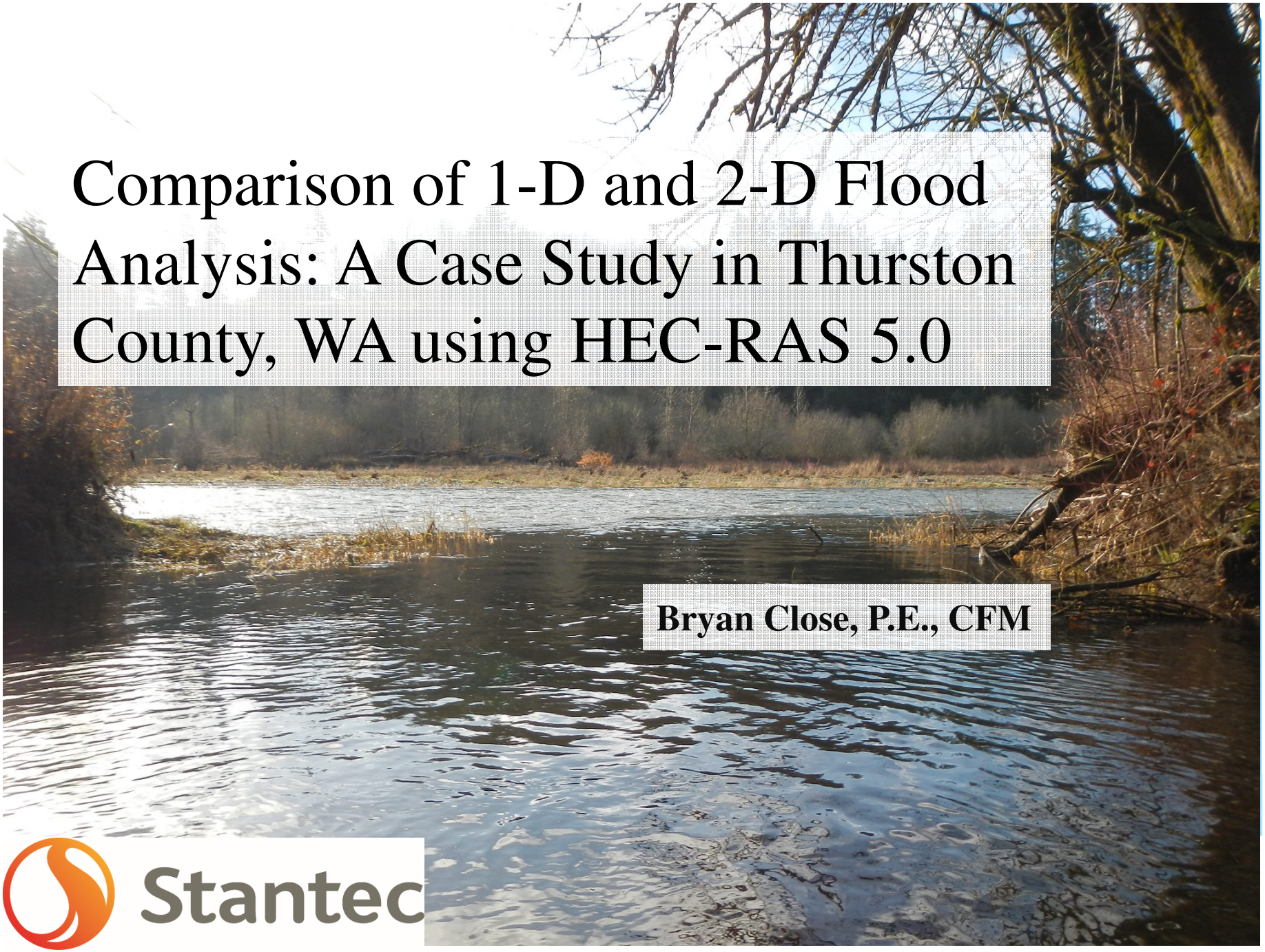
Comparison of 1-D and 2-D Flood Analysis: A Case Study in Thurston County, WA using HEC-RAS 5.0



Bryan Close, P.E., CFM

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2-D for Flood Modeling

* Good for: split flow, lateral flow, overflow, ponding areas and shallow overland flow
* Can provide quicker more reasonable results
* Can be completed with less trial and error
* Now available in HEC-RAS 5.0

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Scatter Creek

* FEMA Region X,
* New flood study for Thurston County, WA
* Scatter Creek - 41 square mile drainage in western Washington state
* Part of the Chehalis River basin flood study
* Modeled using 1-D HEC-RAS 4.1 model
* Combined 1-D and 2-D model for test area using HEC-RAS 5.0

