

HEC-RAS Mapper Results Visualization

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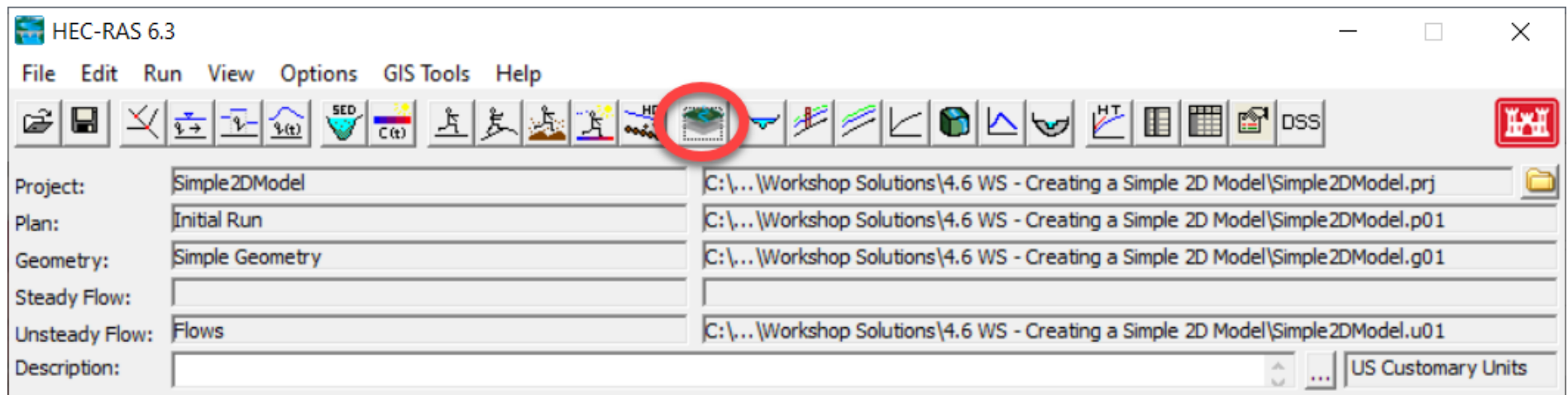
USACE, Institute for Water Resources, Hydrologic Engineering Center





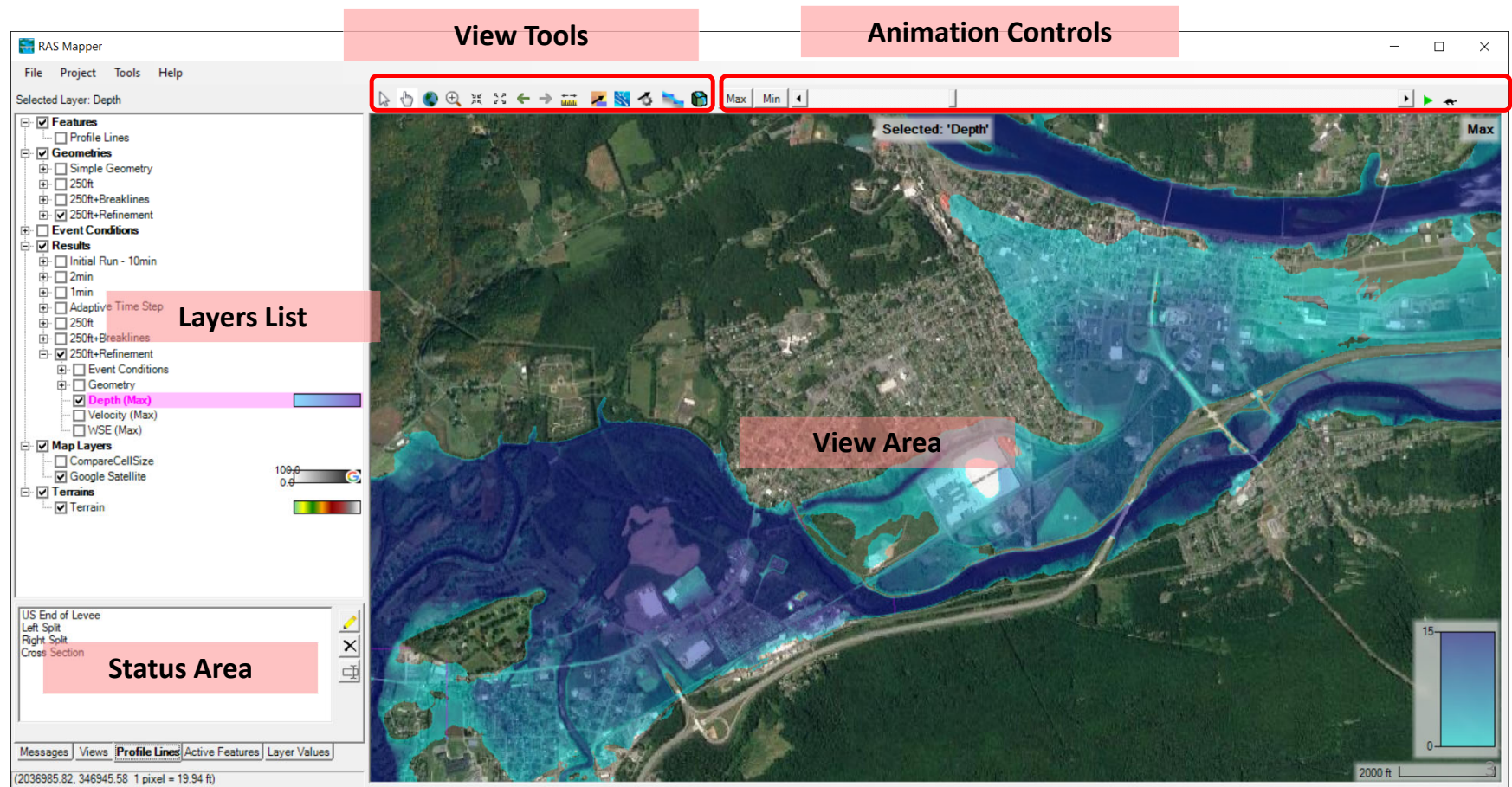
Overview

- How do we visualize RAS results?
- How do we debug our model?
- How do we compare different plans?





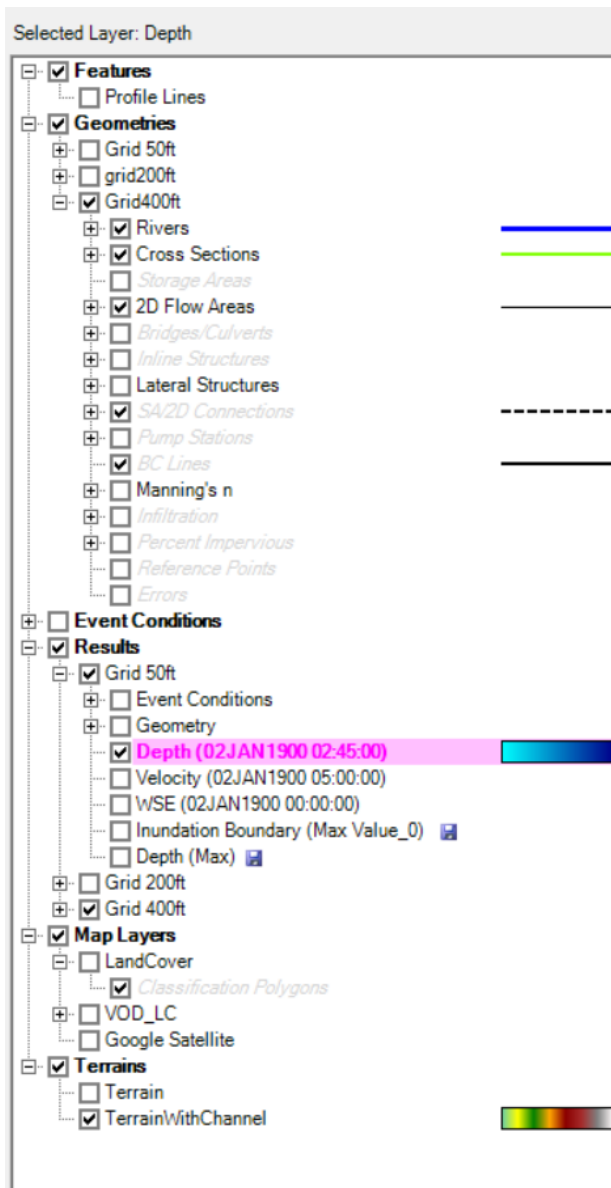
HEC-RAS Mapper





Layers List

- Profile Lines
- Geometries
- Results
- Map Layers
- Terrains



← Symbology is shown to the right of any checked layers.

← The selected layer is highlighted in magenta.



Status Area

- Messages – What just happened
- View – Quickly zoom to predefined areas
- Profile Lines – Access results at specific locations
- Active Features – Quick access to features in layer
- Layer Values – Watch values for multiple results

Geometry 'Imported GIS Data +Bridges' association was set to the one terrain available (Terrain)
XS Interpolation Surfaces generated in 167 ms

Airport
Confluence
WWTP
Santa Fe Ave Bridge

US End of Levee
Left Split
Right Split
Cross Section

15696.24
15485.51
15370.43
15205.20

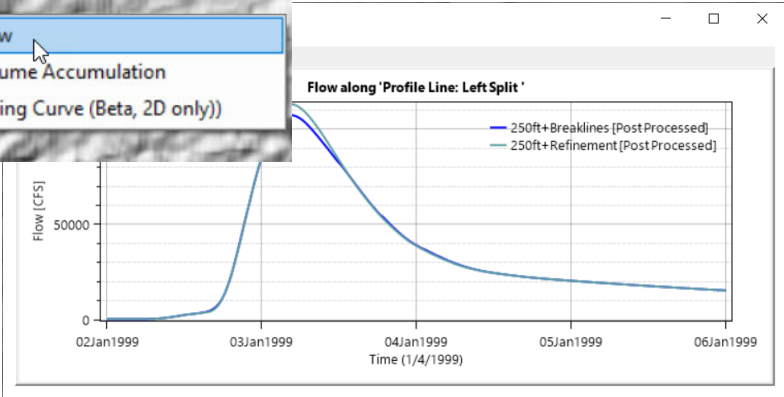
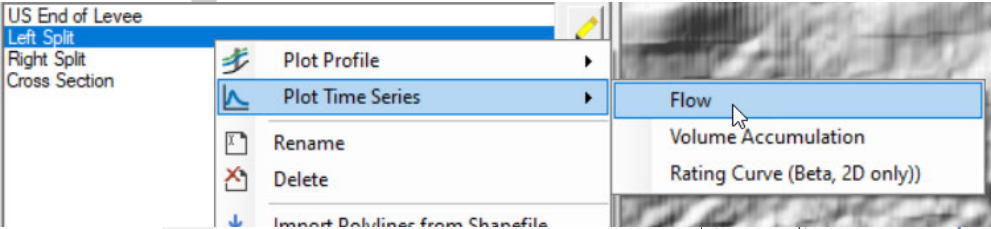
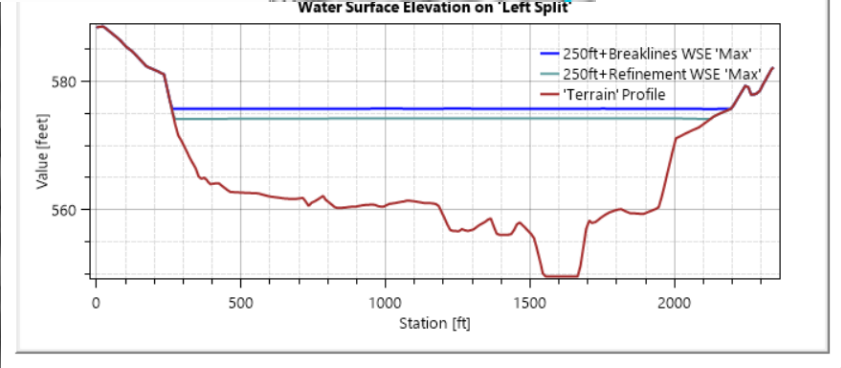
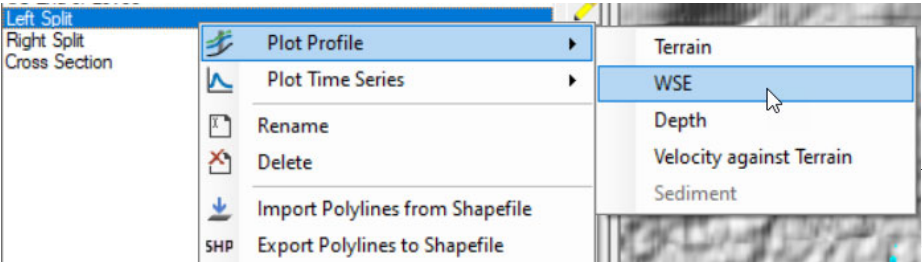
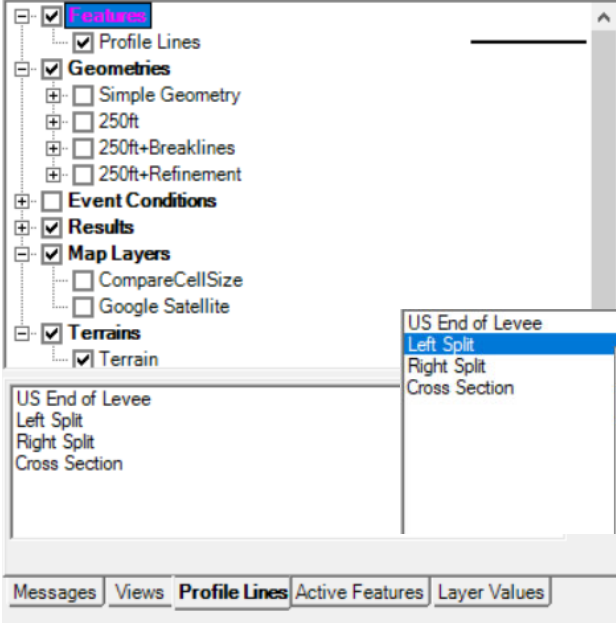
Use	Name	ID	Value
<input checked="" type="checkbox"/>	Velocity (250ft+Refinement)	vR	1.51
<input checked="" type="checkbox"/>	Velocity (250ft+Breaklines)	vBL	1.40
<input checked="" type="checkbox"/>	WSE (250ft+Refinement)	wR	573.71
<input checked="" type="checkbox"/>	WSE (250ft+Breaklines)	wBL	575.43

