

HEC-RAS Mapper Results Visualization

Alex Kennedy

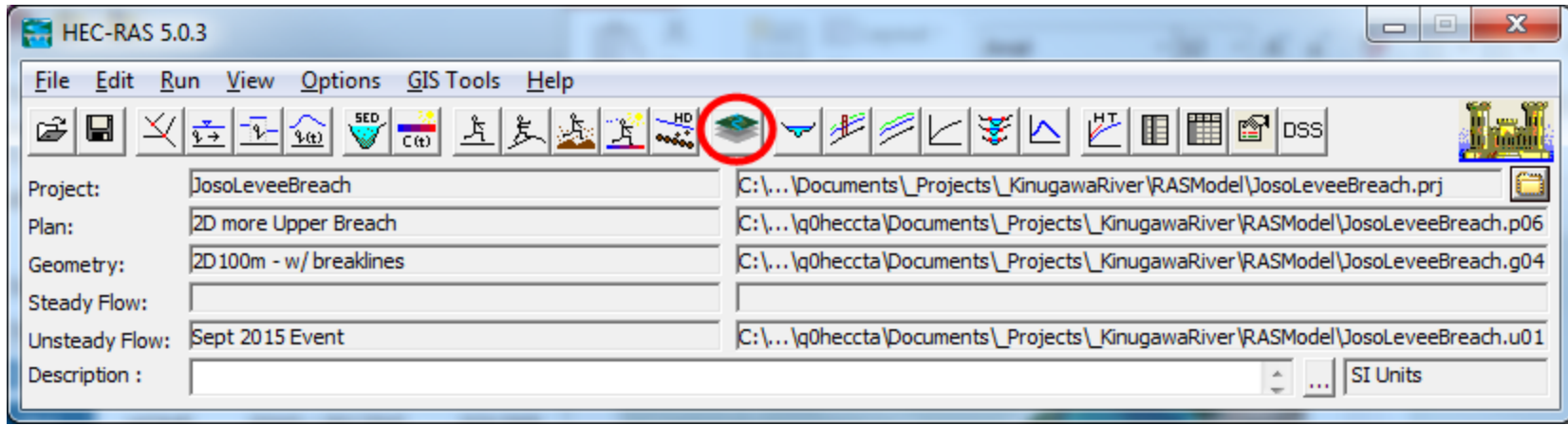
USACE, Institute for Water Resources, Hydrologic Engineering Center





Overview

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





HEC-RAS Mapper

The screenshot displays the HEC-RAS Mapper application window. The interface is divided into several key sections:

- View Tools:** A toolbar at the top center, highlighted with a red box, containing icons for navigation (pan, zoom, pan up/down), display (toggle layers, 3D view), and window management (Max, Min).
- Animation Controls:** A set of playback controls (play, stop, back, forward) located at the top right of the toolbar, also highlighted with a red box.
- Layers List:** A hierarchical tree view on the left side of the window, listing various data layers such as Features, Geometries, Event Conditions, Results, Map Layers, and Terrains. The 'Depth (Max)' layer is currently selected and highlighted in pink.
- View Area:** The central map area showing a satellite-style view of a river and surrounding land. A red box highlights a specific region of the river, labeled 'View Area'. A color scale legend for depth is visible in the bottom right corner of the map area, ranging from 0 to 15 feet.
- Status Area:** A panel at the bottom left of the window, labeled 'Status Area', which displays the current coordinates (2036985.82, 346945.58) and a scale of 1 pixel = 19.94 ft.



Layers List

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

Selected Layer: Depth

Layers List:

- Features**
 - Profile Lines
- Geometries**
 - Grid 50ft
 - grid200ft
 - Grid400ft
 - Rivers
 - Cross Sections
 - Storage Areas
 - 2D Flow Areas
 - Bridges/Culverts
 - Inline Structures
 - Lateral Structures
 - SA/2D Connections
 - Pump Stations
 - BC Lines
 - Manning's n
 - Infiltration
 - Percent Impervious
 - Reference Points
 - Errors
- Event Conditions**
- Results**
 - Grid 50ft
 - Event Conditions
 - Geometry
 - Depth (02JAN1900 02:45:00)**
 - Velocity (02JAN1900 05:00:00)
 - WSE (02JAN1900 00:00:00)
 - Inundation Boundary (Max Value_0)
 - Depth (Max)
 - Grid 200ft
 - Grid 400ft
- Map Layers**
 - LandCover
 - Classification Polygons
 - VOD_LC
 - Google Satellite
- Terrains**
 - Terrain
 - TerrainWithChannel