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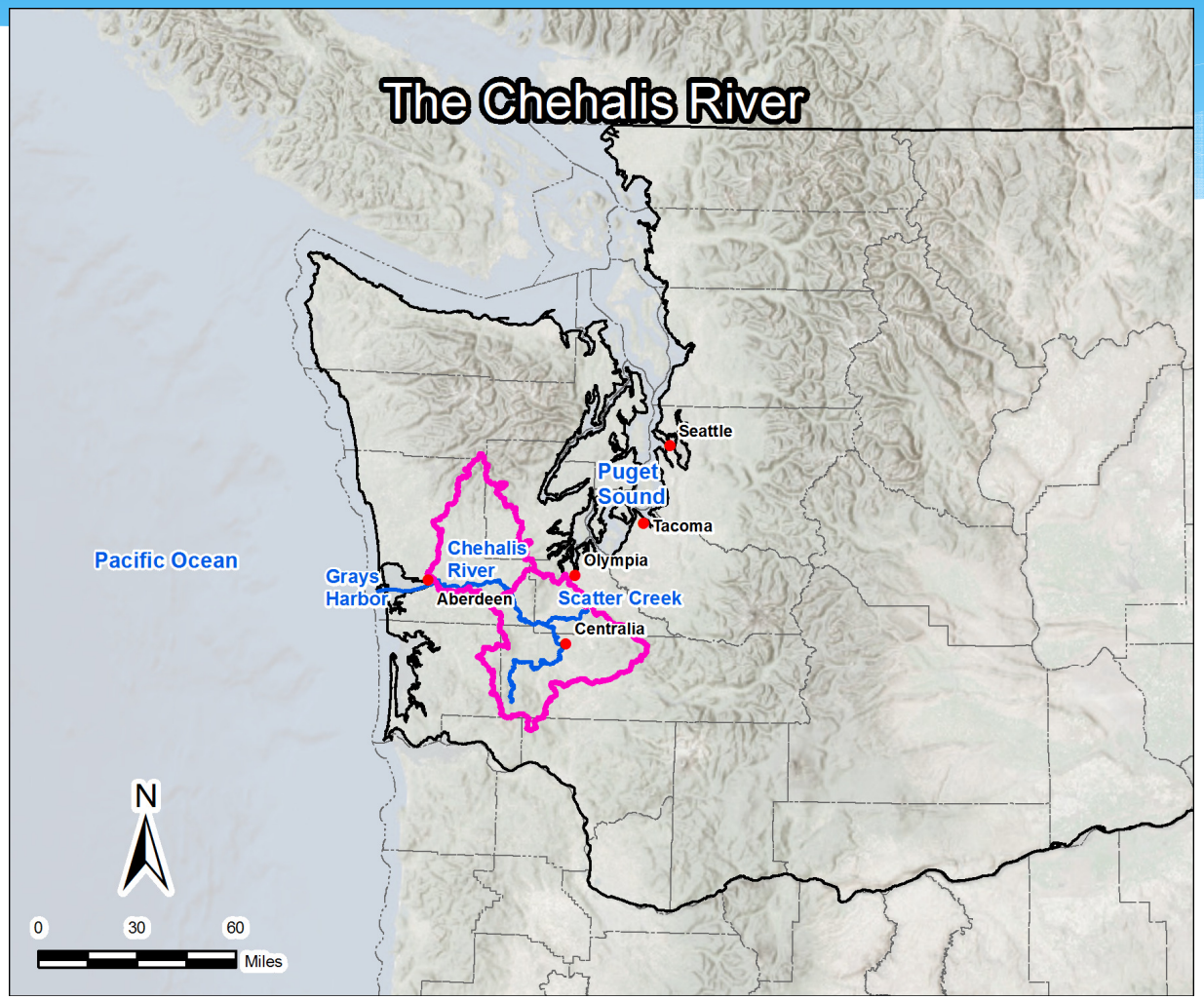
Scatter Creek and the Chehalis River Basin



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The Chehalis Gap

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The Chehalis Gap

* Gap in Coast Range of Washington State
* Broad Valley formed by glacial melt water during Pleistocene ice age
* Broad valley makes for unconfined flood plains

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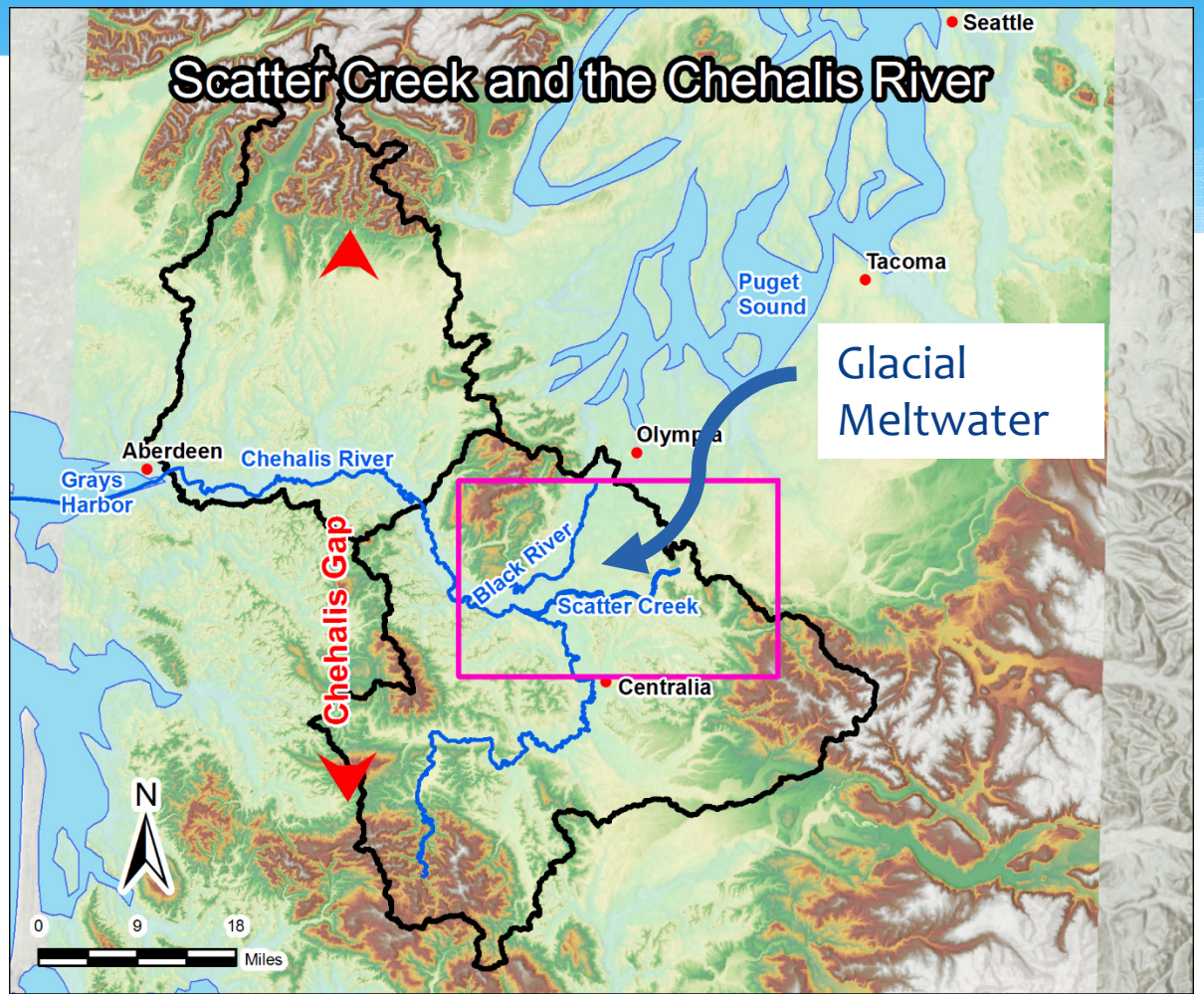
Scatter Creek