Messages Views Profile Lines Active Features **Layer Values**



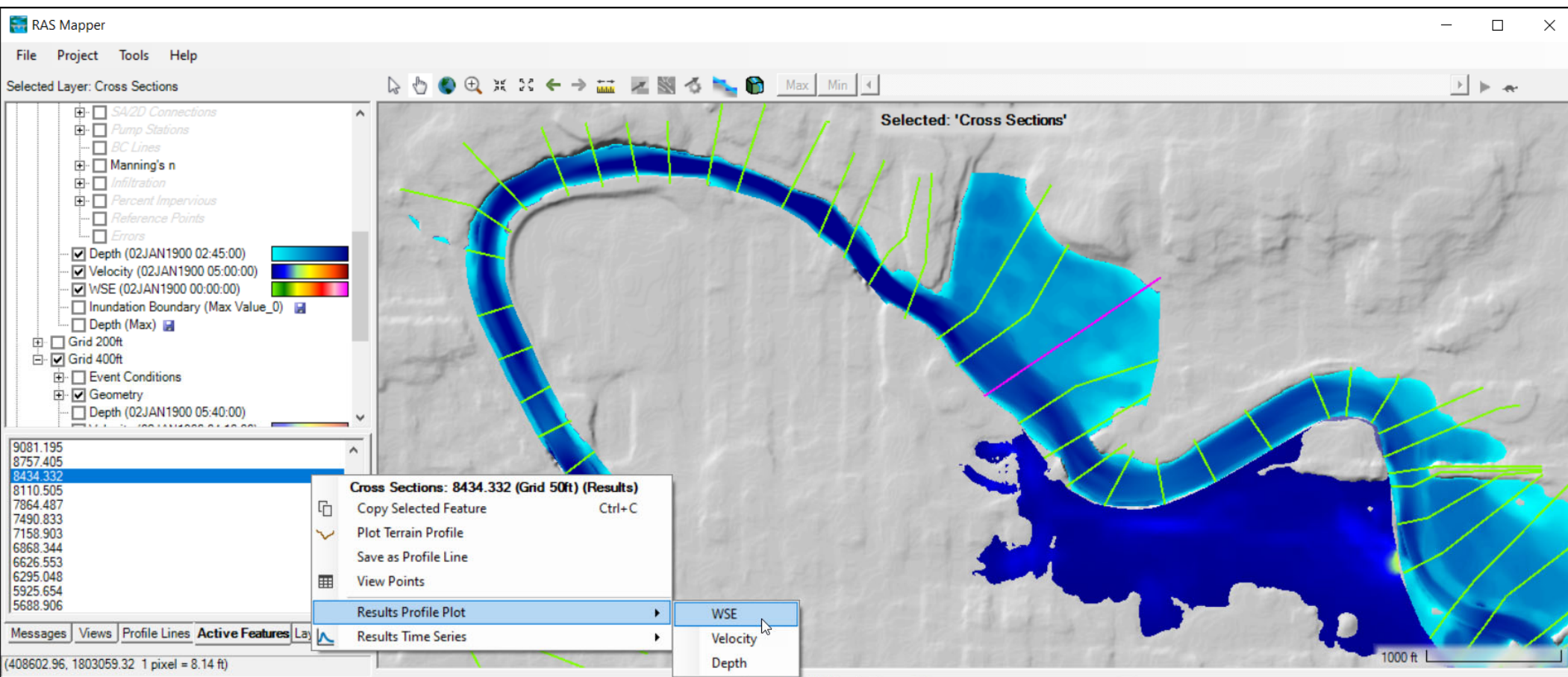
Profile Lines

- User-defined/editable features



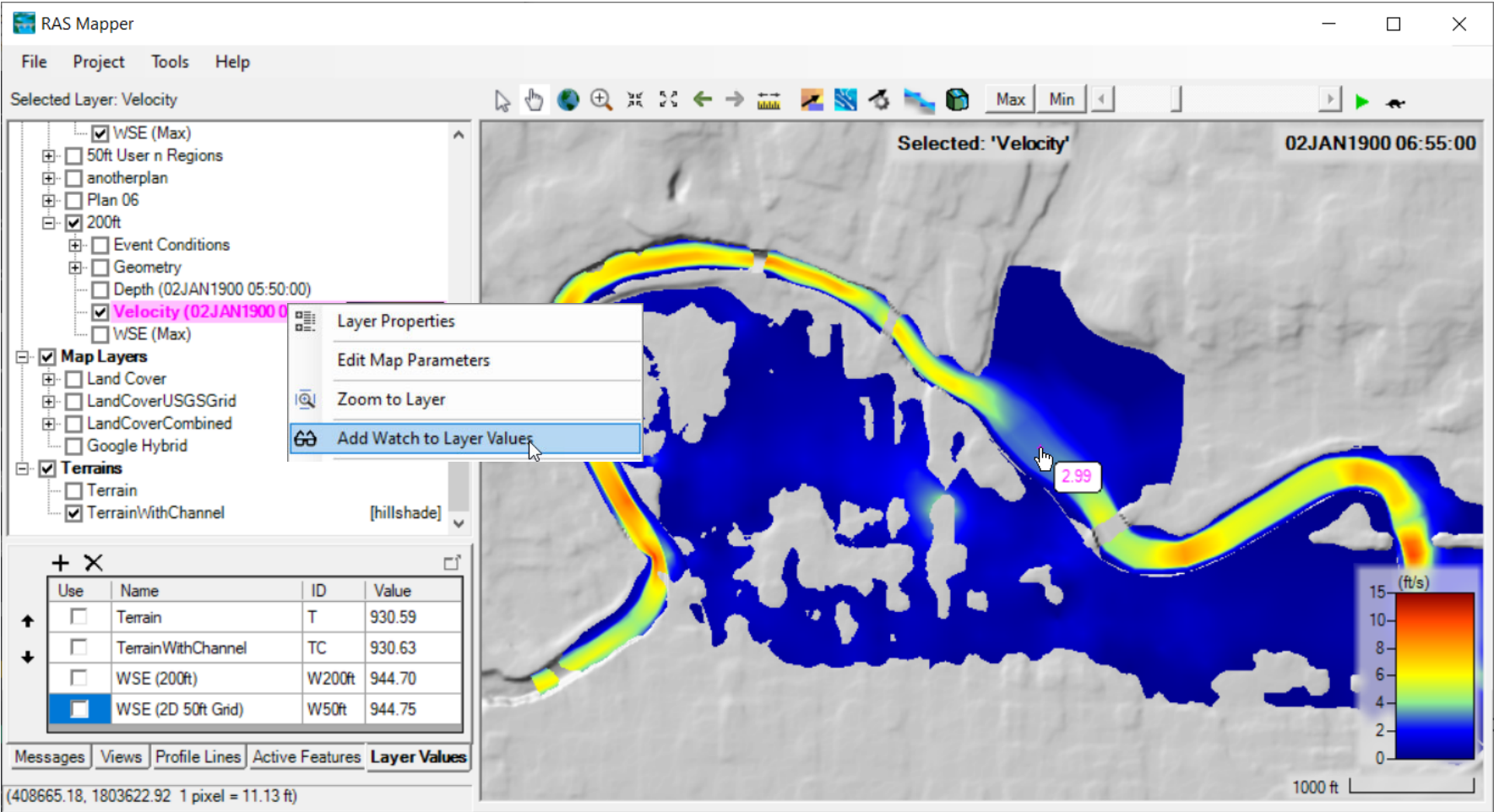


Active Features



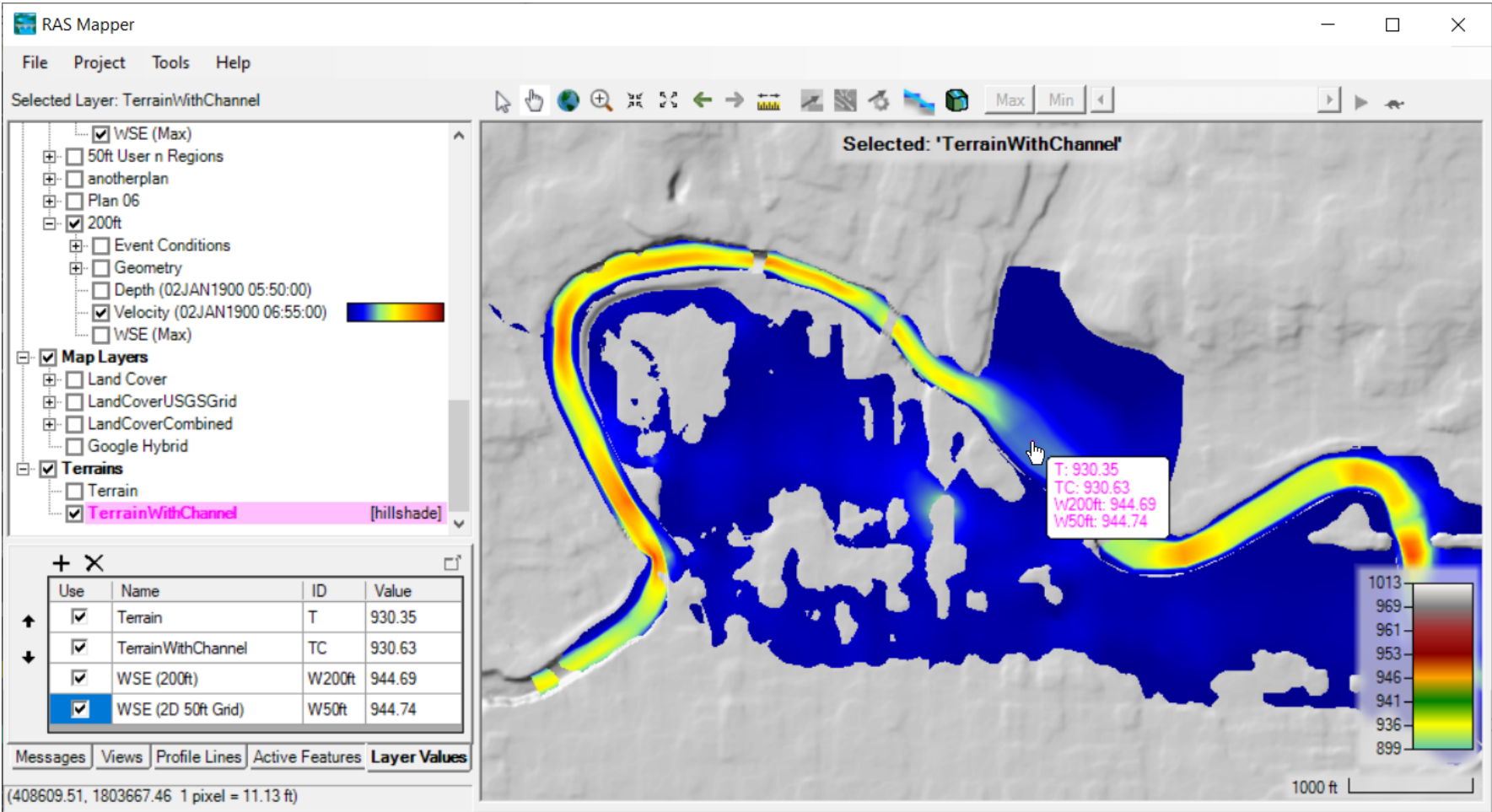


Watch Layers List



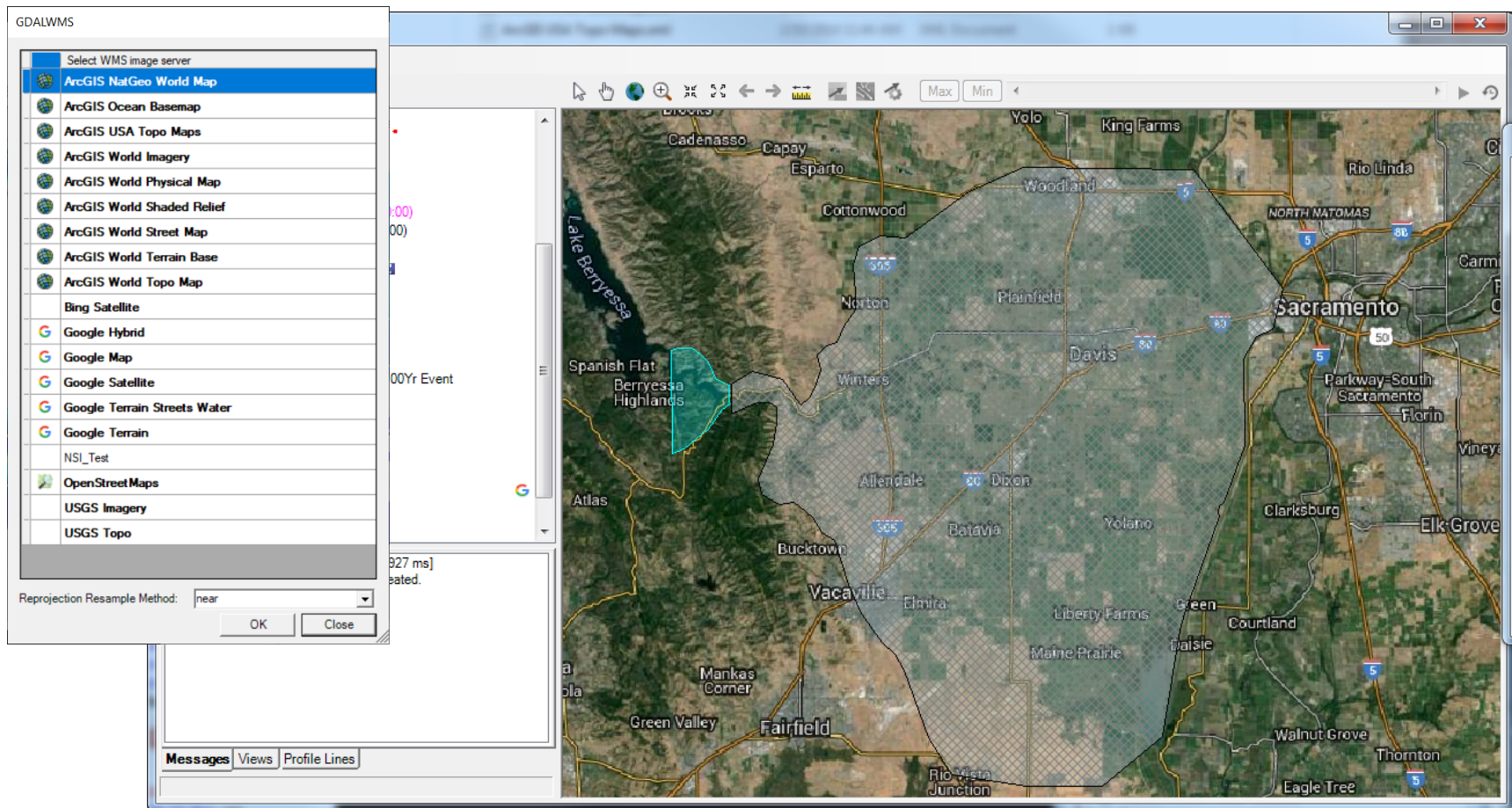


Watch Layers List





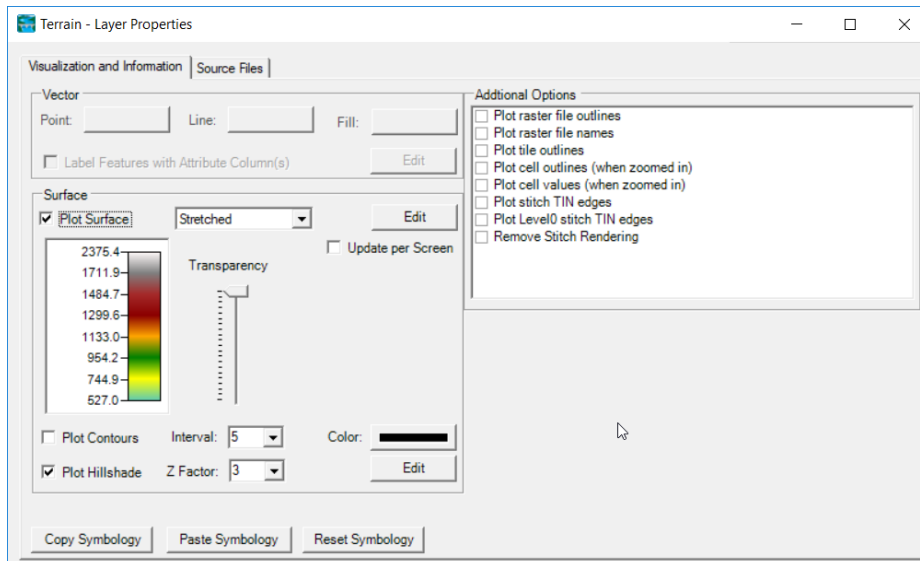
Web Imagery



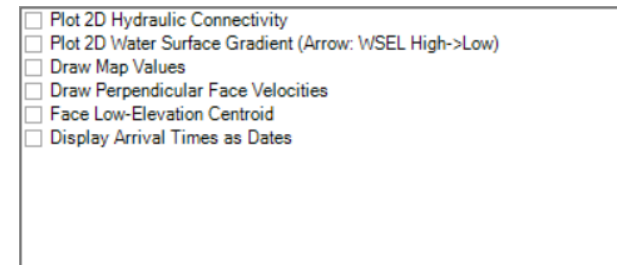


Plot Options – Layer Specific!

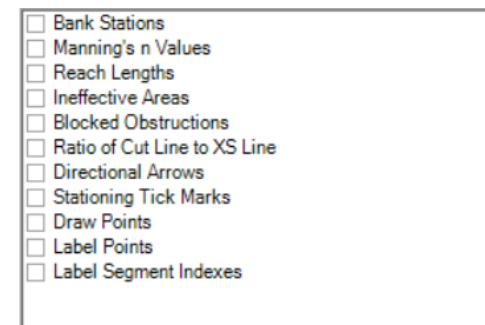
- Terrain



- Depth, WSE



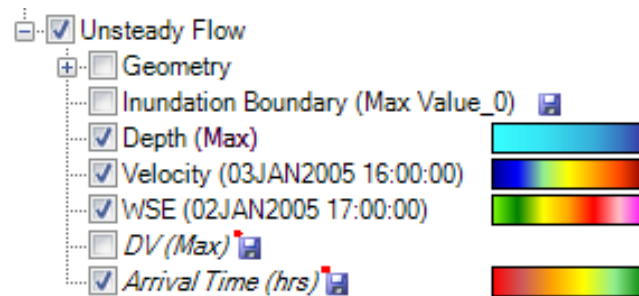
- River, Cross Sections





Results Mapping

- Dynamic Mapping – on-the-fly mapping
 - Animation of results without waiting



- Stored Maps – results written to file

* = *There was a problem reading data*



Results Mapping

Map Type | Profile/Parameter | Mode

Results Map Parameters

Map Type

Hydraulics

Water Surface Elevation

Velocity

Flow (1D Only)

Inundation Boundary

Depth

Courant (Velocity/Length)

Courant (Residence Time, 2D Only)

Froude

Shear Stress

Depth * Velocity

Depth * Velocity^2

Energy (Depth)

Energy (Elevation)

Arrival Time

Arrival Time (Max)

Recession

Duration

Parameters

Start Time at: 02JAN1900 00:00:00

☒ Start of simulation

☐ Offset from start of simulation

d

h

m

☐ Fixed date/time (08JUL1995 17:00:00)

Unsteady Profile

☒ Hours

☐ Days

Parameters

Threshold Depth:

Map Output Mode

Generated for Current View (in memory)

☒ Raster (with Associated Terrain)

☐ Point Feature Layer:

Stored (saved to disk)

☐ Raster based on Terrain:

TerrainWithChannel

☐ Point Feature Layer:

☐ Polygon Boundary at Value:

0

Map Type	Layer Name
Arrival Time	Arrival Time

Add Map

Close

Map Type: A Map layer will be created for The time (from a specified Start Time) for water to reach a specified flood depth.

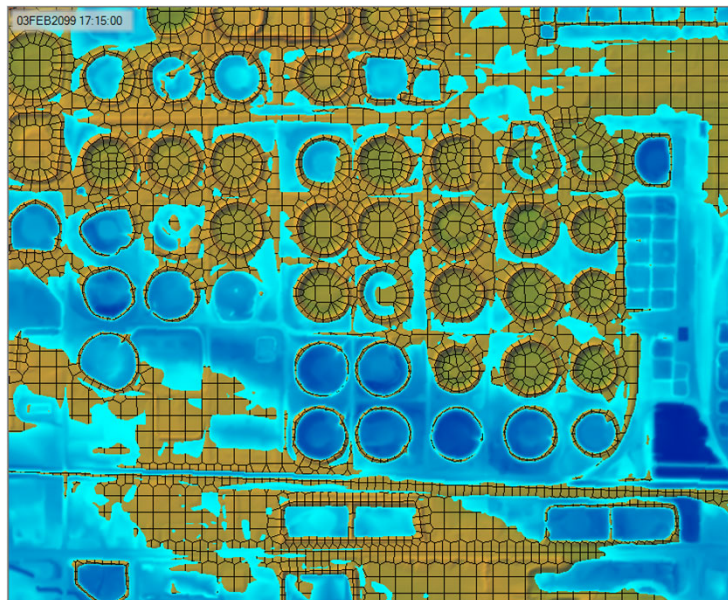
Map Mode: Map results are generated on-the-fly for the current view.