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

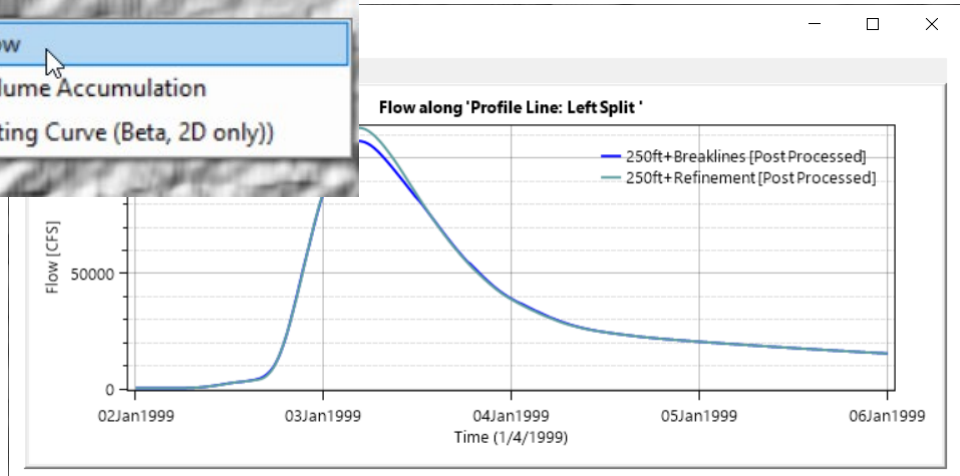
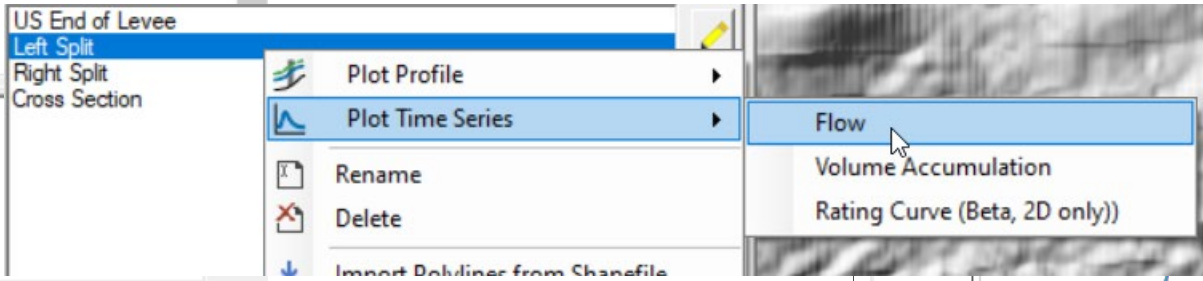
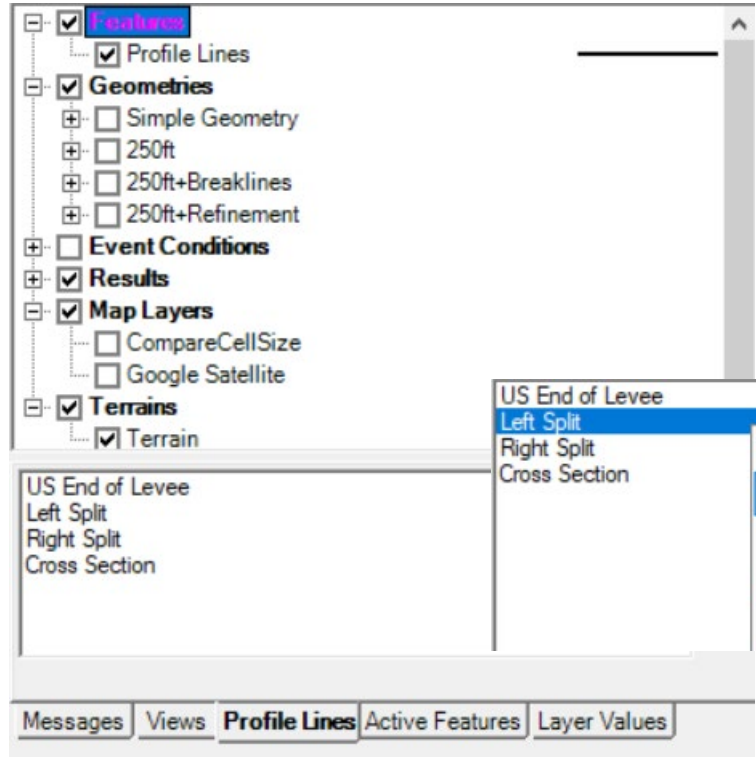
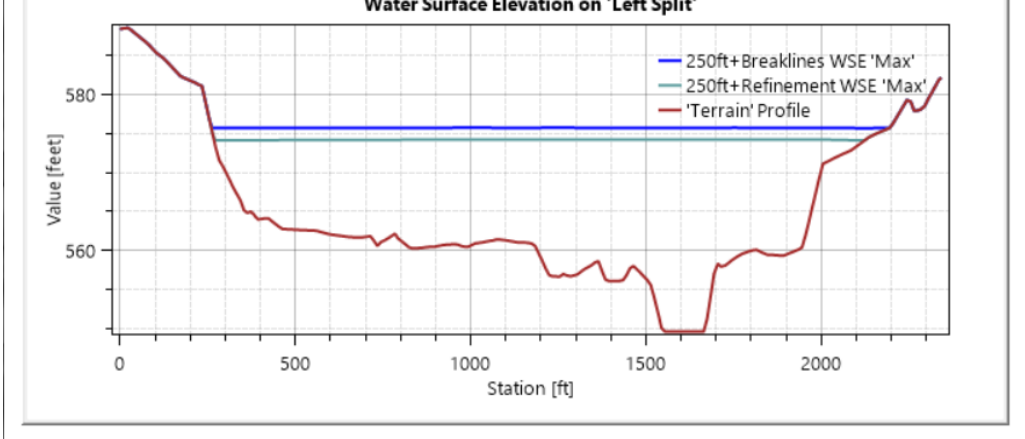
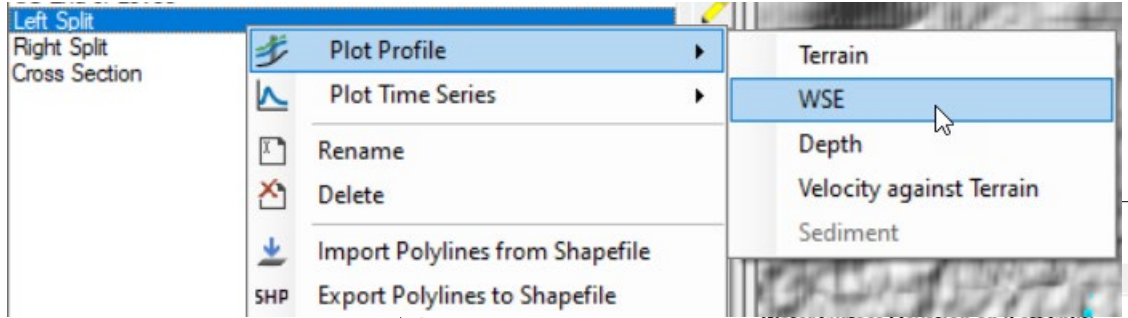
Use	Name	ID	Value
<input checked="" type="checkbox"/>	Velocity (250ft+Refinement)	vR	1.51
<input checked="" type="checkbox"/>	Velocity (250ft+Breaklines)	vBL	1.40
<input checked="" type="checkbox"/>	WSE (250ft+Refinement)	wR	573.71
<input checked="" type="checkbox"/>	WSE (250ft+Breaklines)	wBL	575.43