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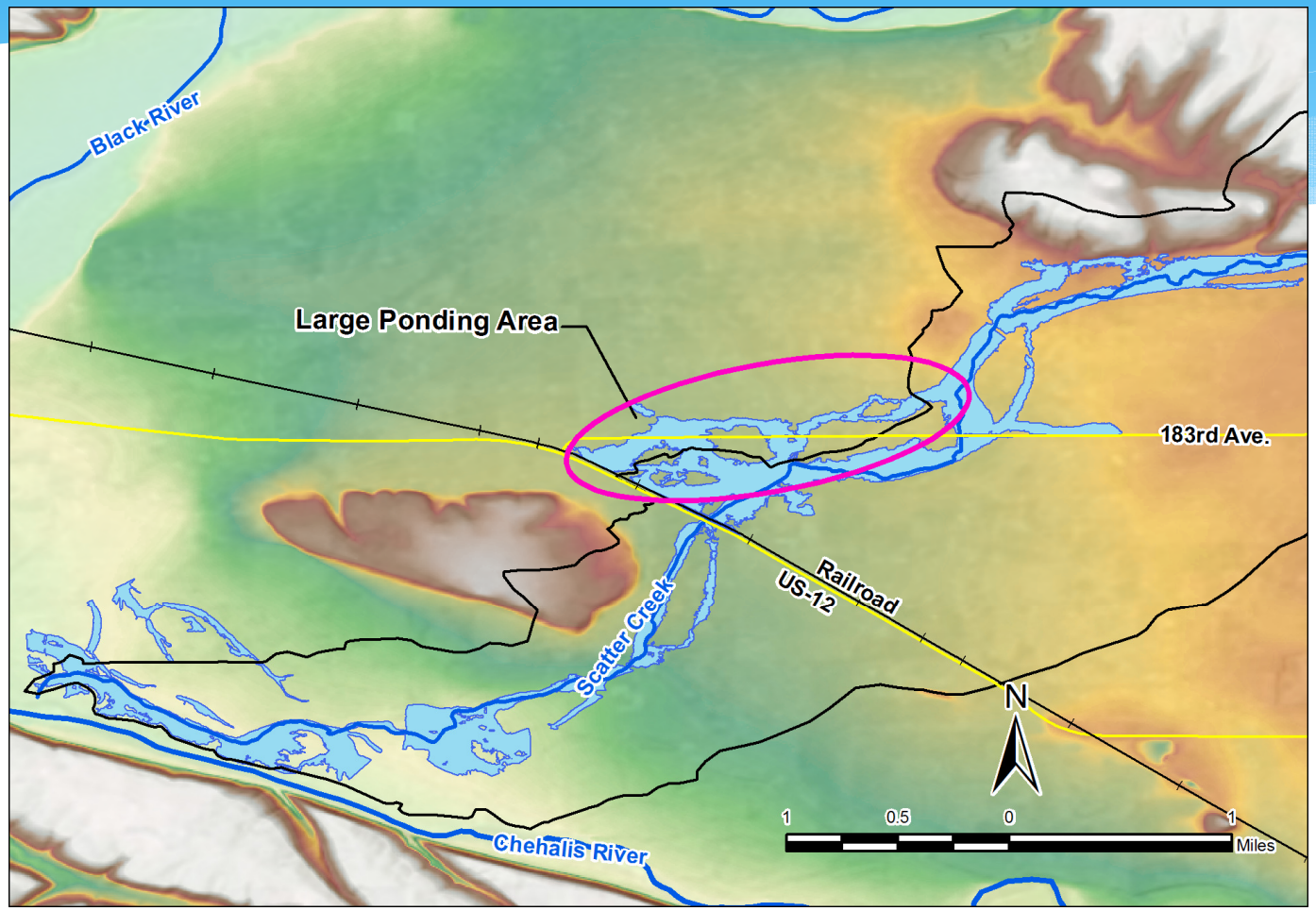
Unconfined Floodplain



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Overland Flow Area

Overflow/Ponding Area Upstream of This Railway Embankment.