Default maps: Depth, Water Surface Elevation, Velocity

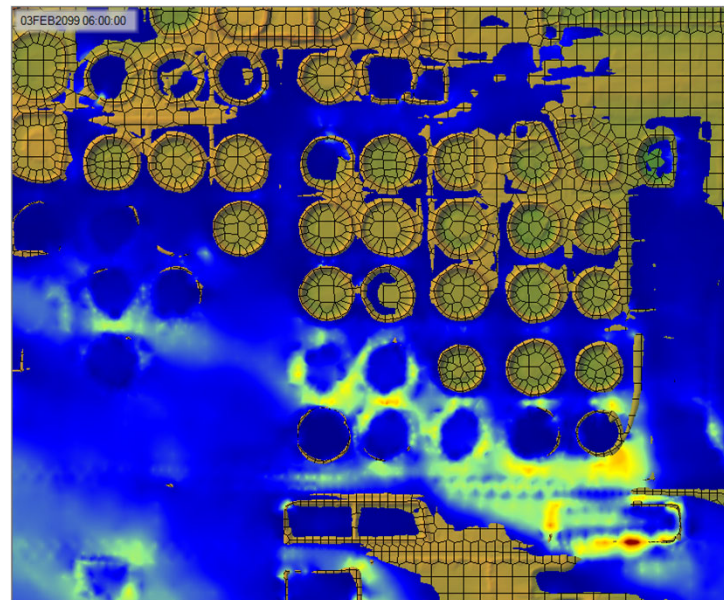


Example Maps

- Depth

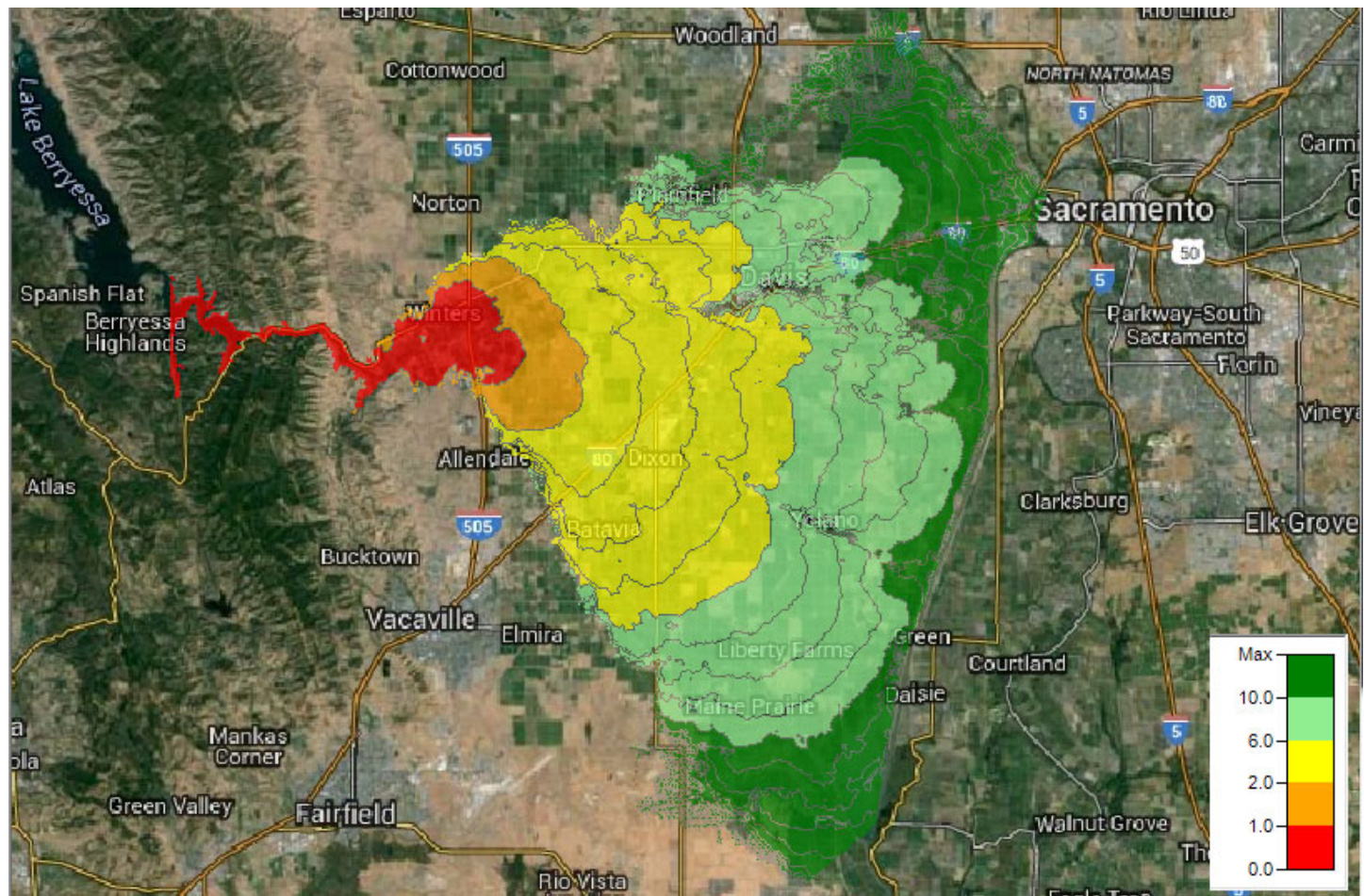


- Velocity



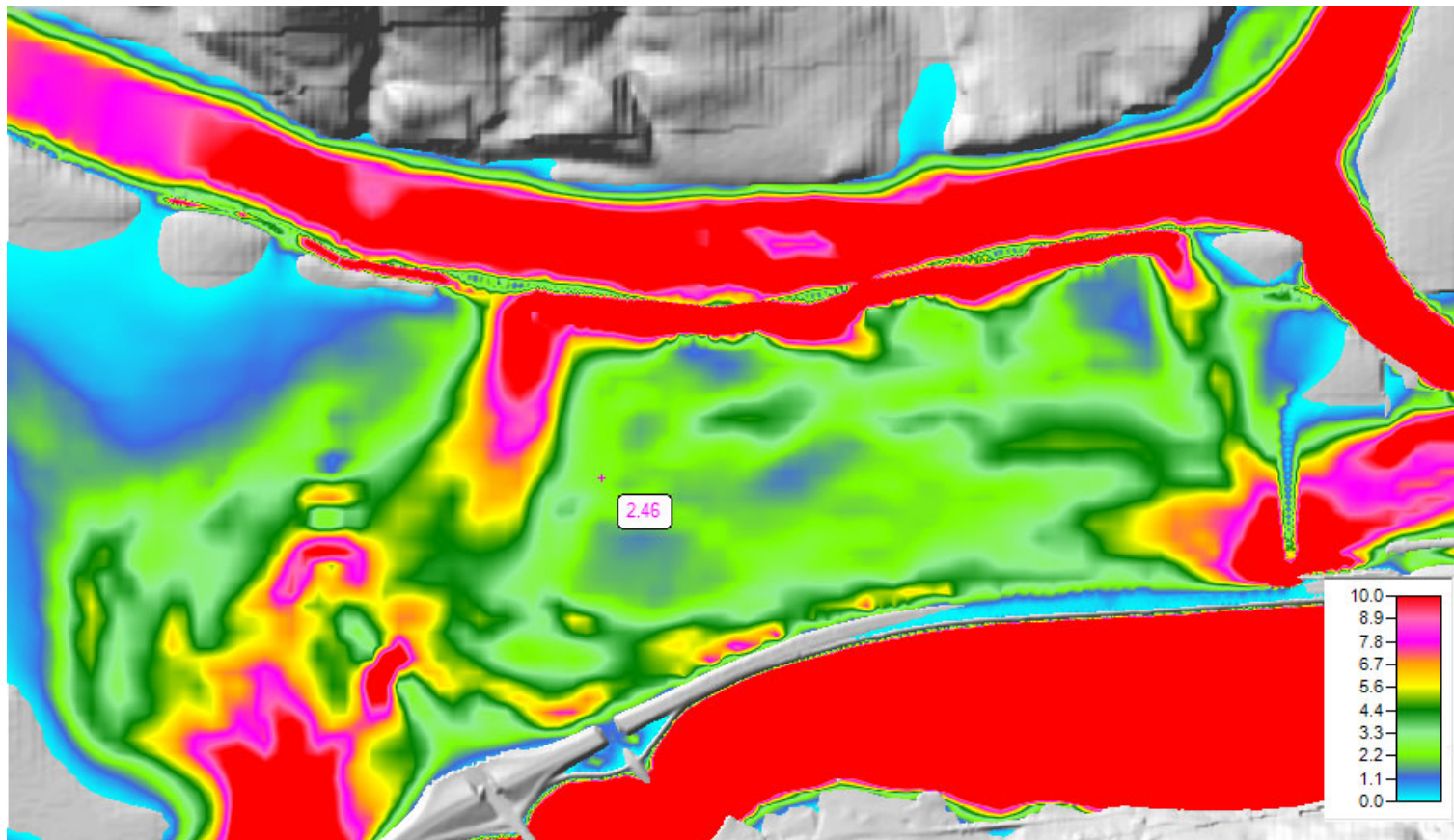


Arrival Time



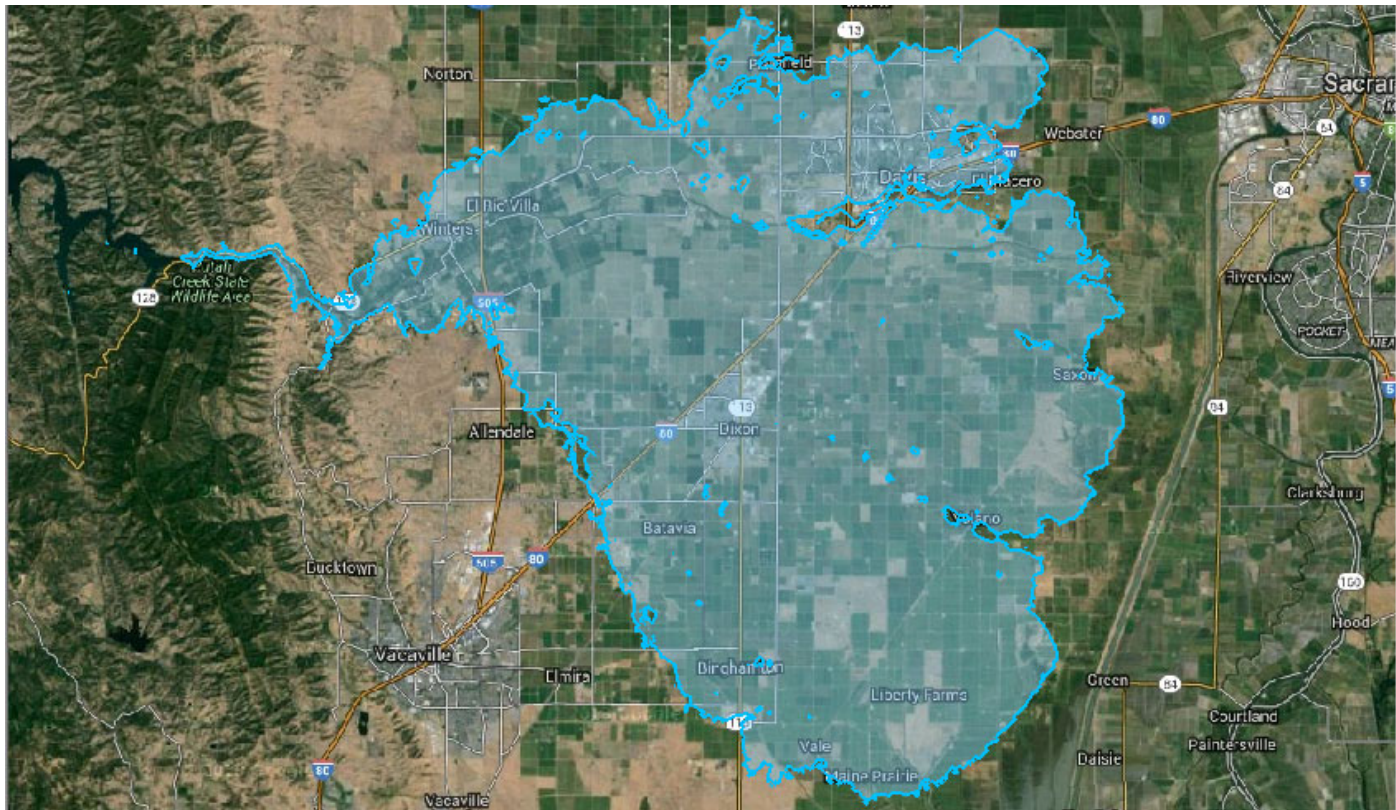


Hazard Mapping



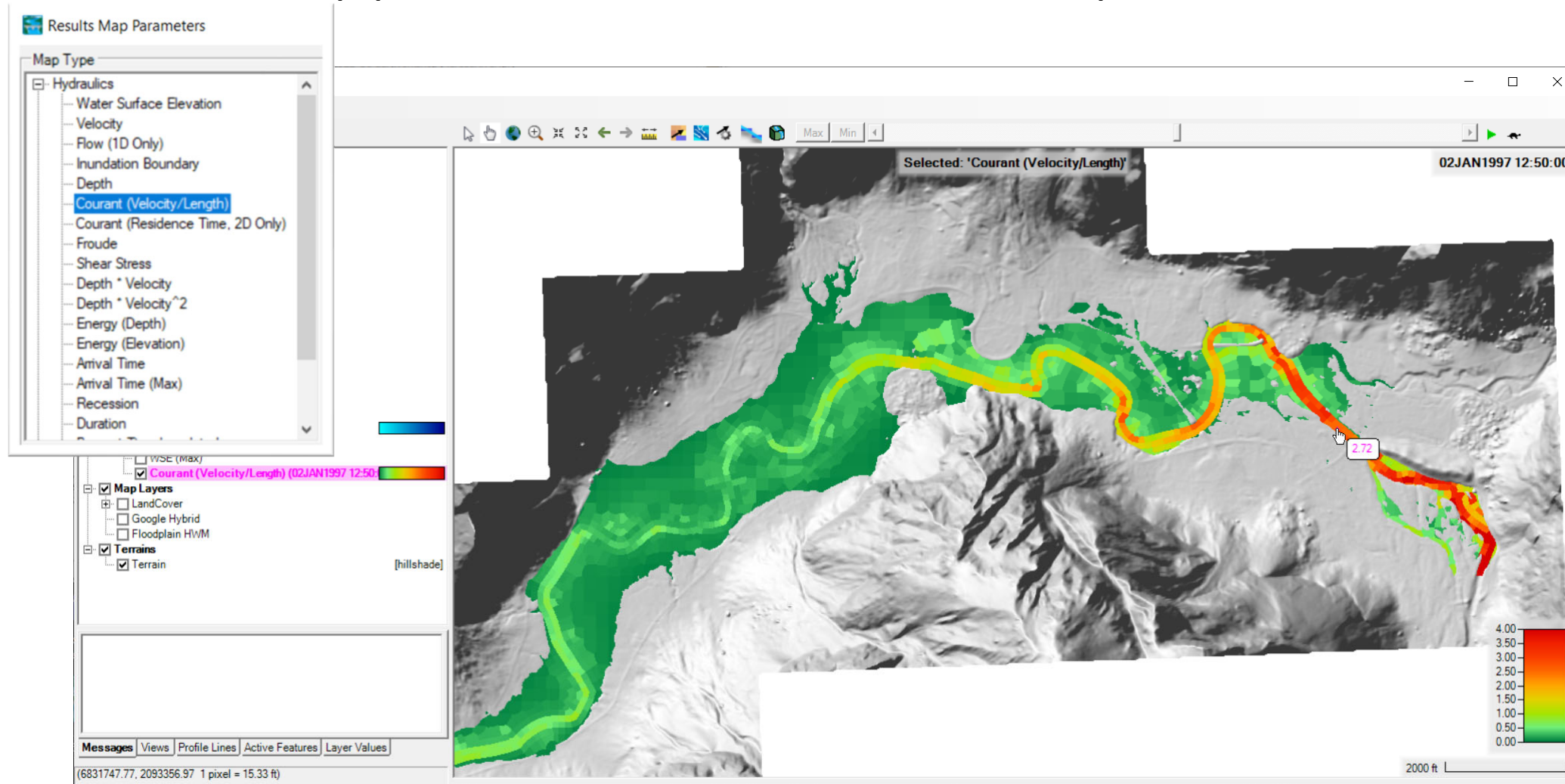


Inundation Boundary





RAS Mapper Courant Number Map



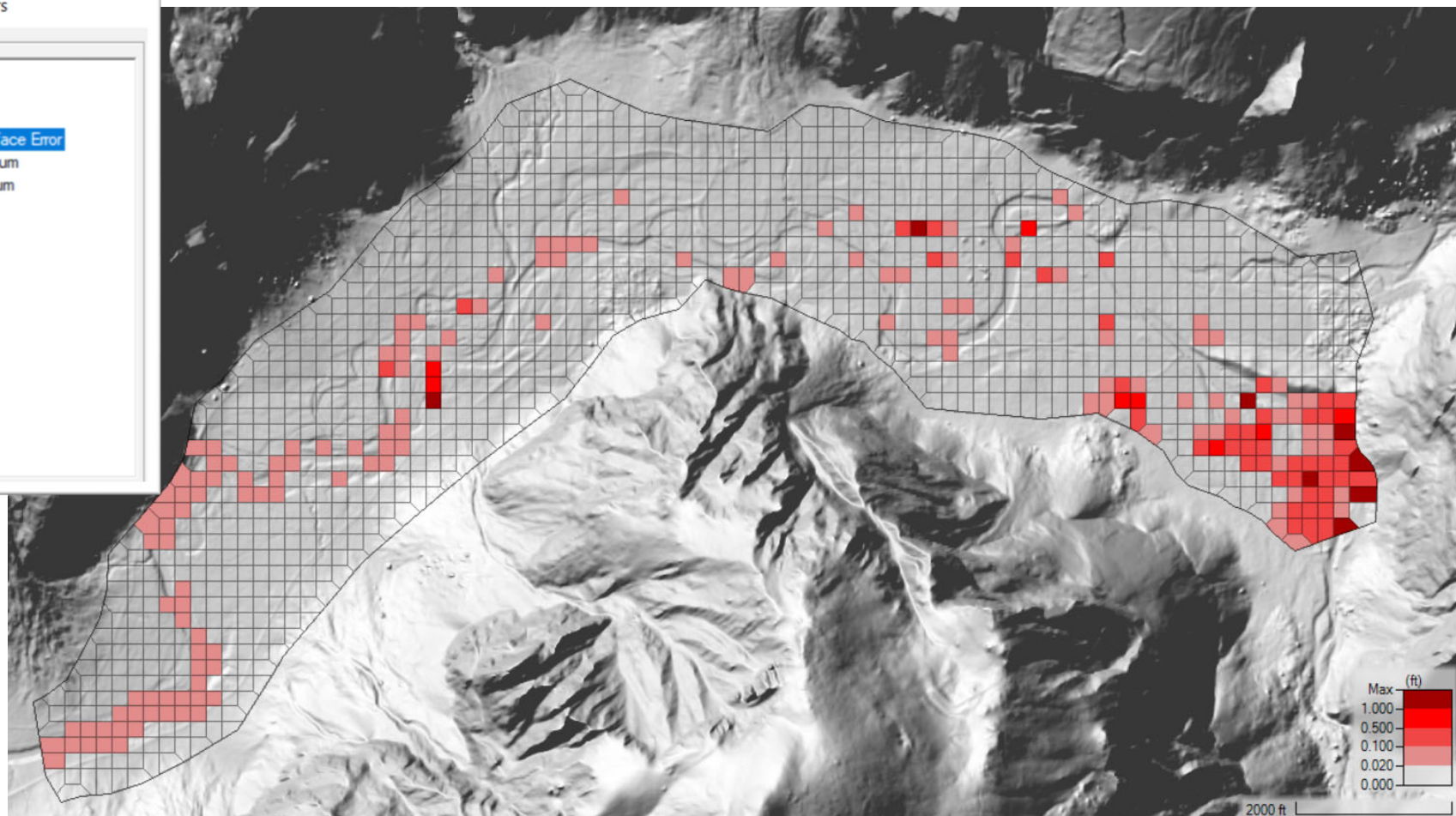


Maximum Water Surface Error

Results Map Parameters

Map Type

- Hydraulics
- Additional 2D Variables
 - Cumulative Iteration
 - Maximum Water Surface Error
 - Face Velocity Maximum
 - Face Velocity Minimum