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



Profile Lines

- User-defined/editable features





Active Features

RAS Mapper

File Project Tools Help

Selected Layer: Cross Sections

- SA/2D Connections
- Pump Stations
- BC Lines
- Manning's n
- Infiltration
- Percent Impervious
- Reference Points
- Errors
- Depth (02JAN1900 02:45:00)
- Velocity (02JAN1900 05:00:00)
- WSE (02JAN1900 00:00:00)
- Inundation Boundary (Max Value_0)
- Depth (Max)
- Grid 200ft
- Grid 400ft
- Event Conditions
- Geometry
- Depth (02JAN1900 05:40:00)

9081.195
8757.405
8434.332
8110.505
7864.487
7490.833
7158.903
6868.344
6626.553
6295.048
5925.654
5688.906

Messages Views Profile Lines **Active Features** Lay

(408602.96, 1803059.32 1 pixel = 8.14 ft)

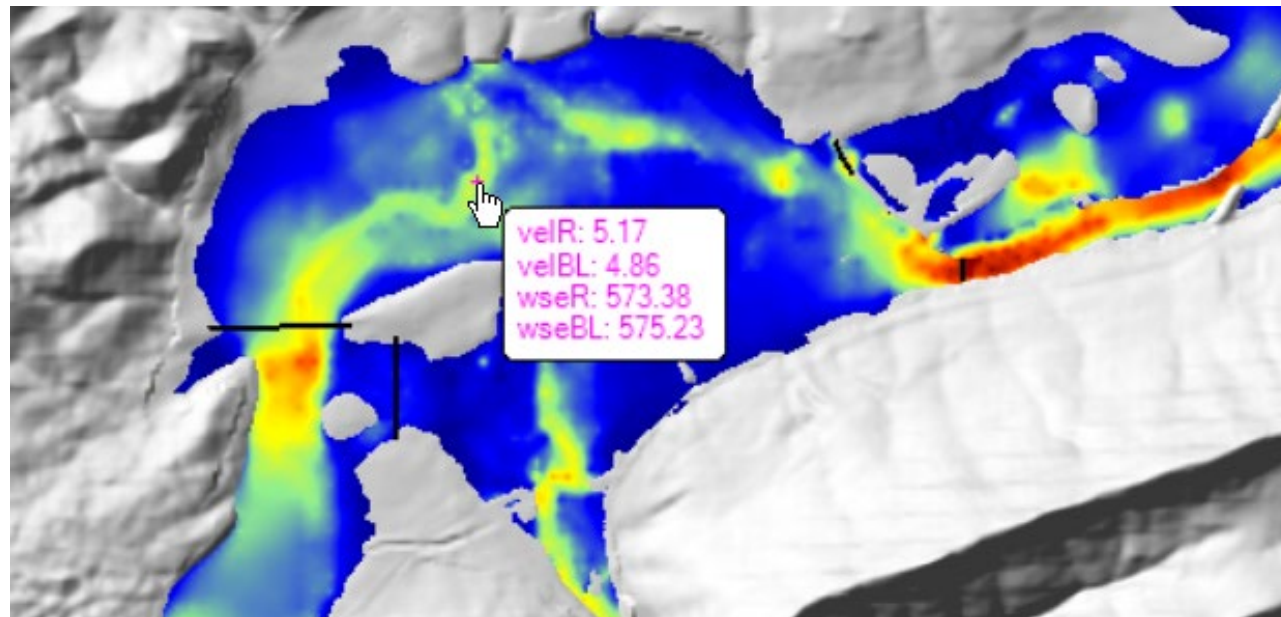
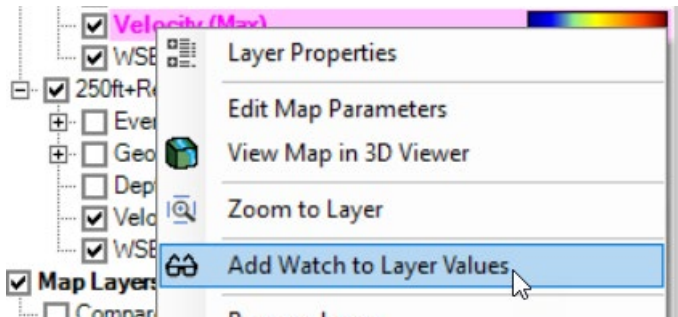
Selected: 'Cross Sections'

Cross Sections: 8434.332 (Grid 50ft) (Results)

- Copy Selected Feature Ctrl+C
- Plot Terrain Profile
- Save as Profile Line
- View Points
- Results Profile Plot
 - WSE
 - Velocity
 - Depth
- Results Time Series



Watch Layer Values



Use	Name	ID	Value
<input checked="" type="checkbox"/>	Velocity (250ft+Refinement)	velR	5.14
<input checked="" type="checkbox"/>	Velocity (250ft+Breaklines)	velBL	5.00
<input checked="" type="checkbox"/>	WSE (250ft+Refinement)	wseR	573.78
<input checked="" type="checkbox"/>	WSE (250ft+Breaklines)	wseBL	575.47