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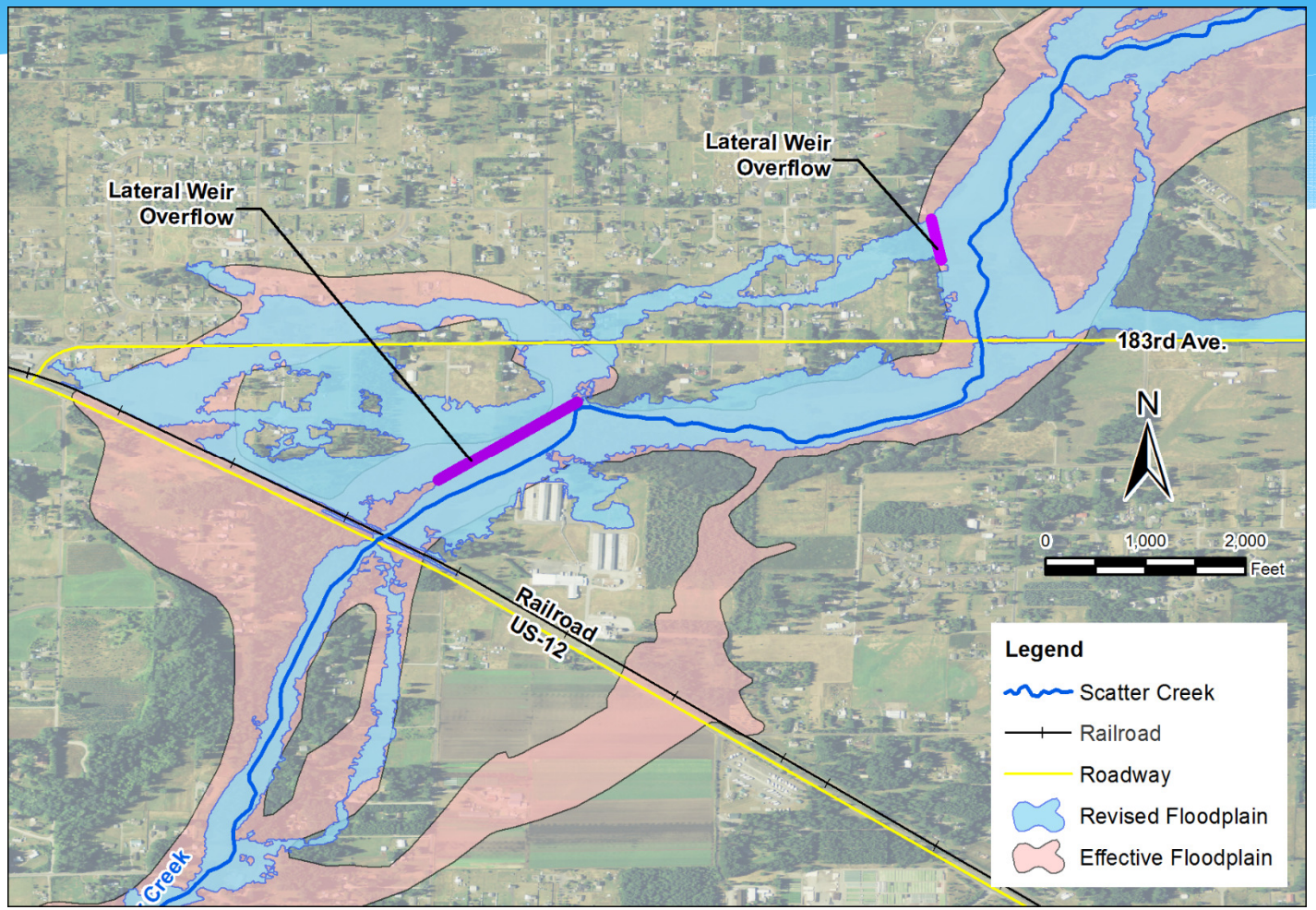
Unconfined Floodplain



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One-Dimensional Modeling

* Lateral Weirs
* Overland Flow Paths
* Cross-sections along Overland Flow Paths
* Trial and Error Process

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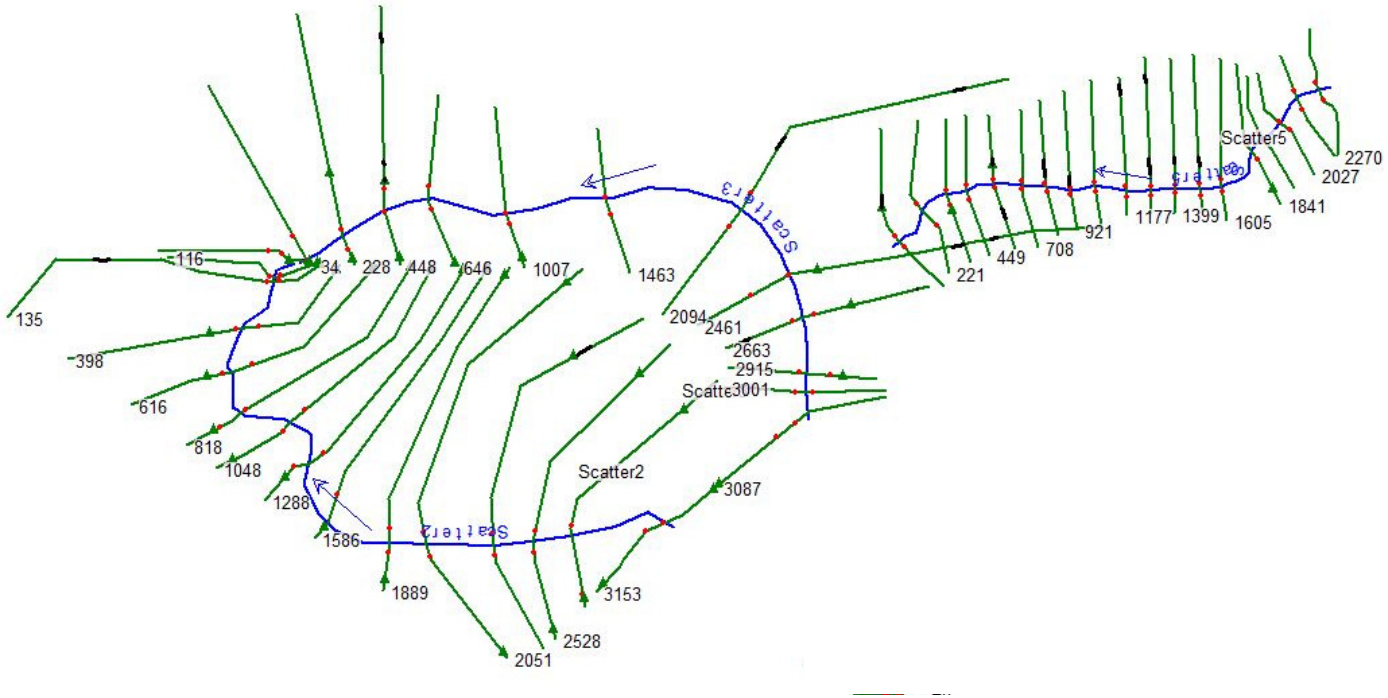
One-Dimensional Modeling