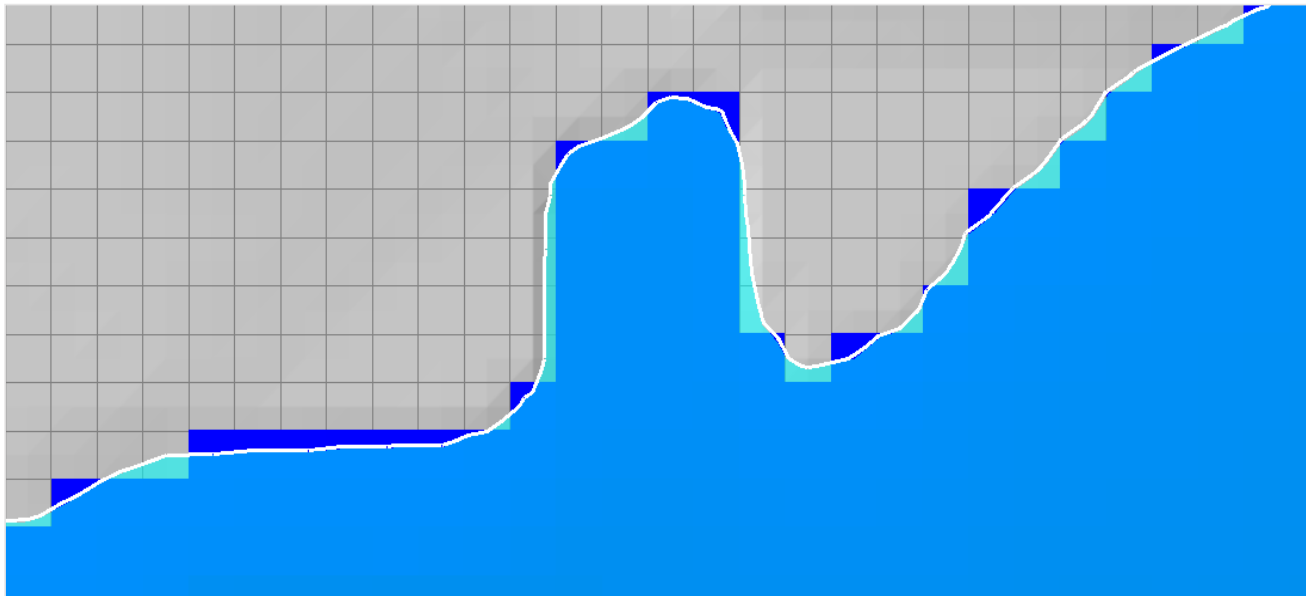
Map Types – Dynamic vs Stored

- Dynamic: Computed on-the-fly
 - Smooth: Computes to screen-resolution
 - Doesn't use disk space
- Stored: Computed to terrain resolution
 - Stored to disk
 - Faster rendering for slow map types



Dynamic vs Stored Results

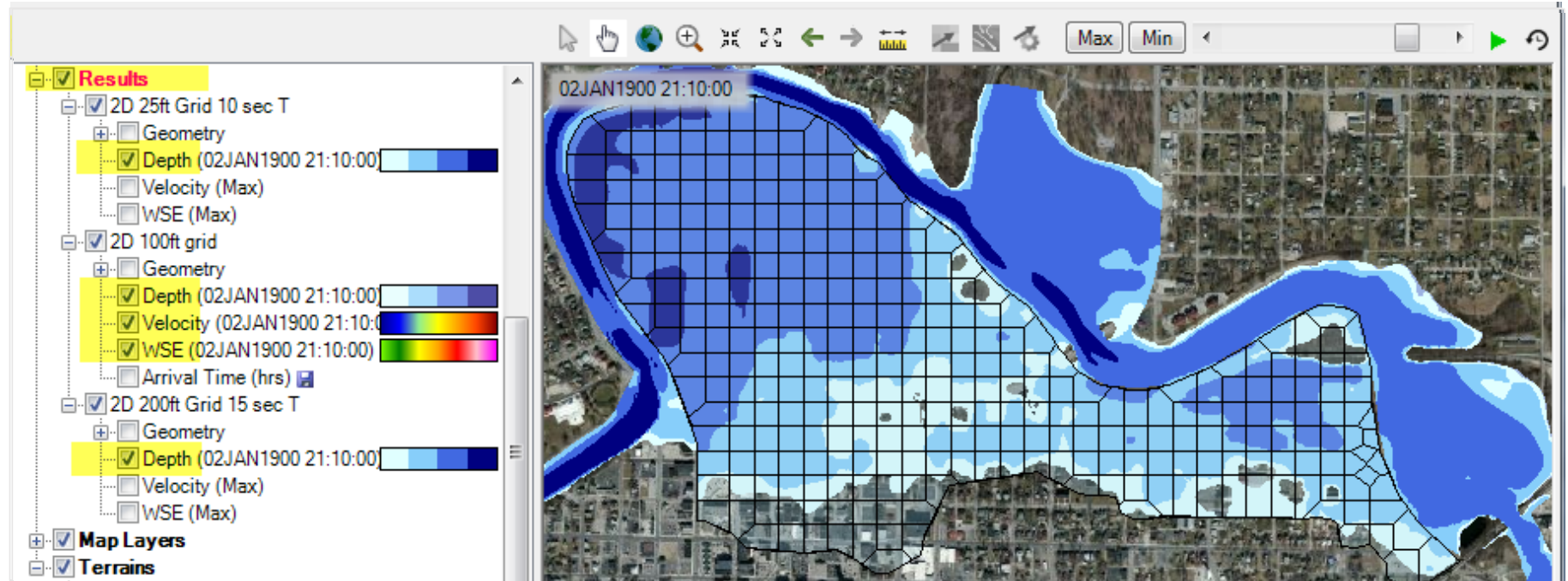
- Dynamic results plot values for the current pyramid level. Boundaries are defined based on interpolation.
- Stored results have a single value per cell.





Dynamic Mapping

- Animation Toolbar – works on selected layer/group and syncs the timestep





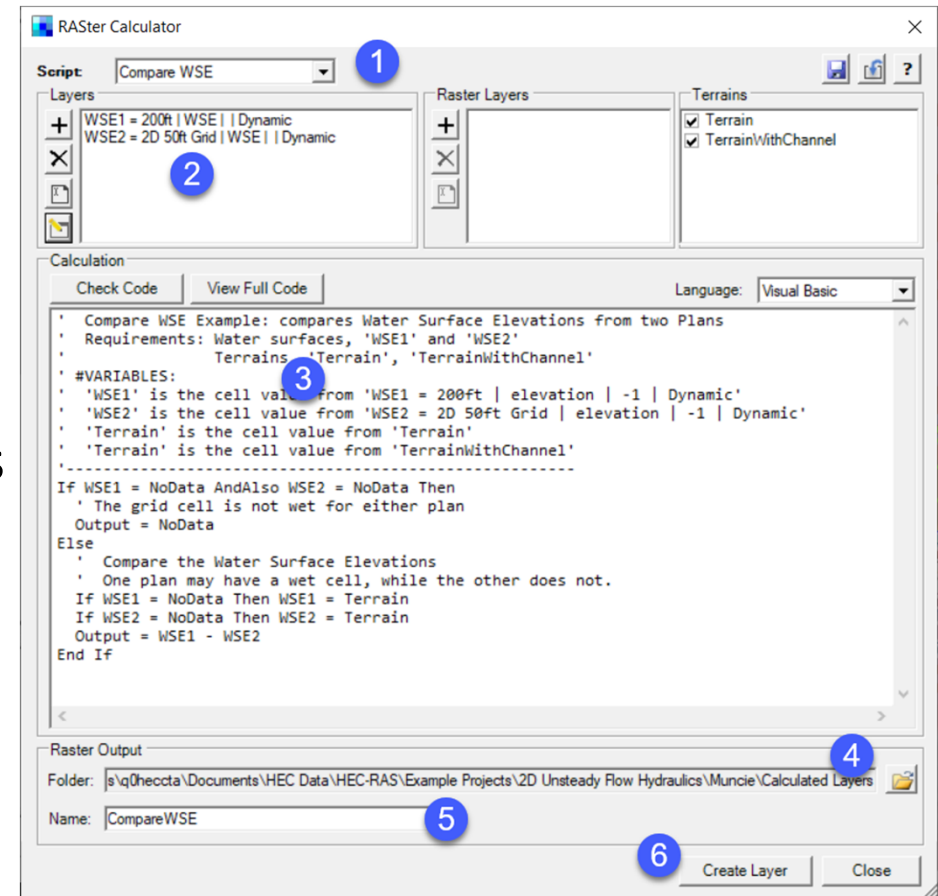
Dynamic Mapping - Animation





Calculated Layer

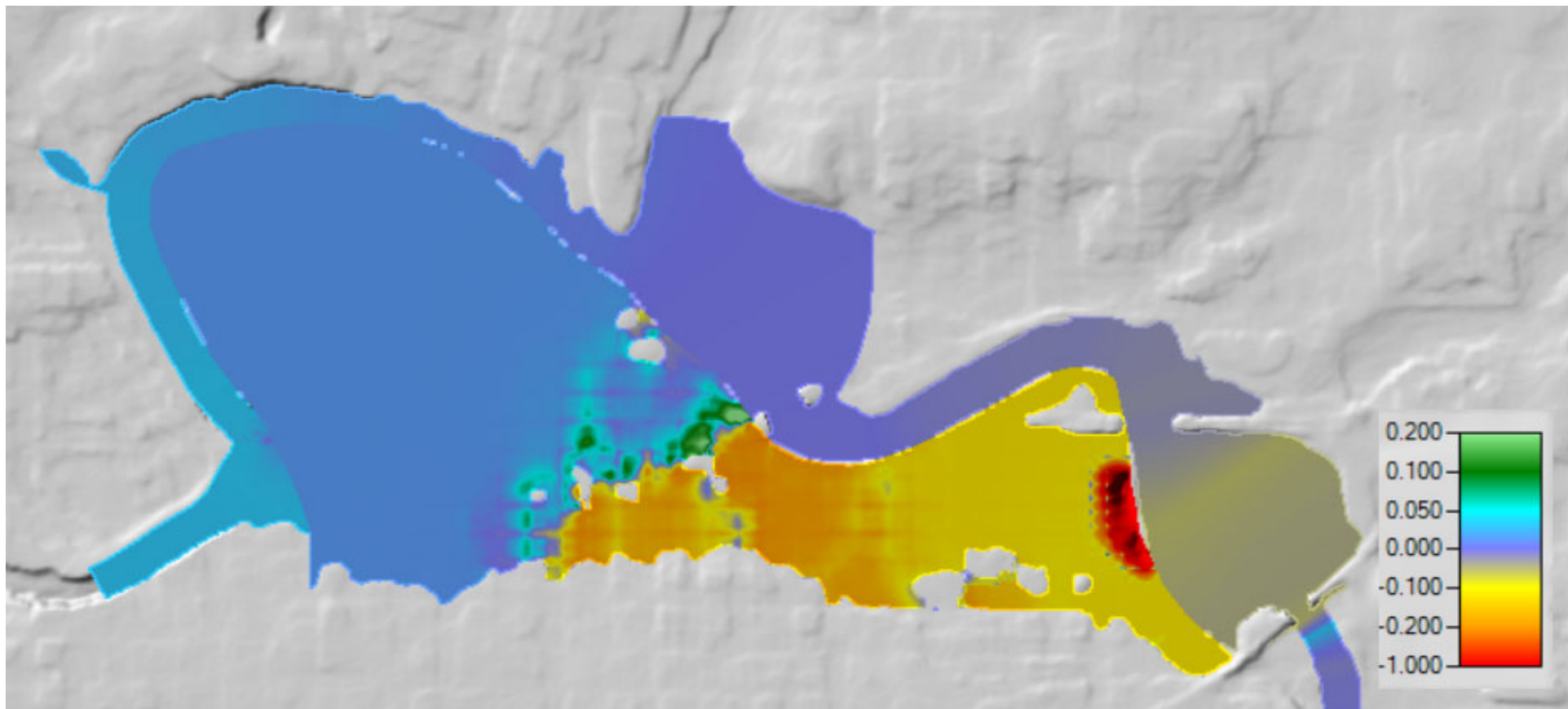
- RASter Calculator
- Custom scripting code to use multiple results
- Works with RAS Results and Terrains
- Works with Rasters on disk





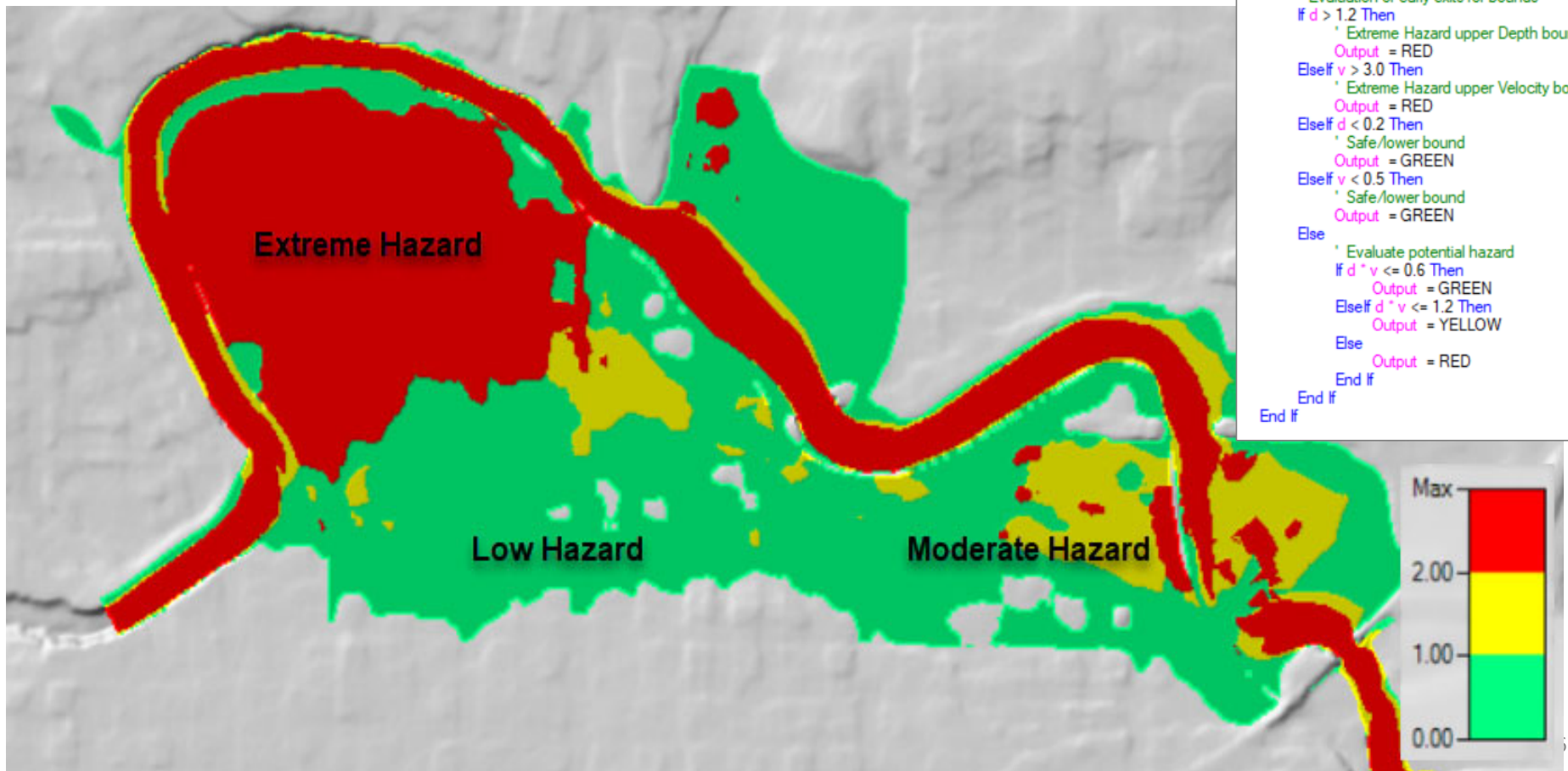
Water Surface Comparison

WSE_Mesh200ft - WSE_Mesh50ft





Hazard Evaluation



```
Const GREEN as Single = 0
Const YELLOW as Single = 1
Const RED as Single = 2

If d = NoData OrElse v = NoData Then
    Output = NoData
Else
    ' Conversion to metric assuming input variables are in feet
    d = d * 0.3048
    v = v * 0.3048
    ' Evaluation of early exits for bounds
    If d > 1.2 Then
        ' Extreme Hazard upper Depth bound
        Output = RED
    ElseIf v > 3.0 Then
        ' Extreme Hazard upper Velocity bound
        Output = RED
    ElseIf d < 0.2 Then
        ' Safe/lower bound
        Output = GREEN
    ElseIf v < 0.5 Then
        ' Safe/lower bound
        Output = GREEN
    Else
        ' Evaluate potential hazard
        If d * v <= 0.6 Then
            Output = GREEN
        ElseIf d * v <= 1.2 Then
            Output = YELLOW
        Else
            Output = RED
        End If
    End If
End If
```