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

(2037649.22, 346306.26 1 pixel = 42.29 ft)



Web Imagery

GDALWMS

Select WMS image server

- ArcGIS NatGeo World Map
- ArcGIS Ocean Basemap
- ArcGIS USA Topo Maps
- ArcGIS World Imagery
- ArcGIS World Physical Map
- ArcGIS World Shaded Relief
- ArcGIS World Street Map
- ArcGIS World Terrain Base
- ArcGIS World Topo Map
- Bing Satellite
- Google Hybrid
- Google Map
- Google Satellite
- Google Terrain Streets Water
- Google Terrain
- NSI_Test
- OpenStreetMaps
- USGS Imagery
- USGS Topo

Reprojection Resample Method: near

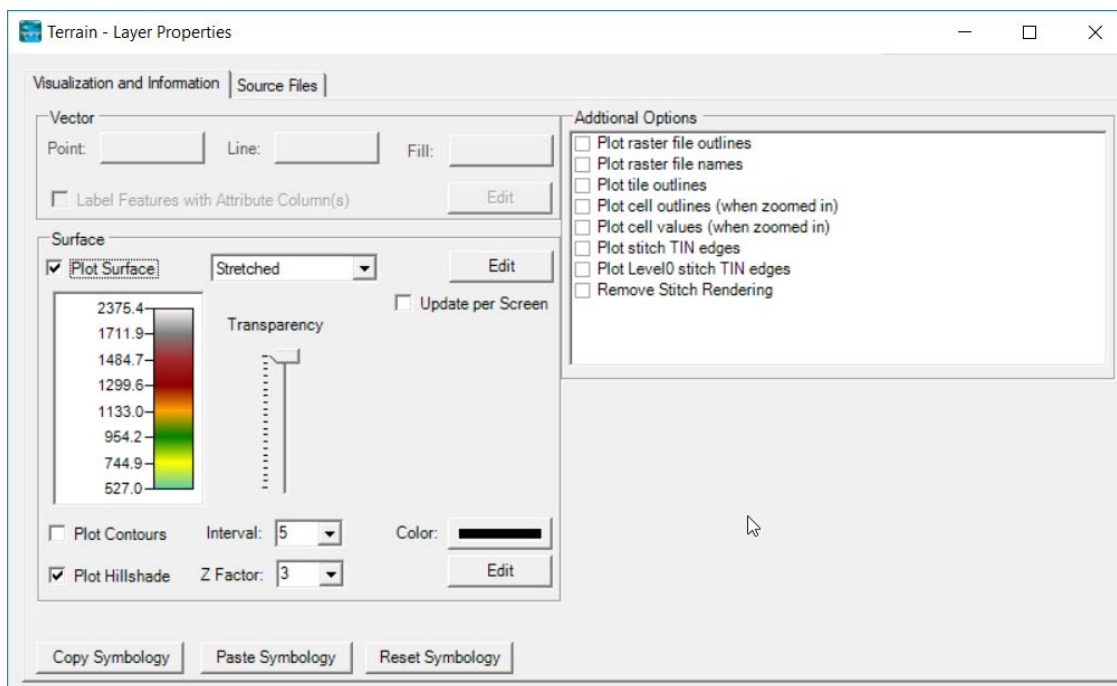
OK Close

Messages Views Profile Lines

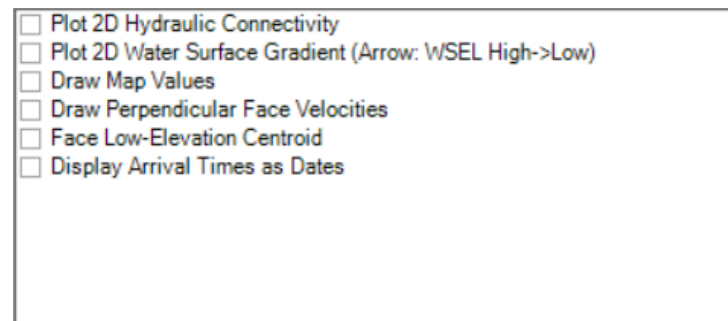


Plot Options

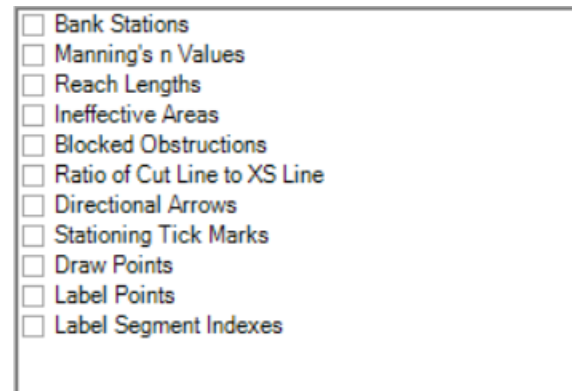
- Terrain



- Depth, WSE



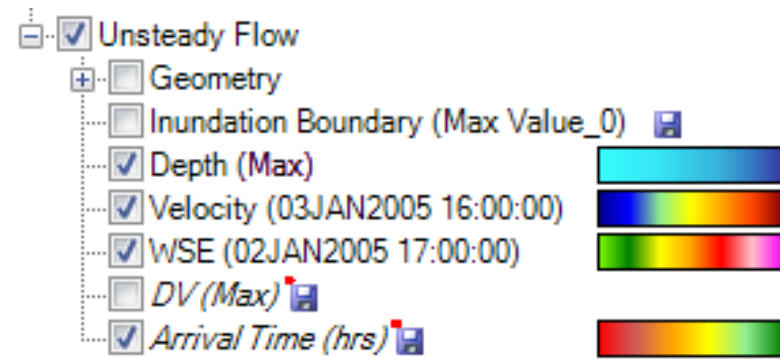
- River, Cross Sections





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 * Velocity²
 - 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

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

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.