* 1-Dimensional Flow Paths
* 1-Dimensional Cross-Sections



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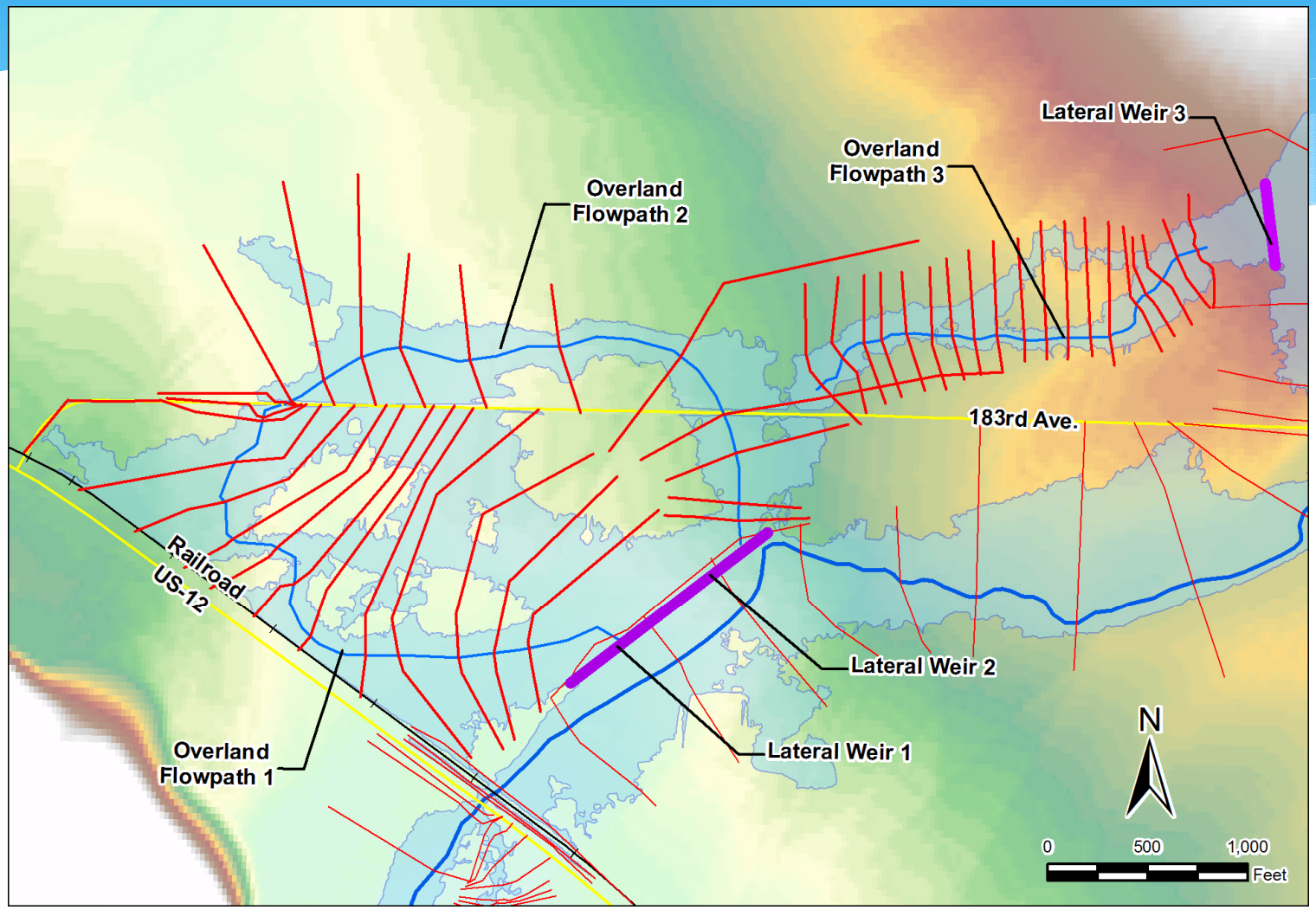
One-Dimensional Modeling



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Two-Dimensional Analysis

* Use new HEC-RAS 5.0 functionality
* Two-Dimensional Grid
* Modeling Overland/Overflow Flow Area
* Connect 1-D to 2-D Area with Lateral Weir
* Convert from Steady-State to Unsteady-State Model

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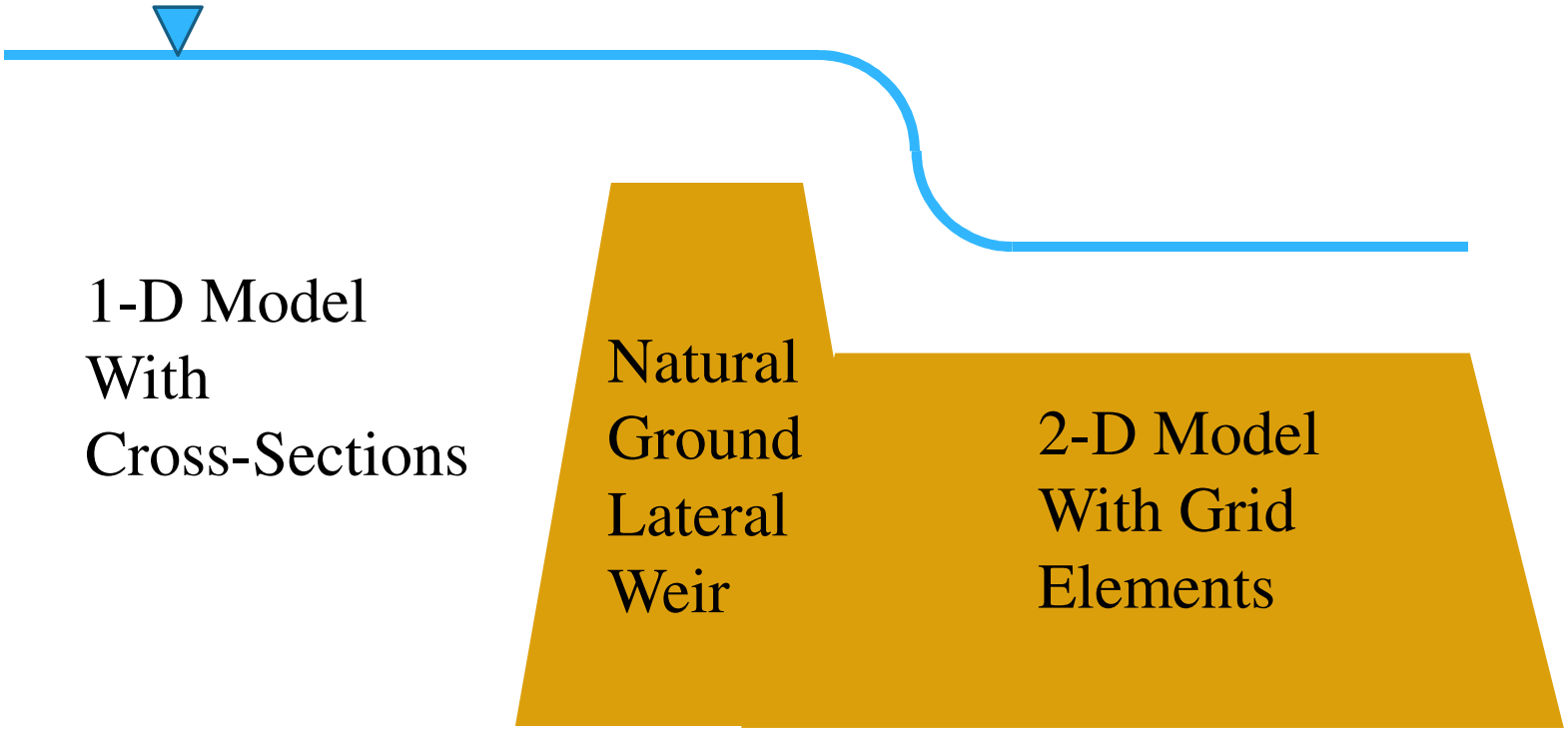
Lateral Weir

