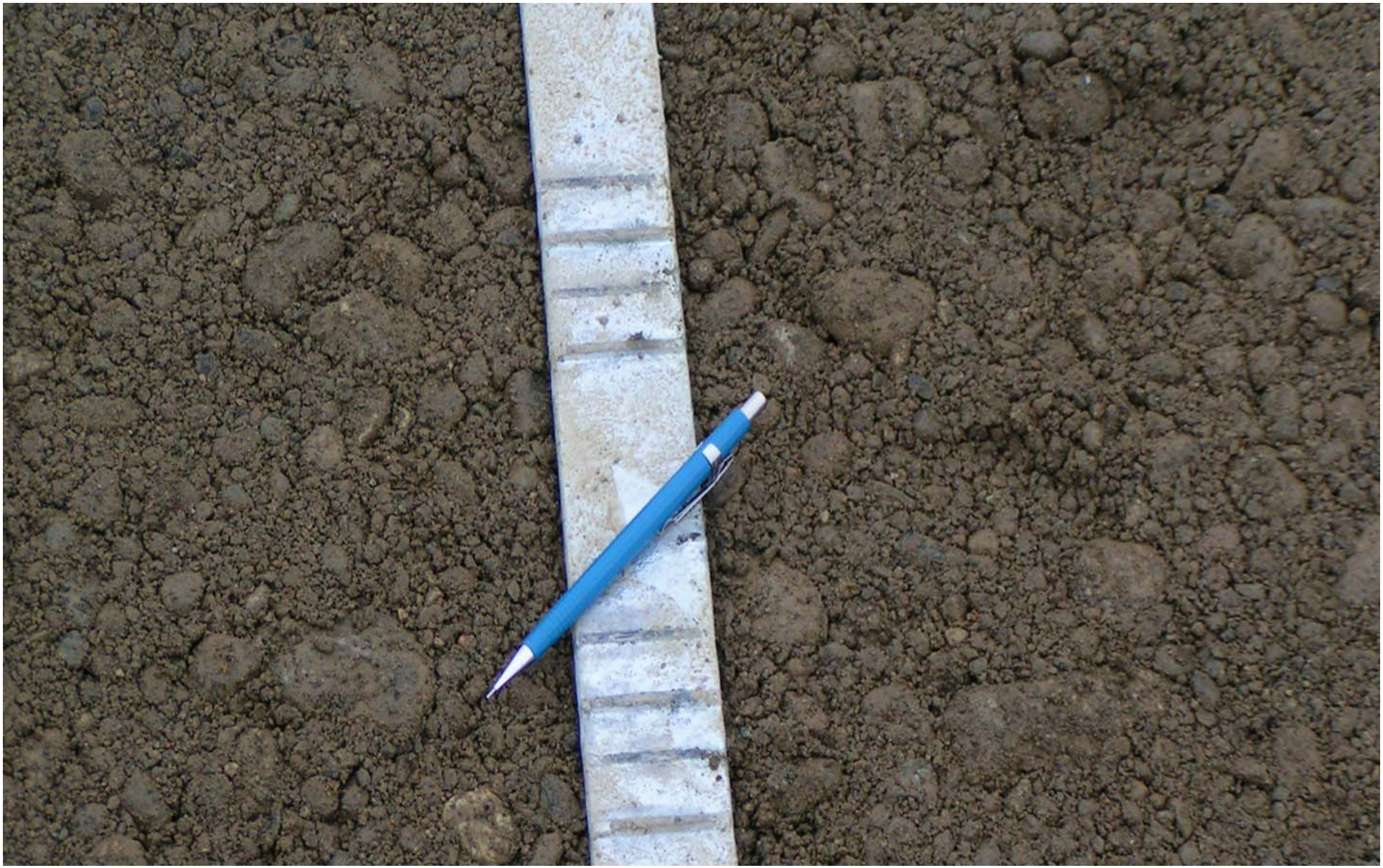
Initial Preferred Approach: Stone Columns



Advantages:
- No dewatering
- Limited volume of soil disposal
- Less risk near adjacent wetlands

Conclusion:
- Ground Improvement results were erratic
- Strength of native soils was actually reduced

Reinforcement Strap Showing Ribs



Wall Panel Bearing Pads