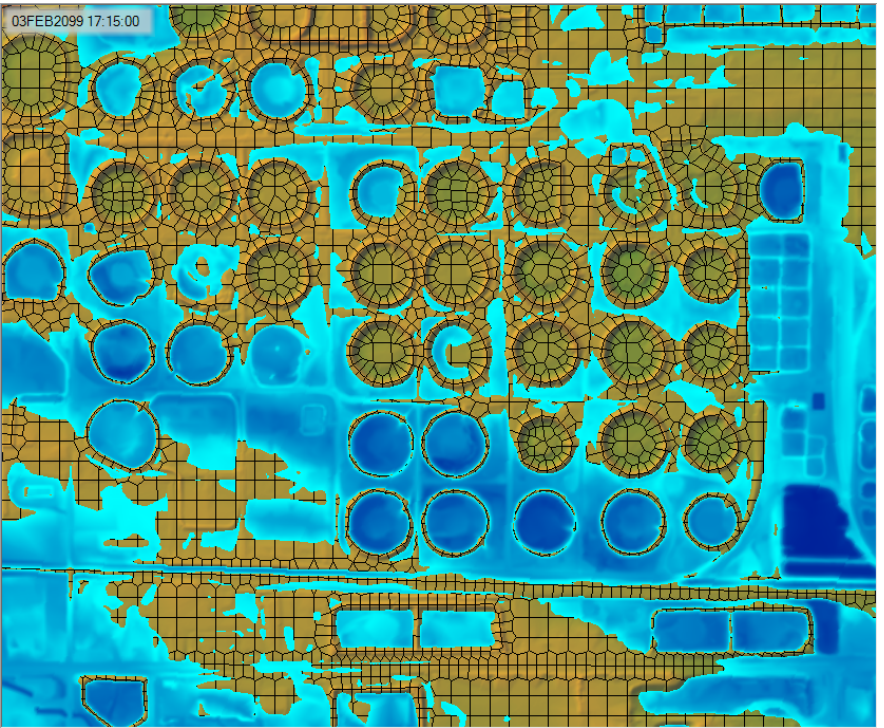
Add Map Close

Default maps: Depth, Water Surface Elevation, Velocity

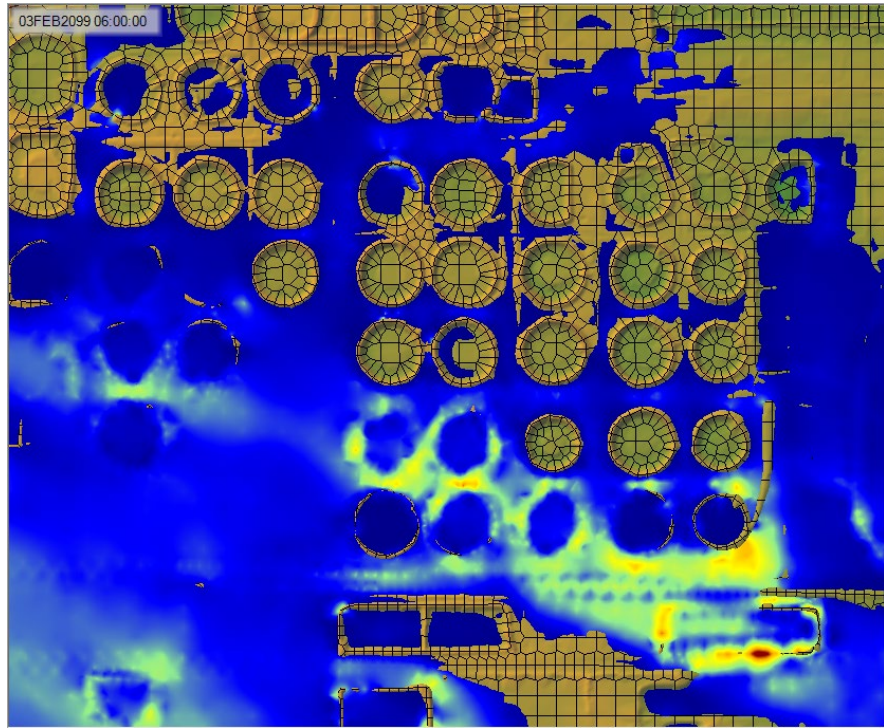


Example Maps

- Depth