* Lateral Weir Connection



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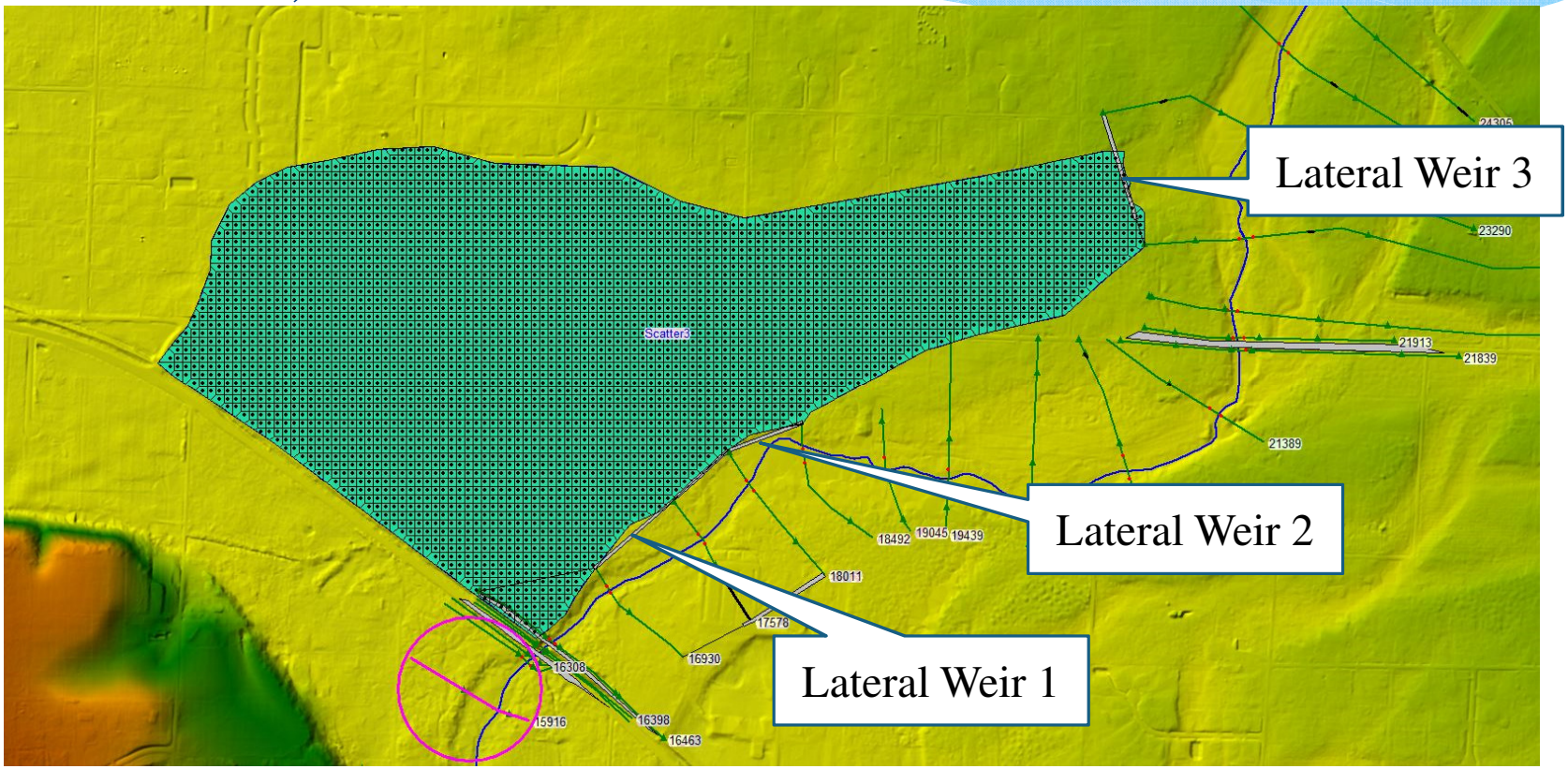
Two-Dimensional Grid

* 2-D Grid, 50 ft x 50 ft cells.