Stored Maps

Manage Results Maps

View Result Maps for: All Plan Results

Compute/Update Stored Maps

Results and Maps	Store Status	
2D 25ft Grid 10 sec T		Add New Map
Depth (03JAN1900 00:00:00)	N/A	Edit Map
Velocity (Max)	N/A	Edit Map
WSE (Max)	N/A	Edit Map
2D 100ft grid		Add New Map
Depth (02JAN1900 21:10:00)	N/A	Edit Map
Velocity (02JAN1900 21:10:00)	N/A	Edit Map
WSE (02JAN1900 21:10:00)	N/A	Edit Map
Arrival Time (hrs)	Map files are out of date	Edit Map
2D 200ft Grid 15 sec T		Add New Map
Depth (02JAN1900 21:10:00)	N/A	Edit Map
Velocity (Max)	N/A	Edit Map
WSE (Max)	N/A	Edit Map
Arrival Time (2ft hrs)	Map not created	Edit Map

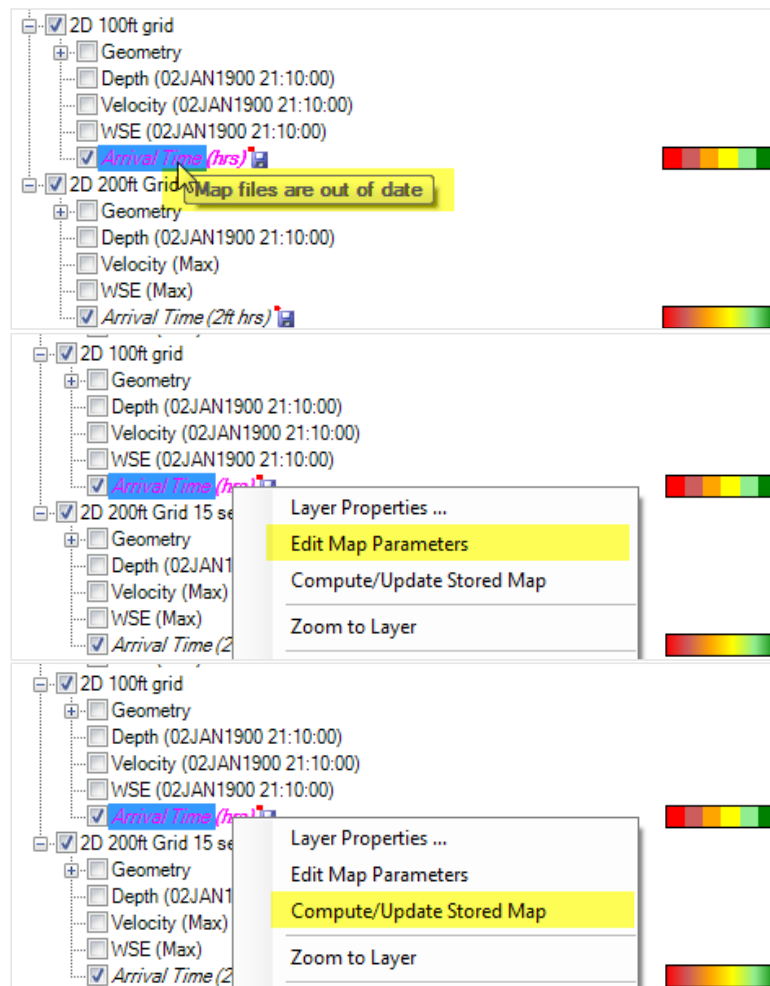


Stored Maps

- Map status message on cursor tool tip

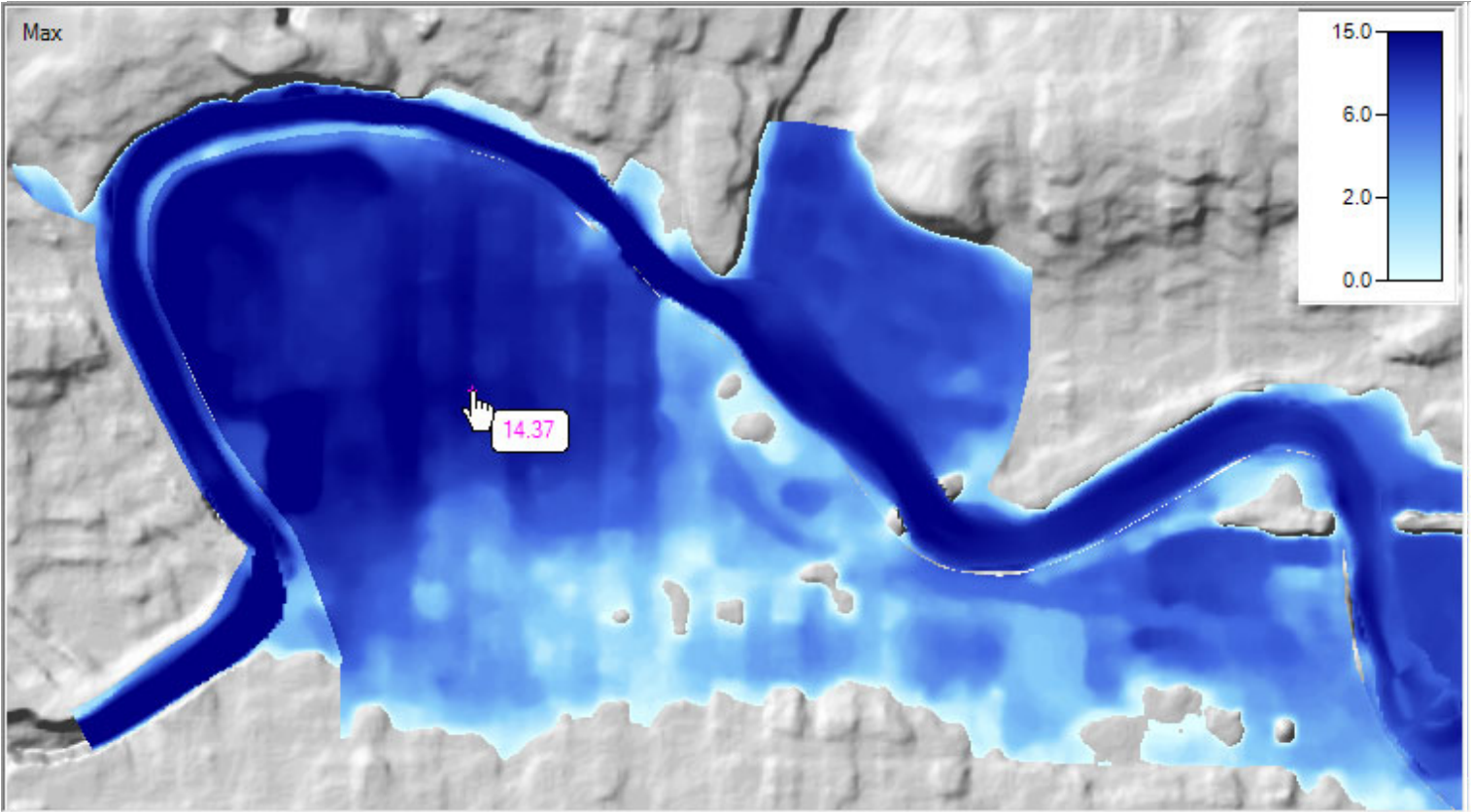
Right-click options:

- Edit Map Parameters
- Compute Map



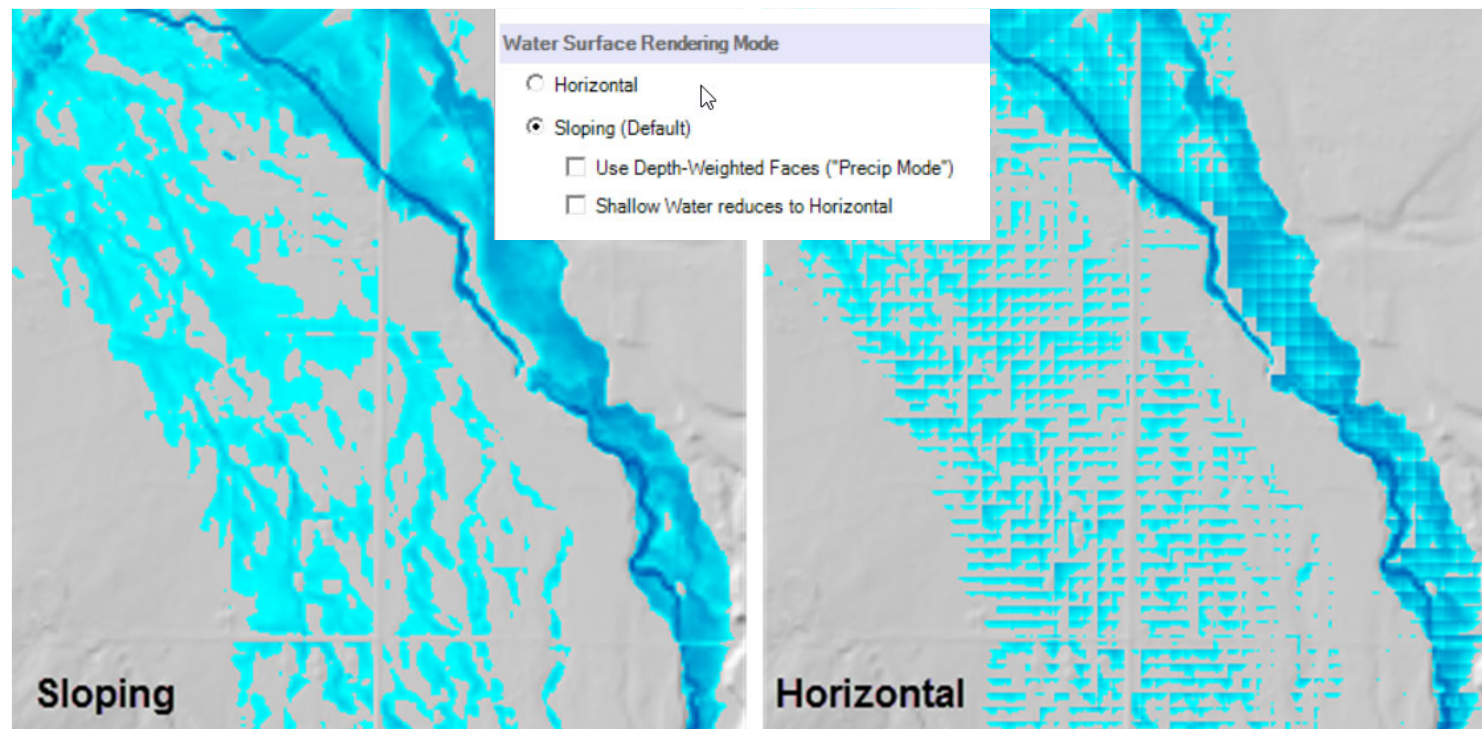


Results Visualization





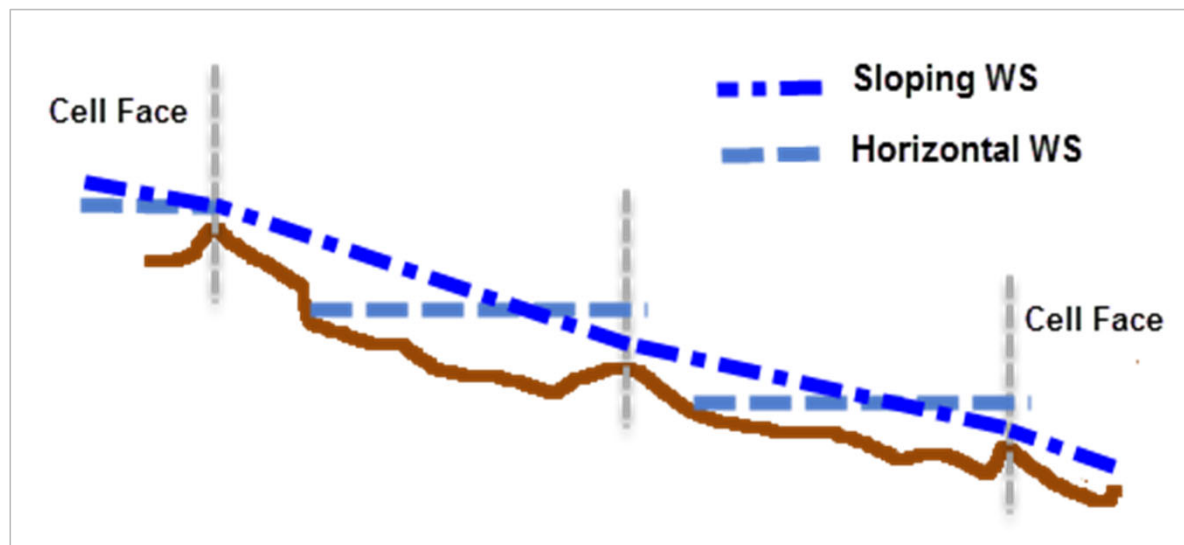
Render Mode Options





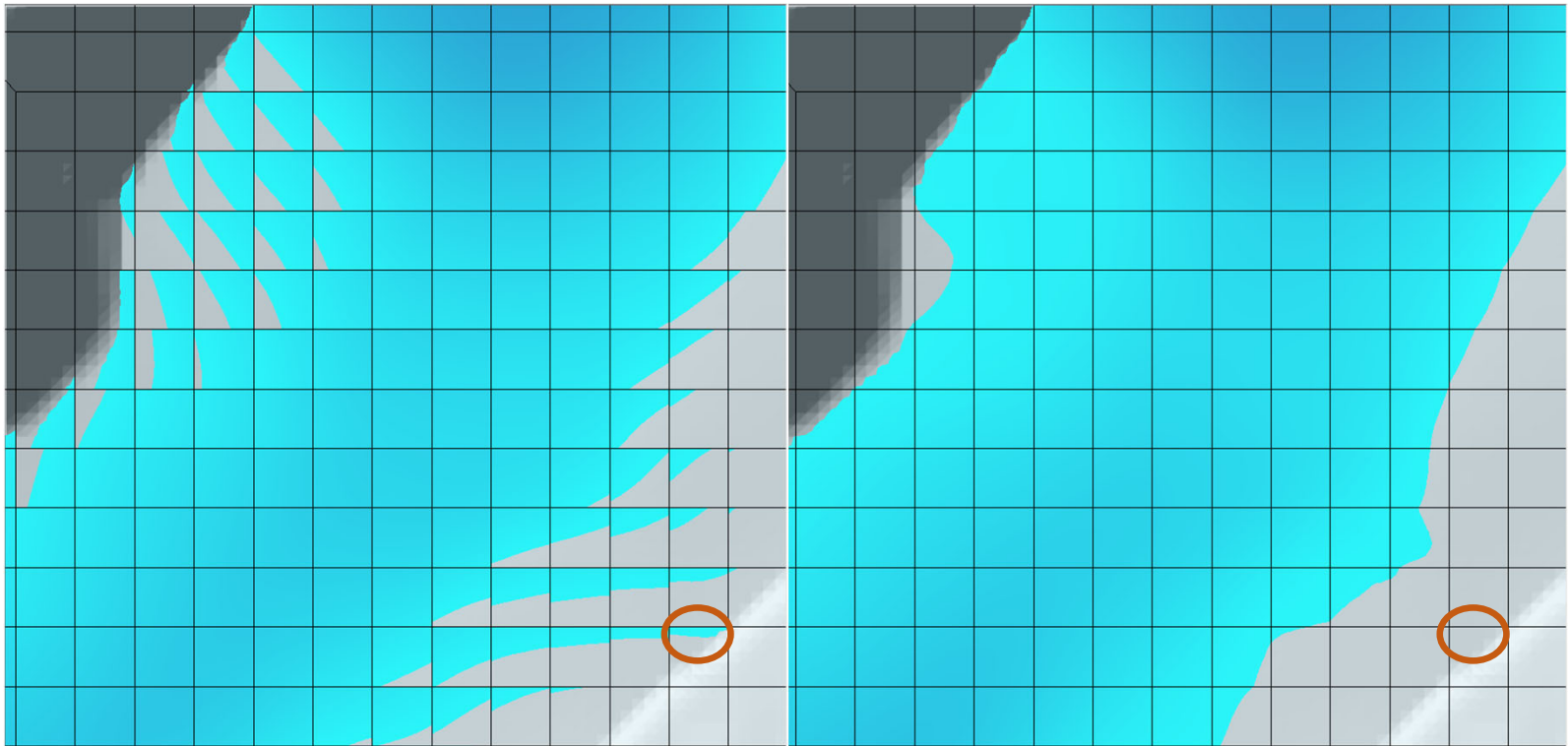
Results Interpolation

- Render mode options allow for interpolation of water surface elevation values or plotting values at the cell centers.