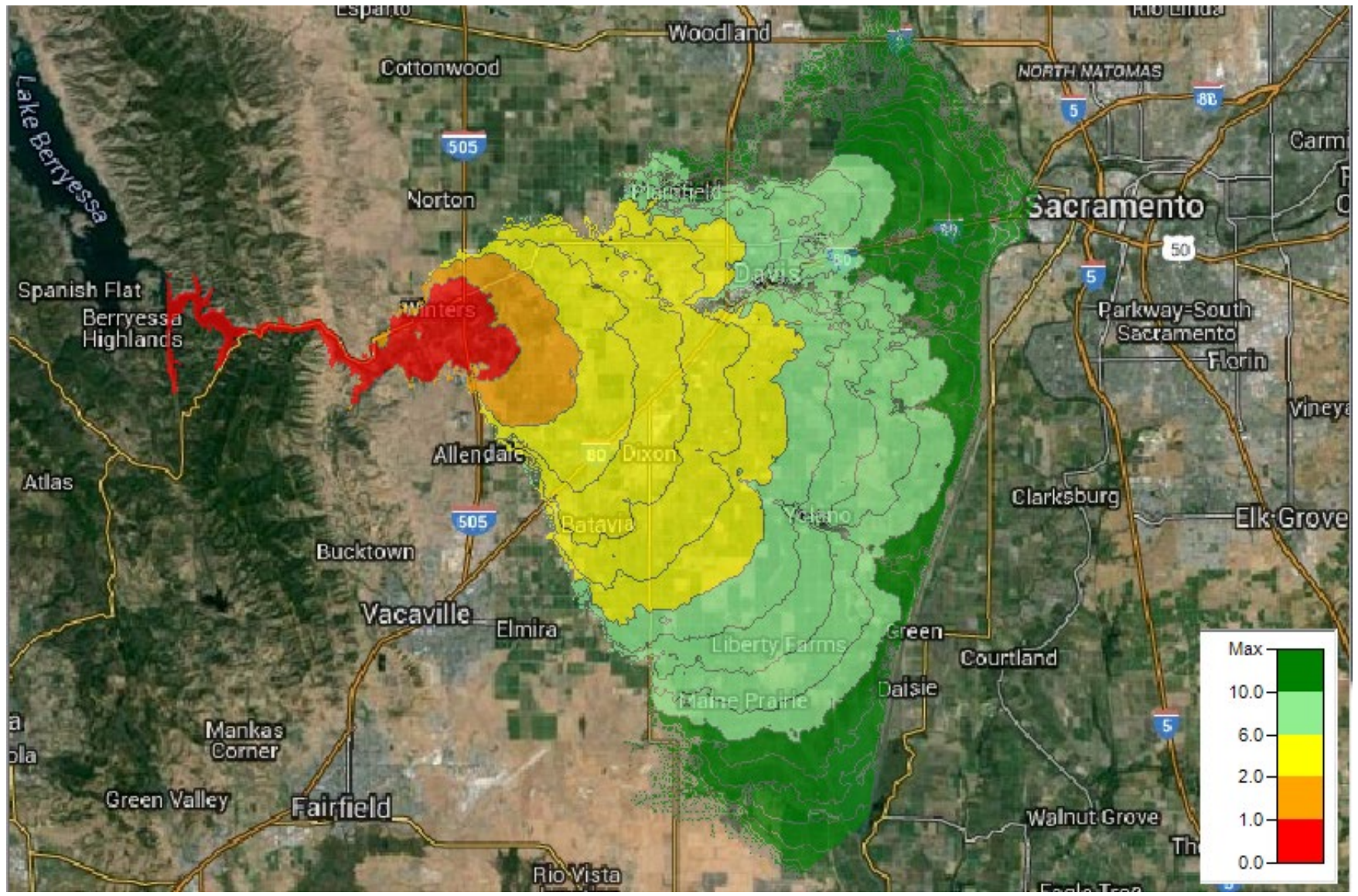


- Velocity



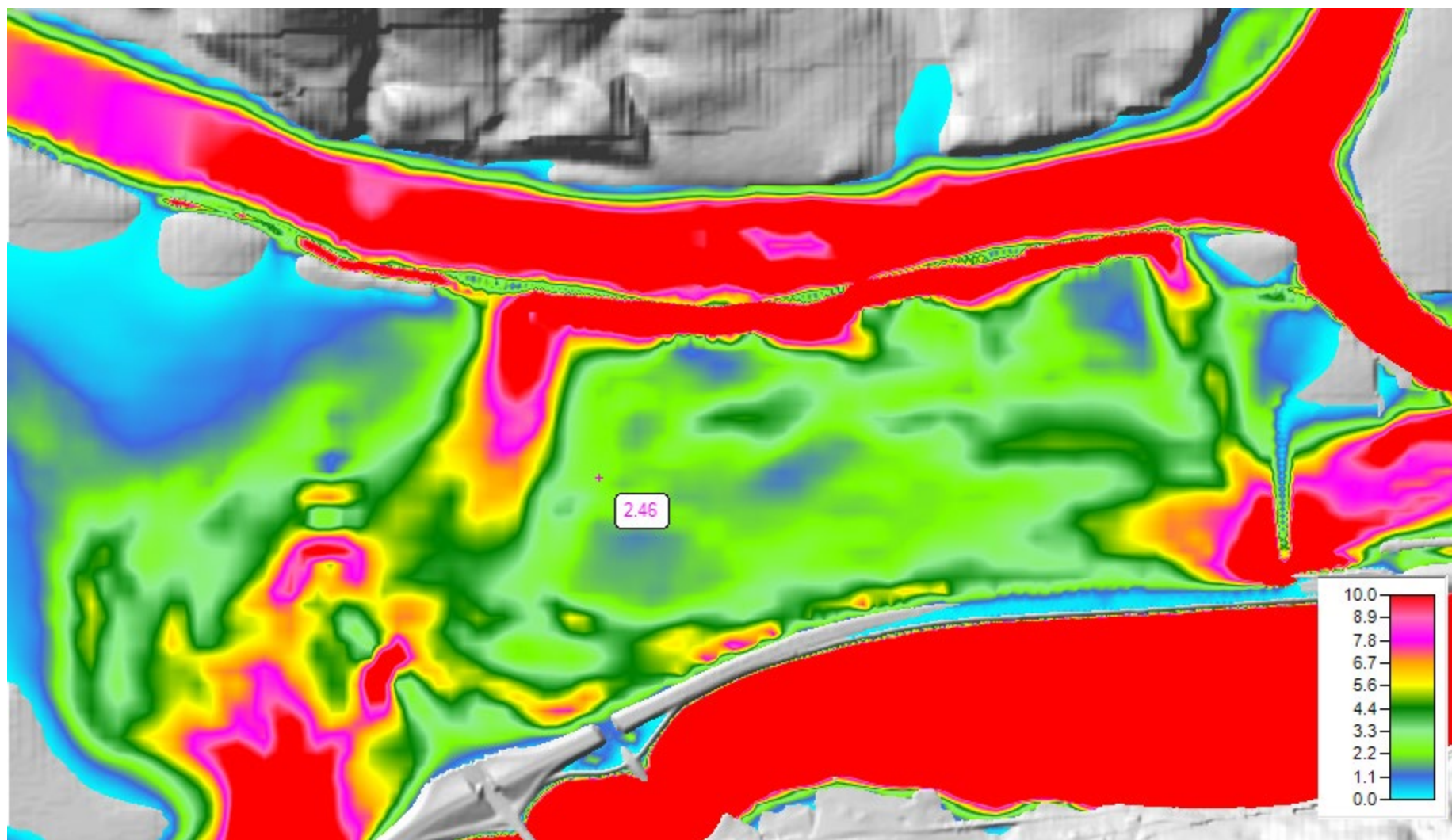


Arrival Time



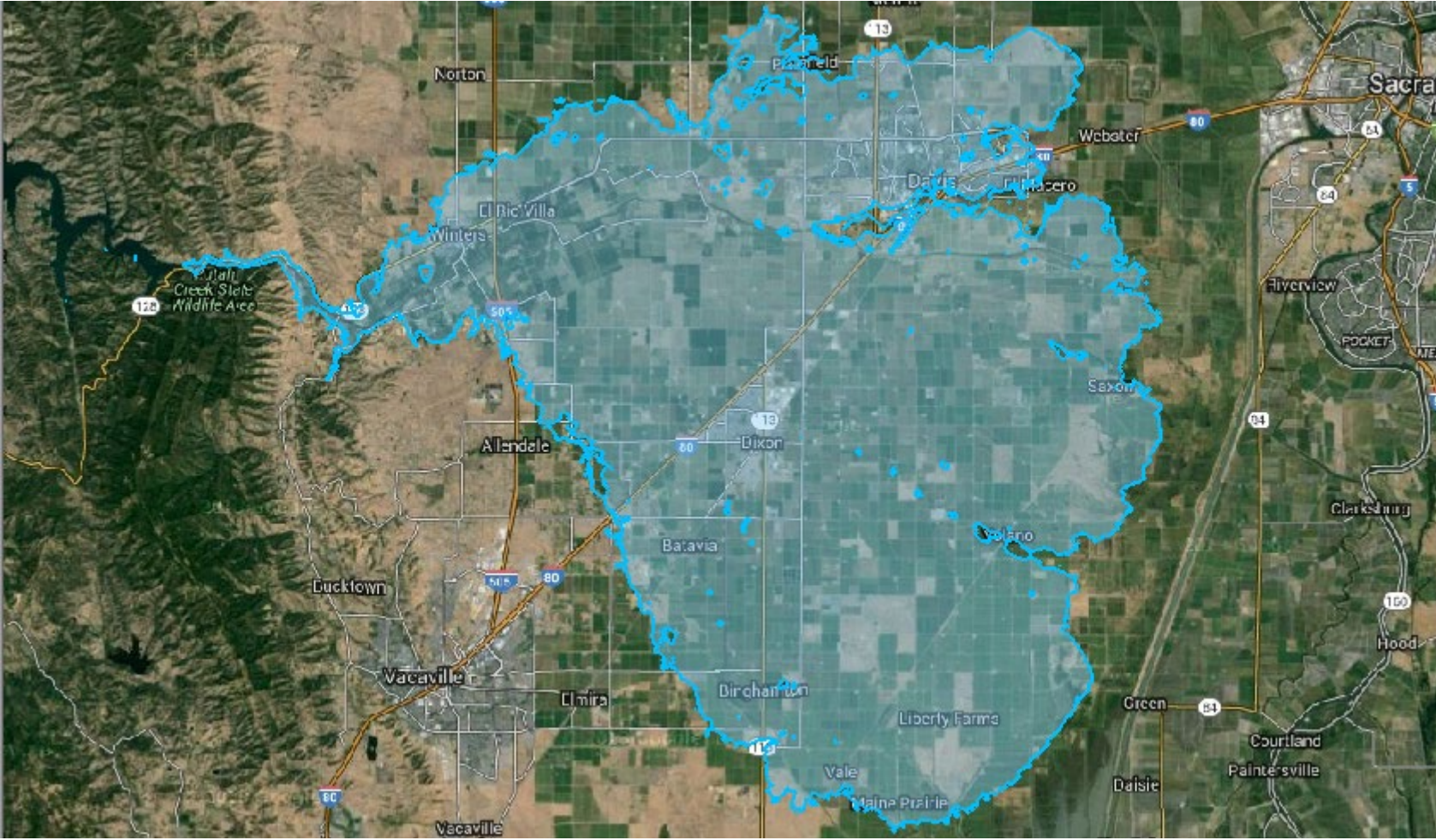


Hazard Mapping





Inundation Boundary