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Tips and Tricks

* Need good LiDAR
* Need a stable unsteady state model
* Run differing grid sizes
* Use break lines to form the mesh
* Run with Diffusion Wave equations first, then switch to full Saint Venant equations

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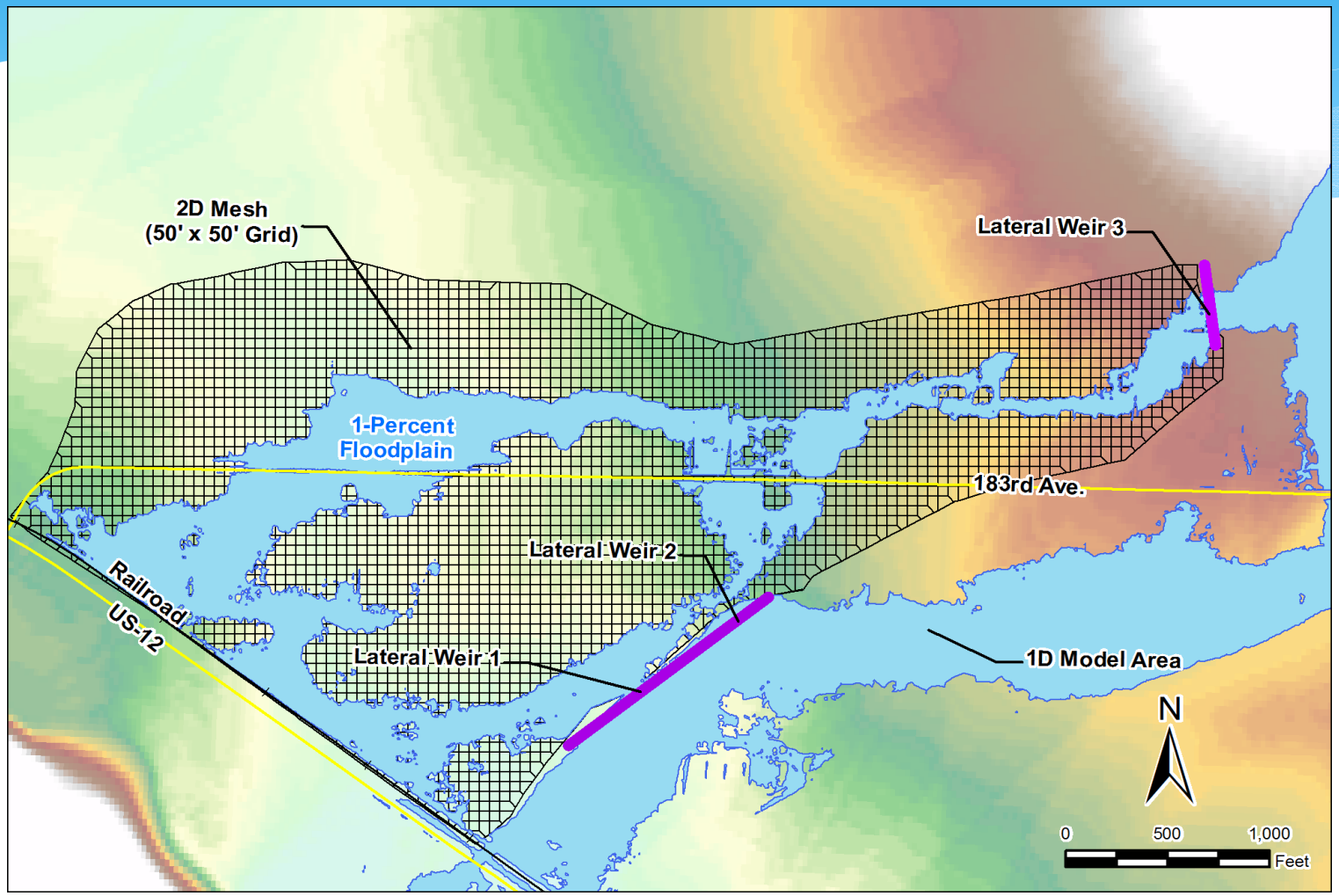
Two-Dimensional Results



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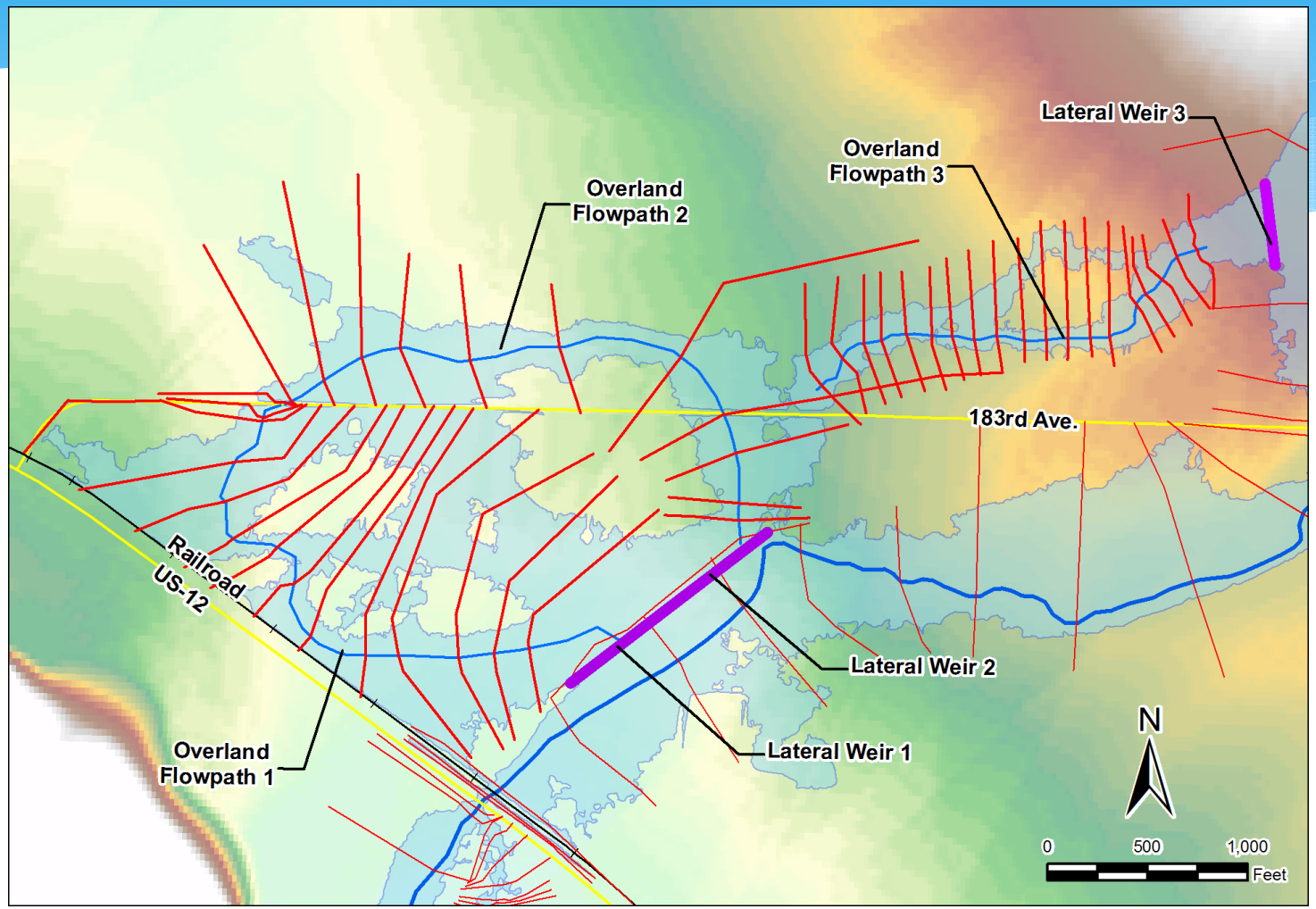
One-Dimensional Results