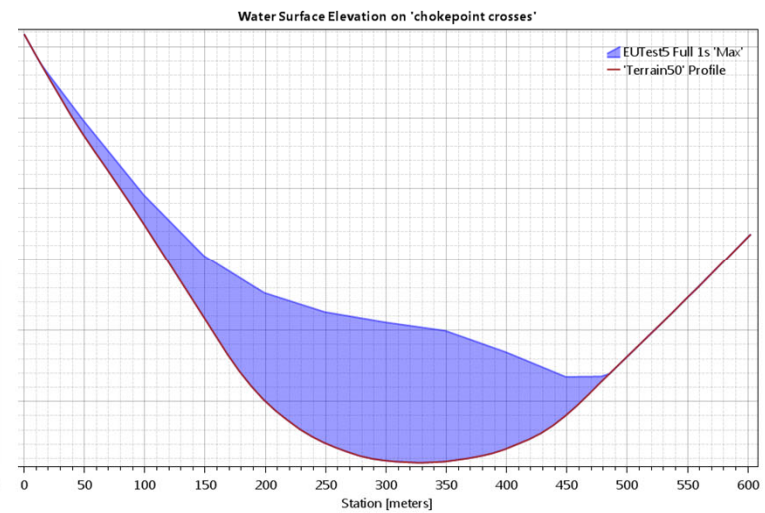
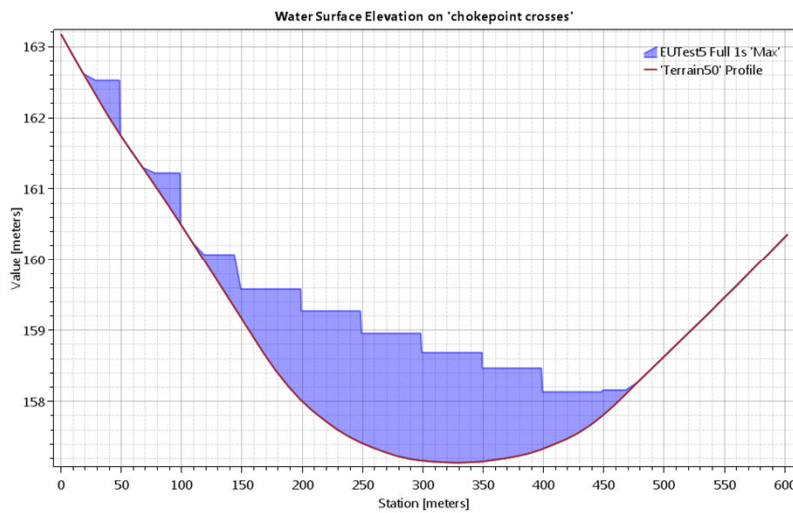


Horizontal vs Sloping Surface



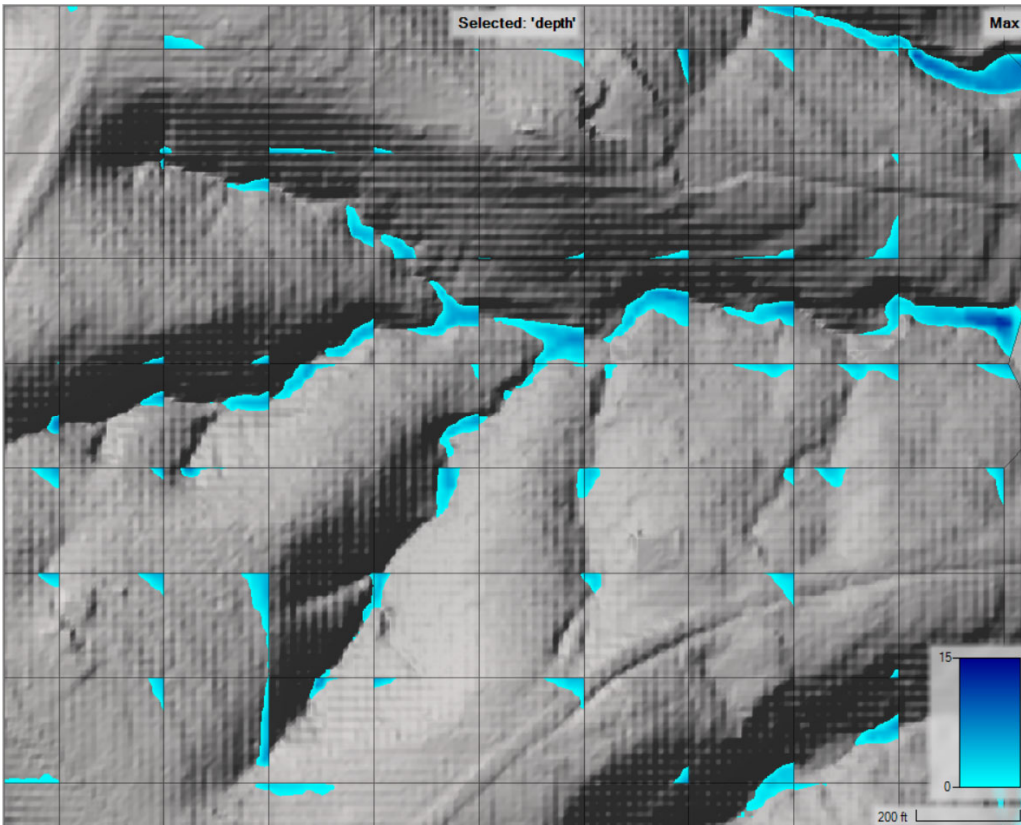


Horizontal vs Sloping Surface

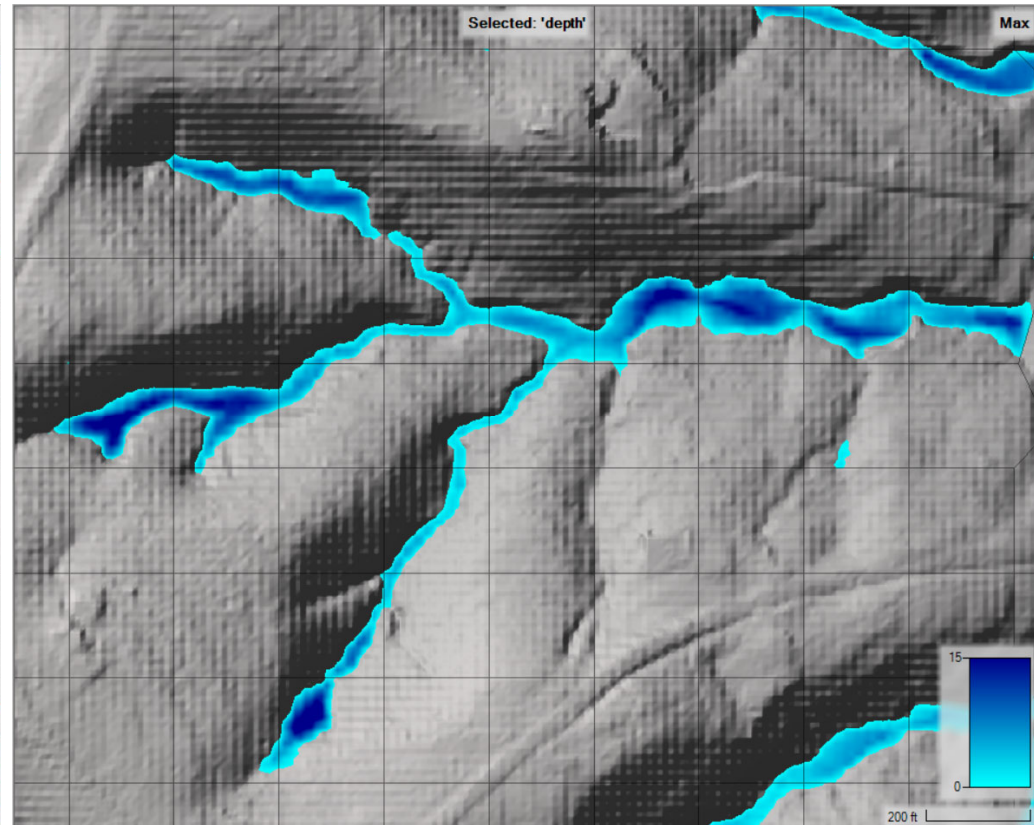




Sloping Surface Errors



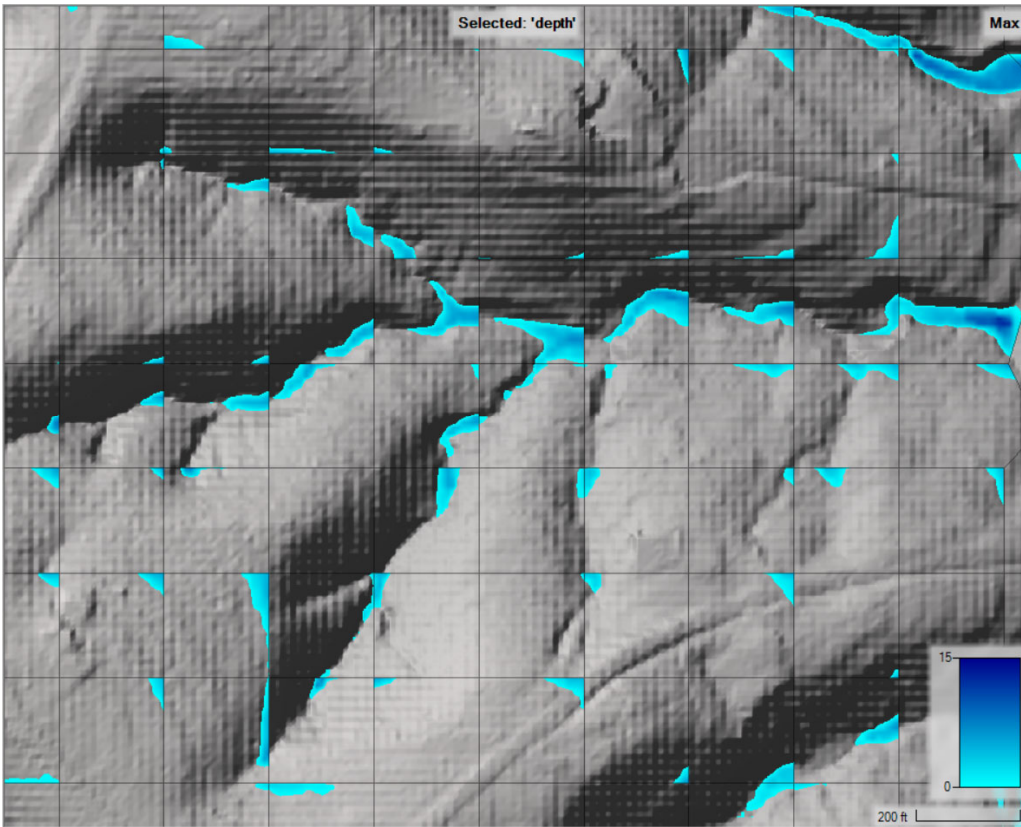
Horizontal



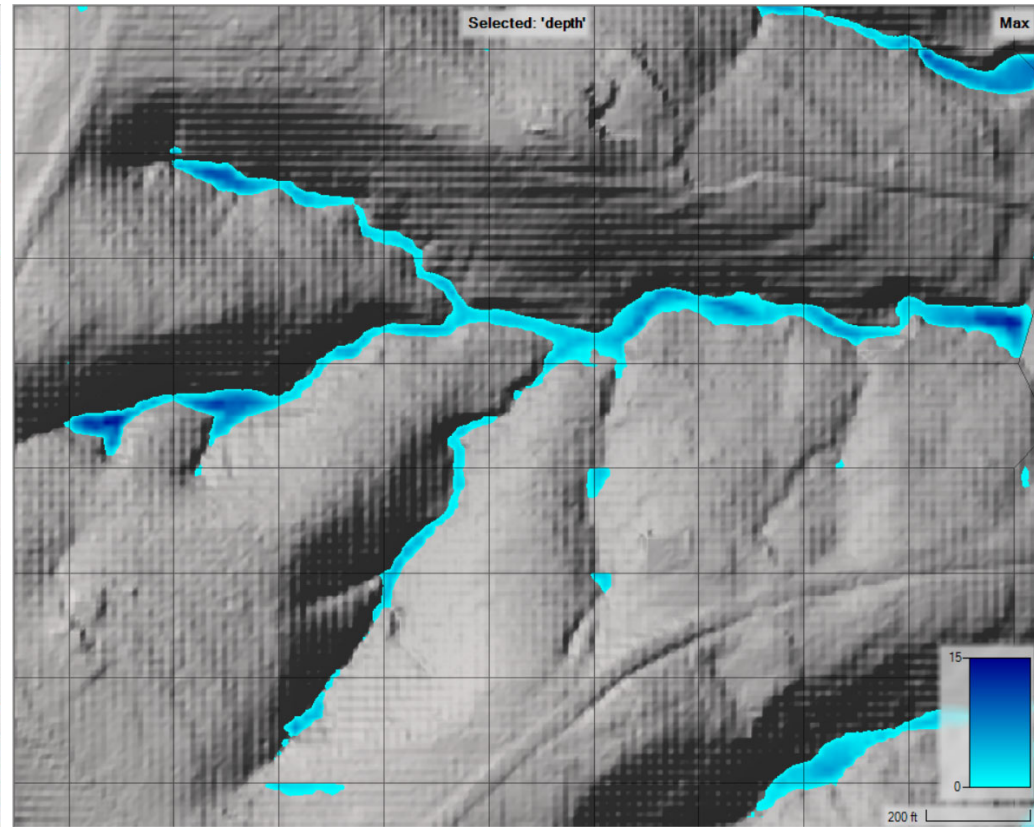
Sloping



Sloping Surface Errors



Horizontal

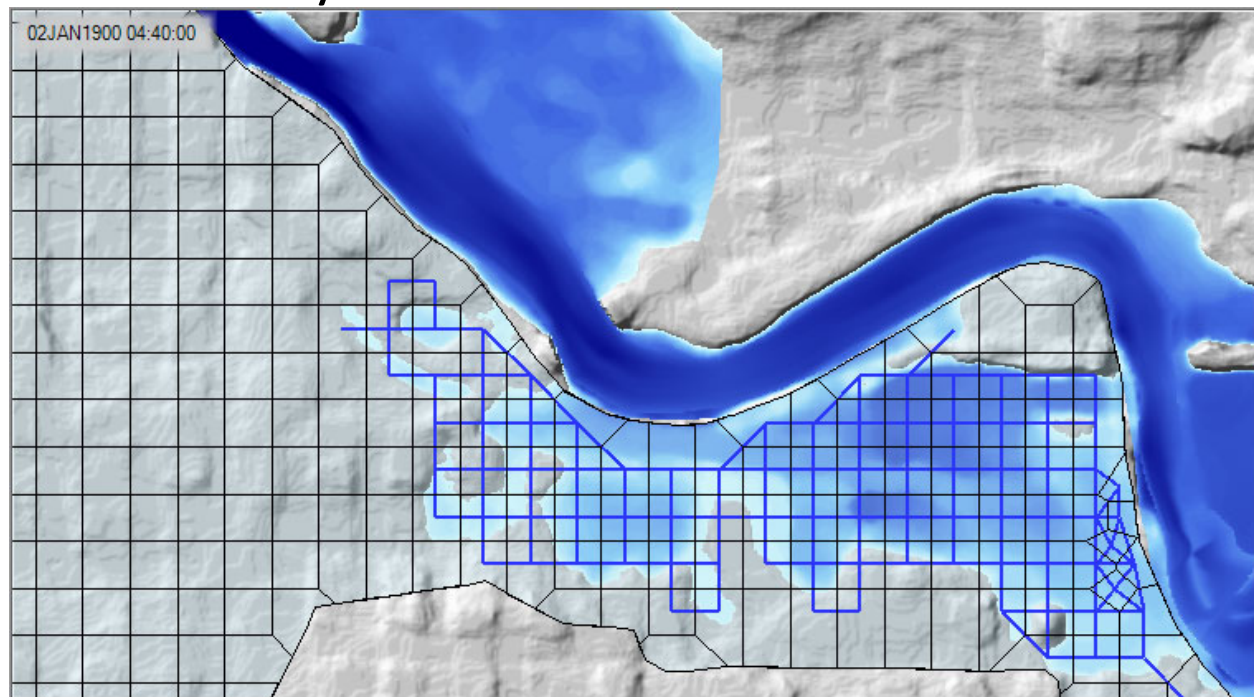


Precip Mode



Depth Results

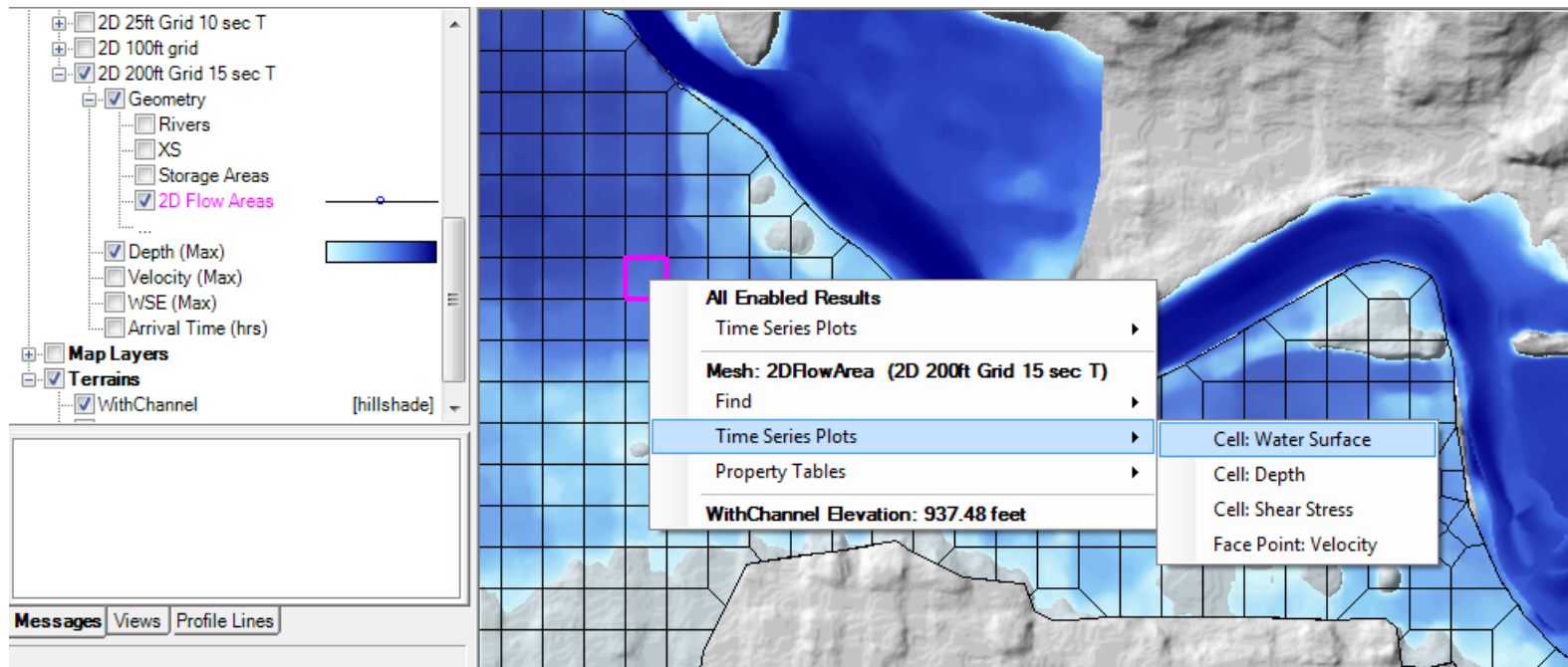
- Hydraulic connectivity from mesh





Results Query

- 2D Flow Area query





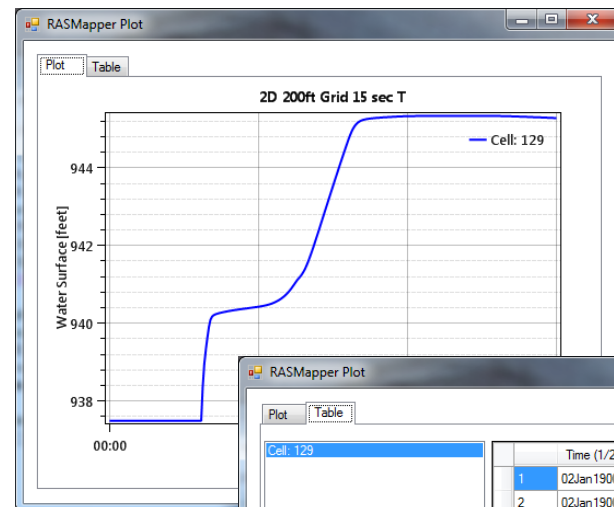
2D Flow Area Queries

- Hydraulic Properties

Cell: Volume - Elevation
Face: Area - Elevation
Face: Wetted Perimeter - Elevation
Face: Manning's n - Elevation
Face: Profile

- Time Series

Cell: Water Surface
Cell: Depth
Cell: Shear Stress
Face Point: Velocity

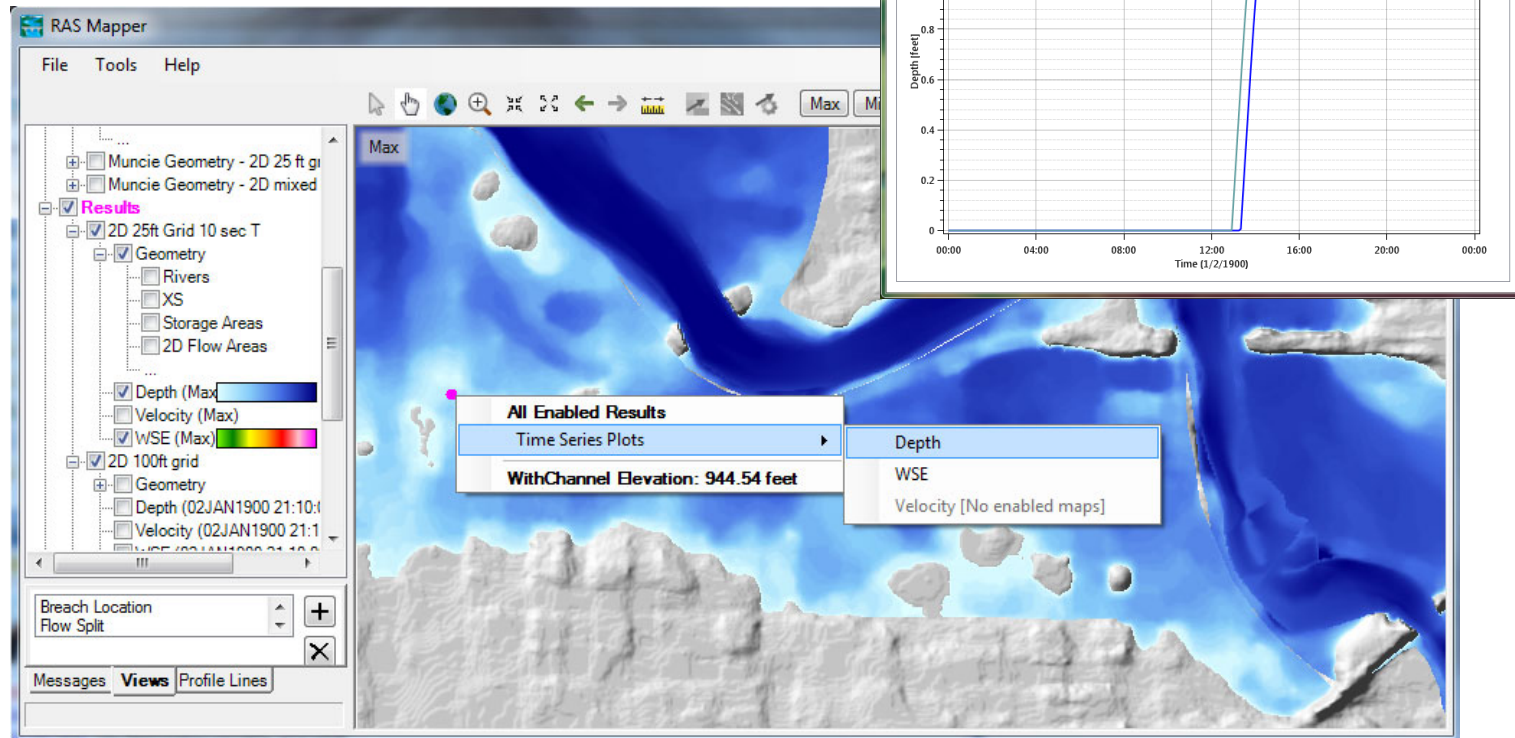


	Time (1/2/1900)	Water Surface
1	02Jan1900 00:00...	937.4891
2	02Jan1900 00:05...	937.4891
3	02Jan1900 00:10...	937.4891
4	02Jan1900 00:15...	937.4891
5	02Jan1900 00:20...	937.4891
6	02Jan1900 00:25...	937.4891
7	02Jan1900 00:30...	937.4891
8	02Jan1900 00:35...	937.4891