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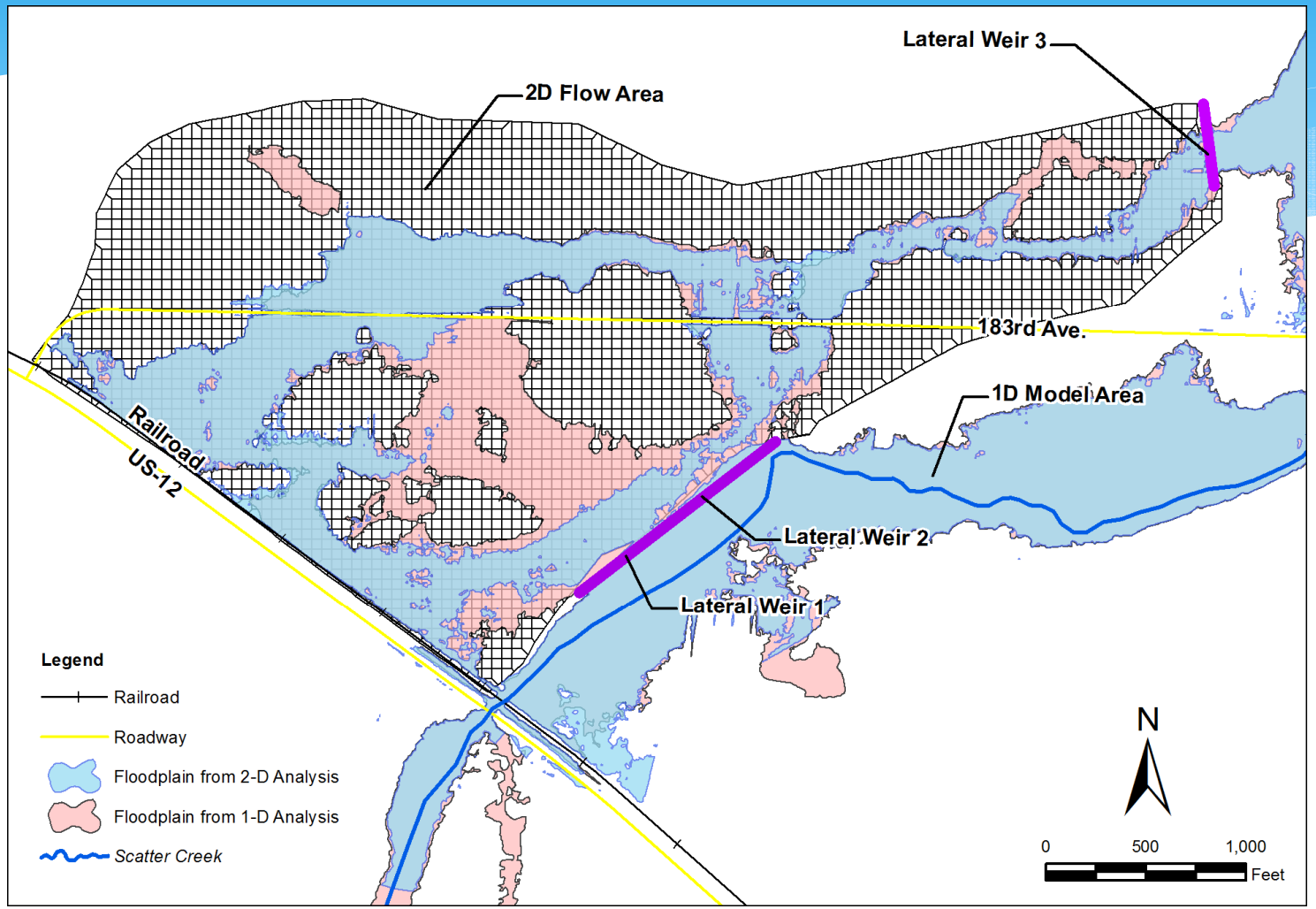
Comparison of 1-Percent Floodplains



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Summary

* 2-D HEC-RAS models are very useful for areas with overland flow, combined flows and storage areas
* Combined 1-D and 2-D capabilities allow for quick conversion of existing 1-D models
* Provide reasonable results with less trial and error
* Time saving and cost effective

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Questions?

Bryan Close, PE CFM
Stantec Consulting
(bryan.close@stantec.com)
(240) 542-3124

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