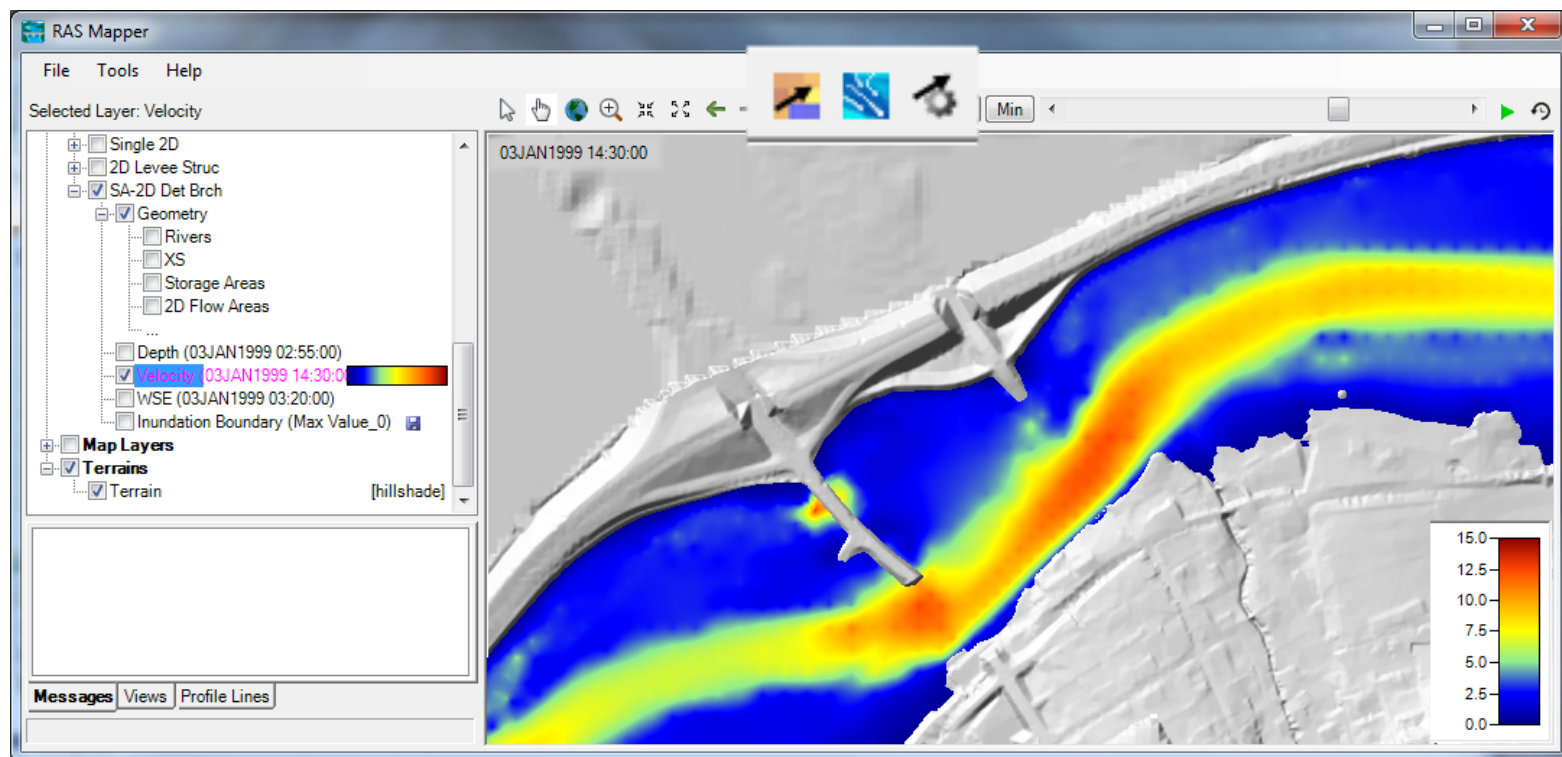
Results Query

- Time Series



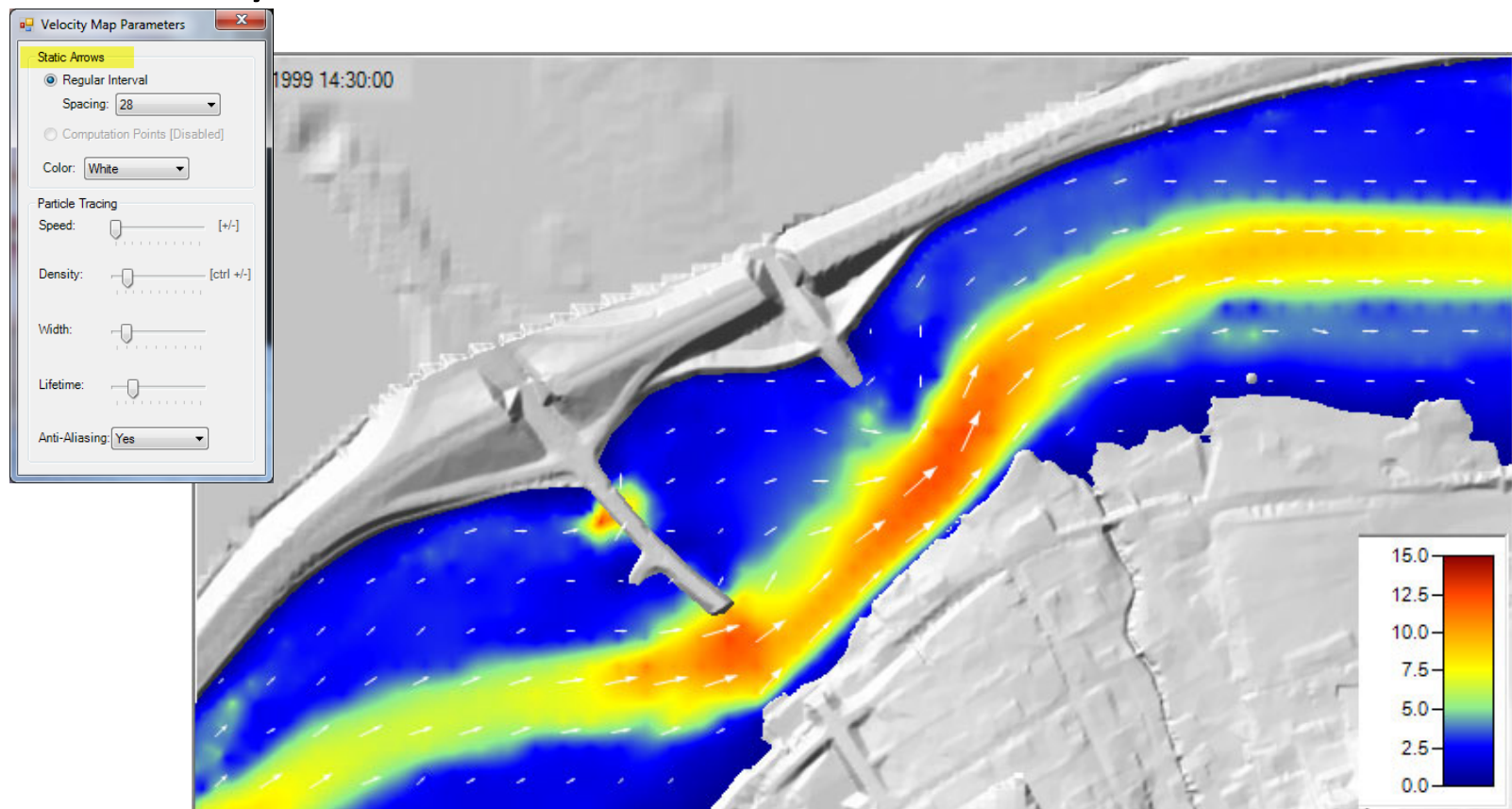


Velocity Results



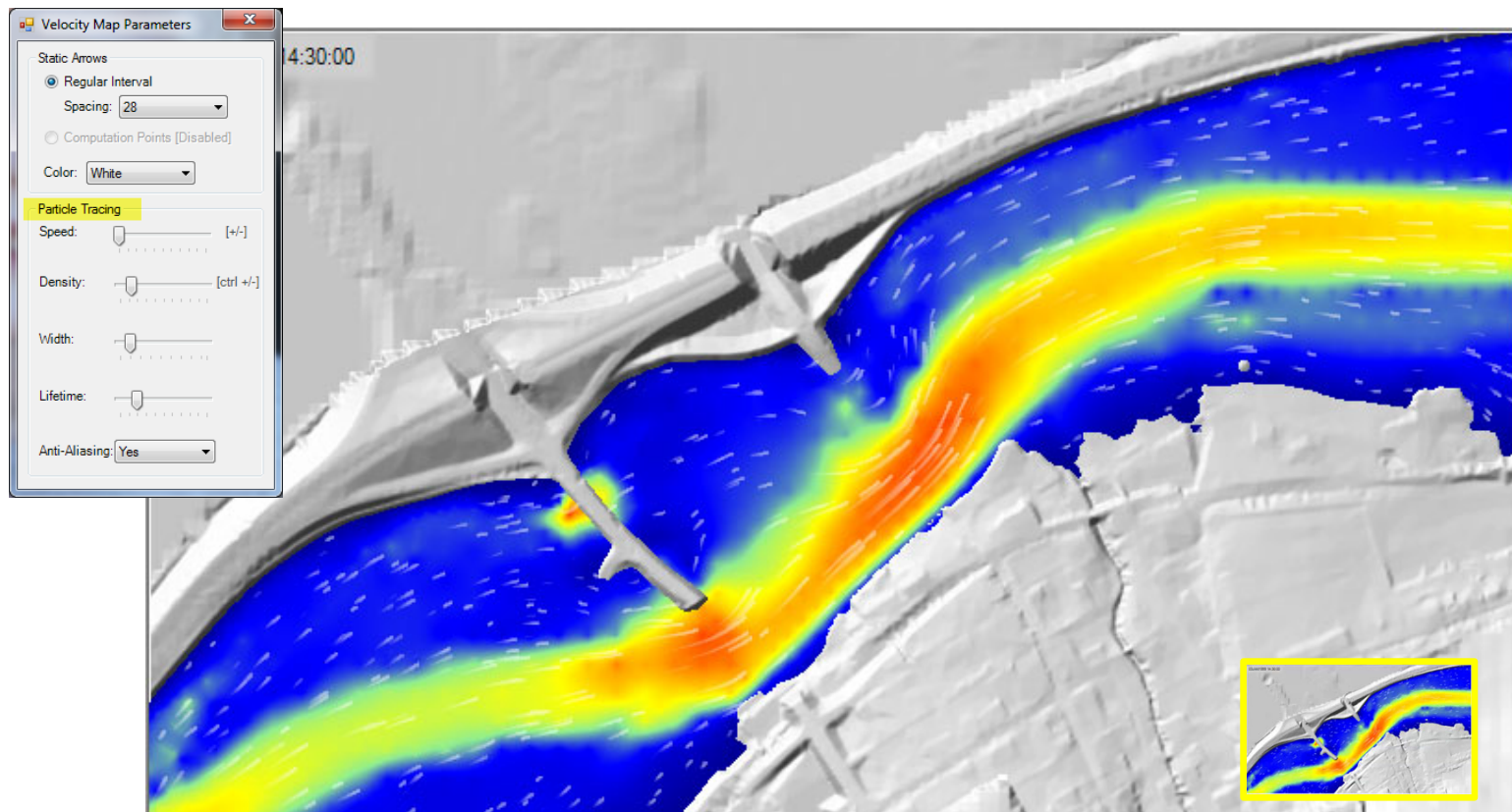


Velocity Arrows



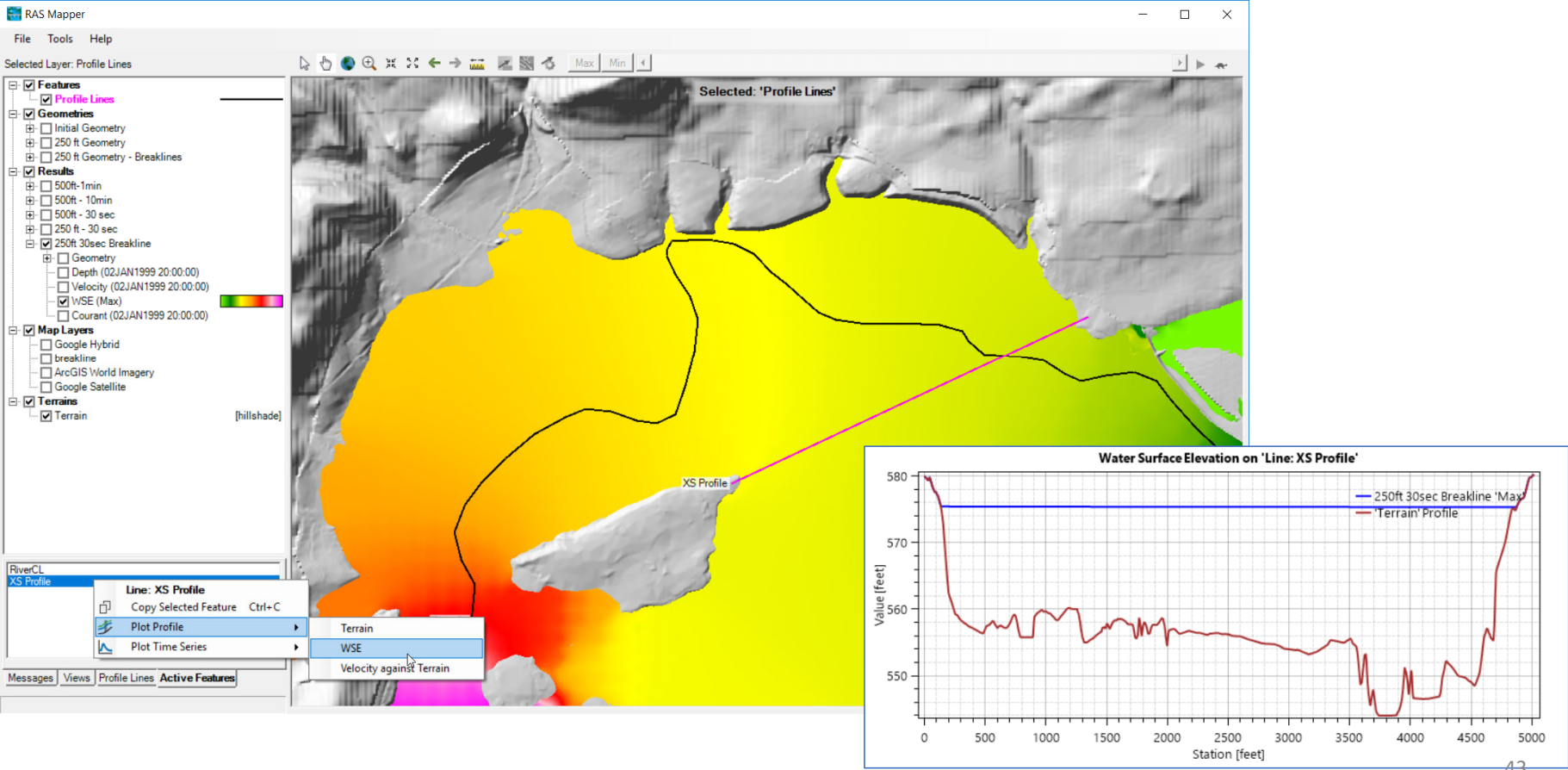


Velocity Tracing





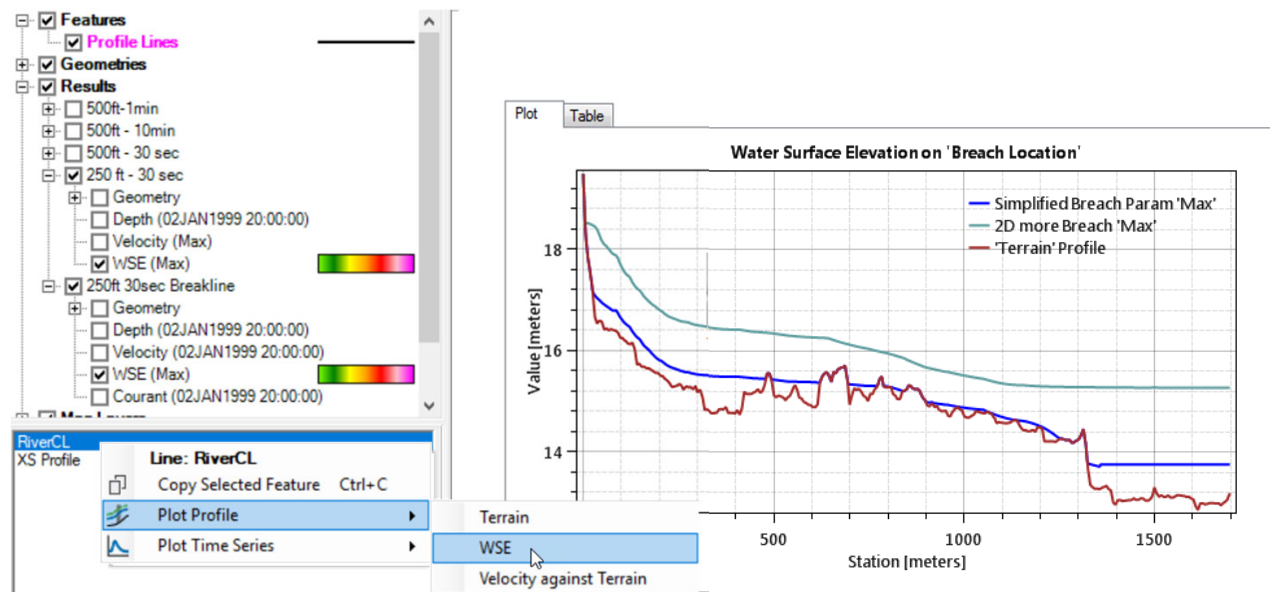
Profile Lines





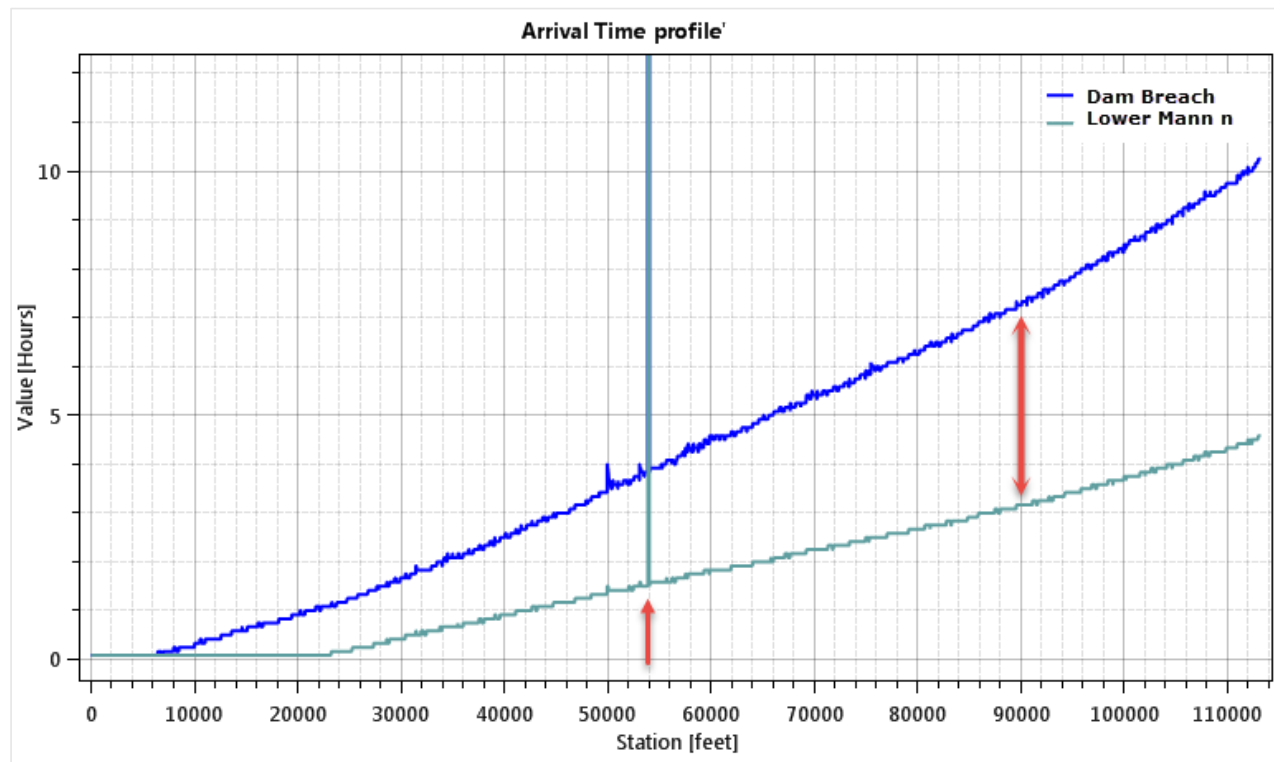
Profile Line - Comparison

- Turn on multiple result maps
- Choose a Profile (i.e. 'Max')
- Choose **Plot Time Series** or **Plot Profile**



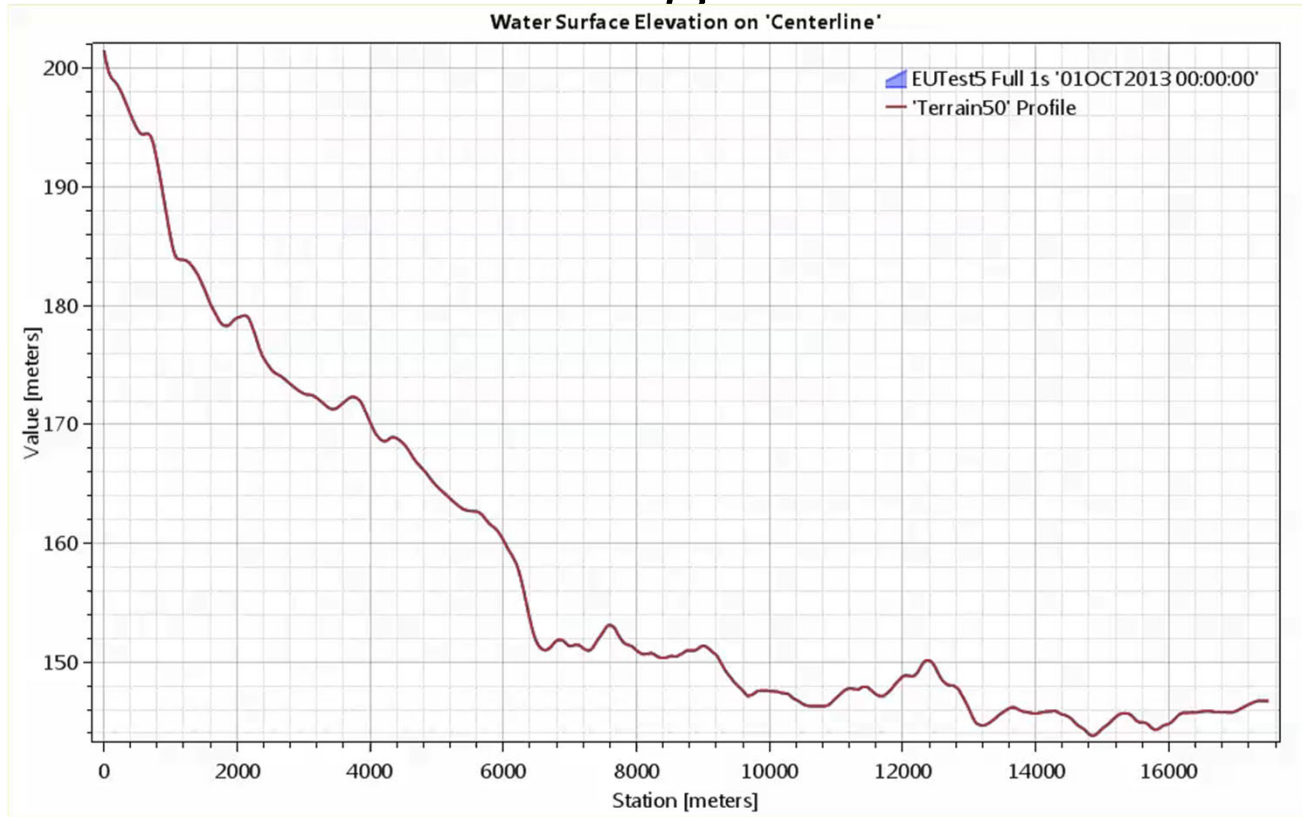


Profile Lines - Comparison



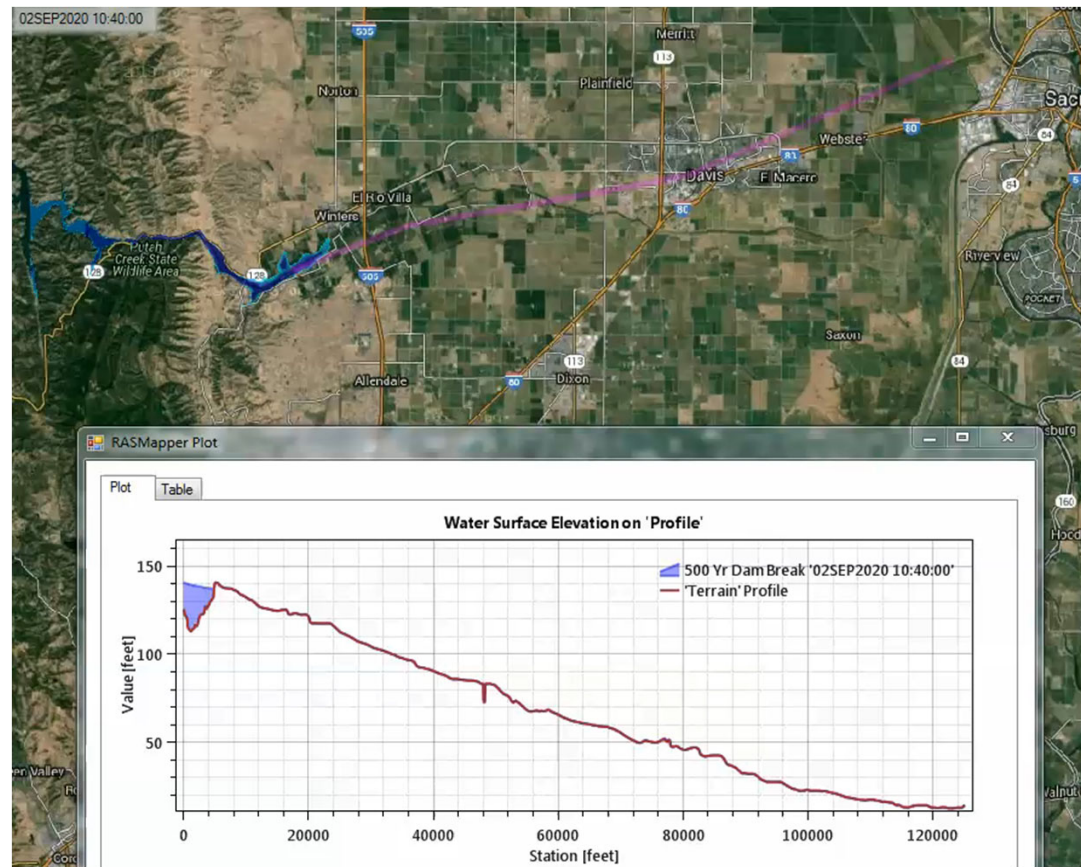


Profile Lines - Animating



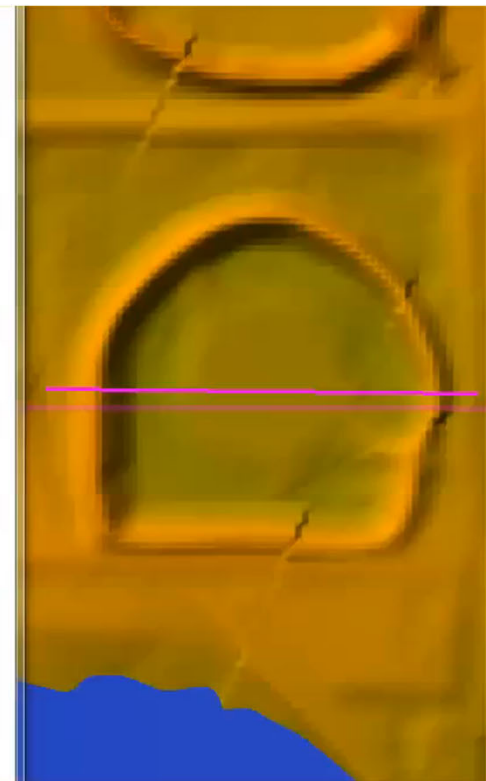
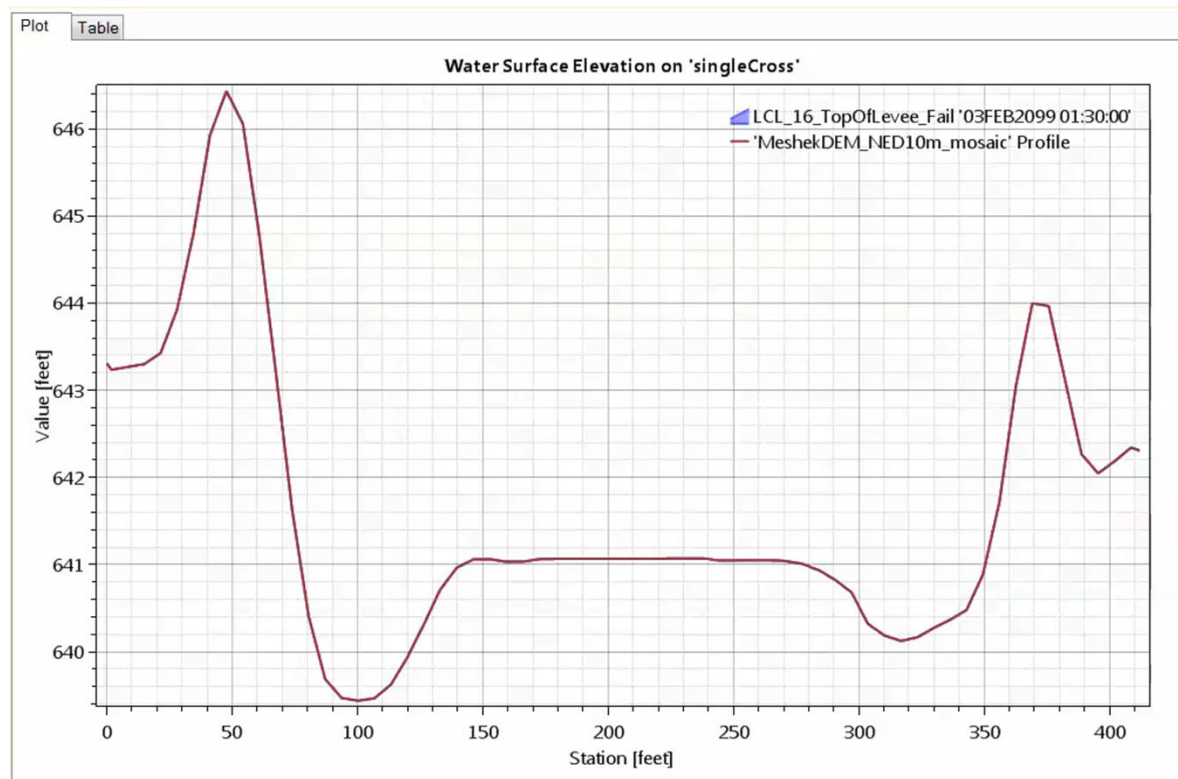


Profile Lines + Spatial Results





Profile Lines - Animating



03JAN1999 12:45:00

Questions?

Questions?