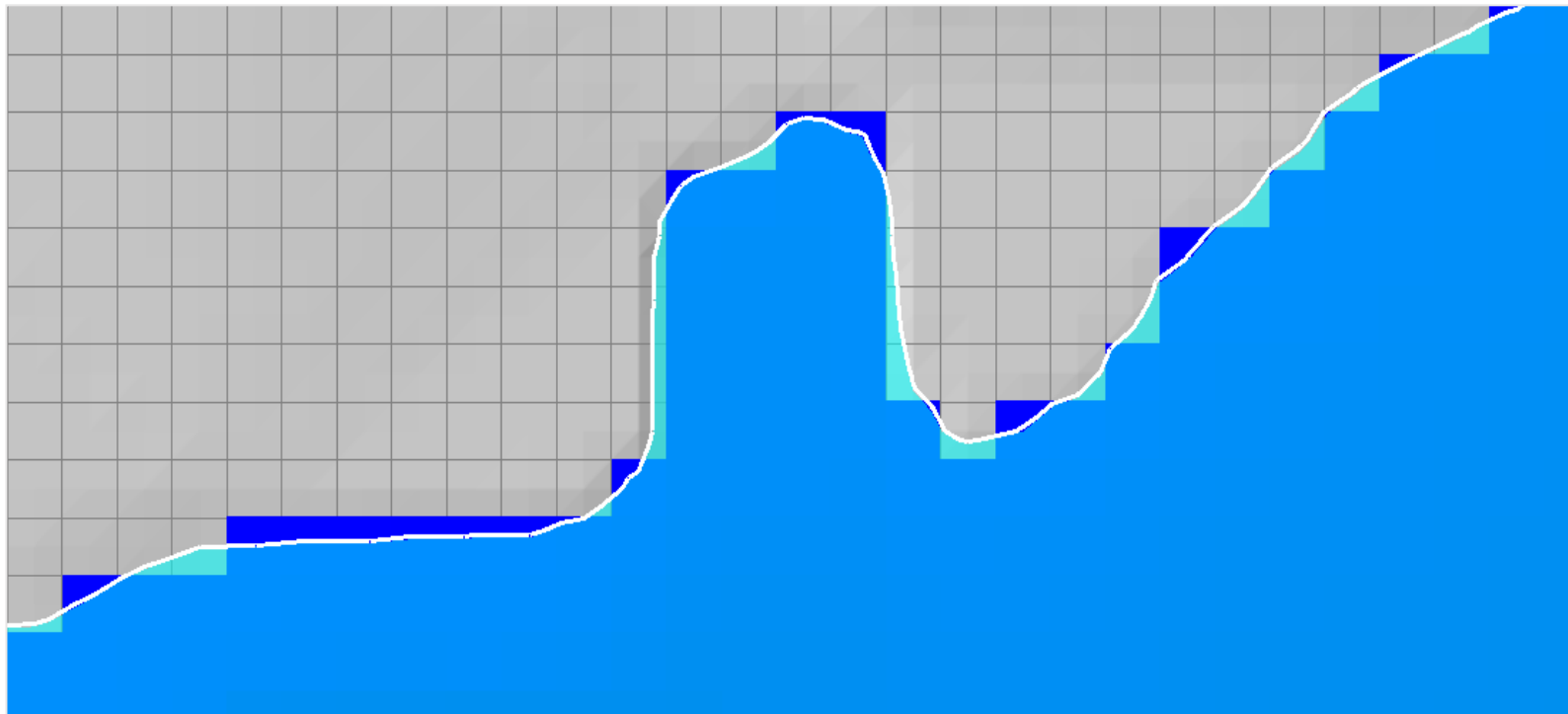
Map Types – Dynamic vs Stored

- **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

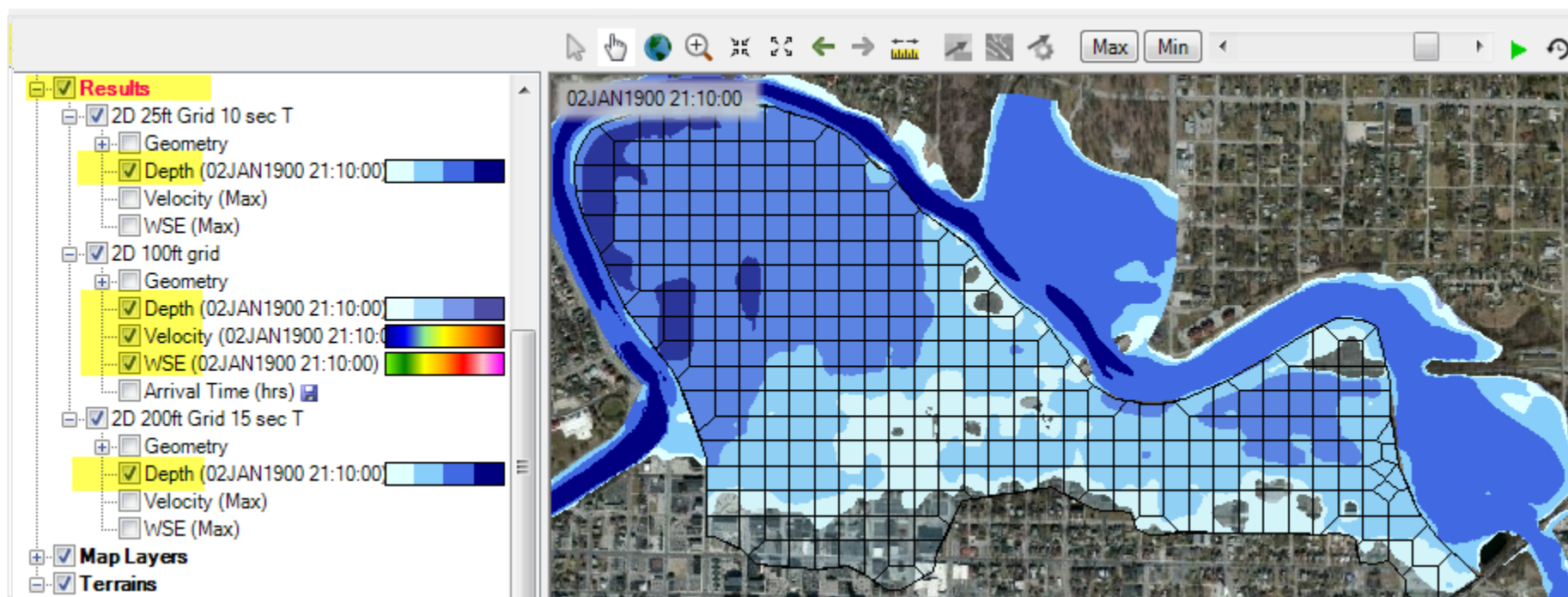
- Dynamic results plot values for the current pyramid level. Boundaries are defined based on interpolation.
- Stored results have a single value per cell.





Dynamic Mapping

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





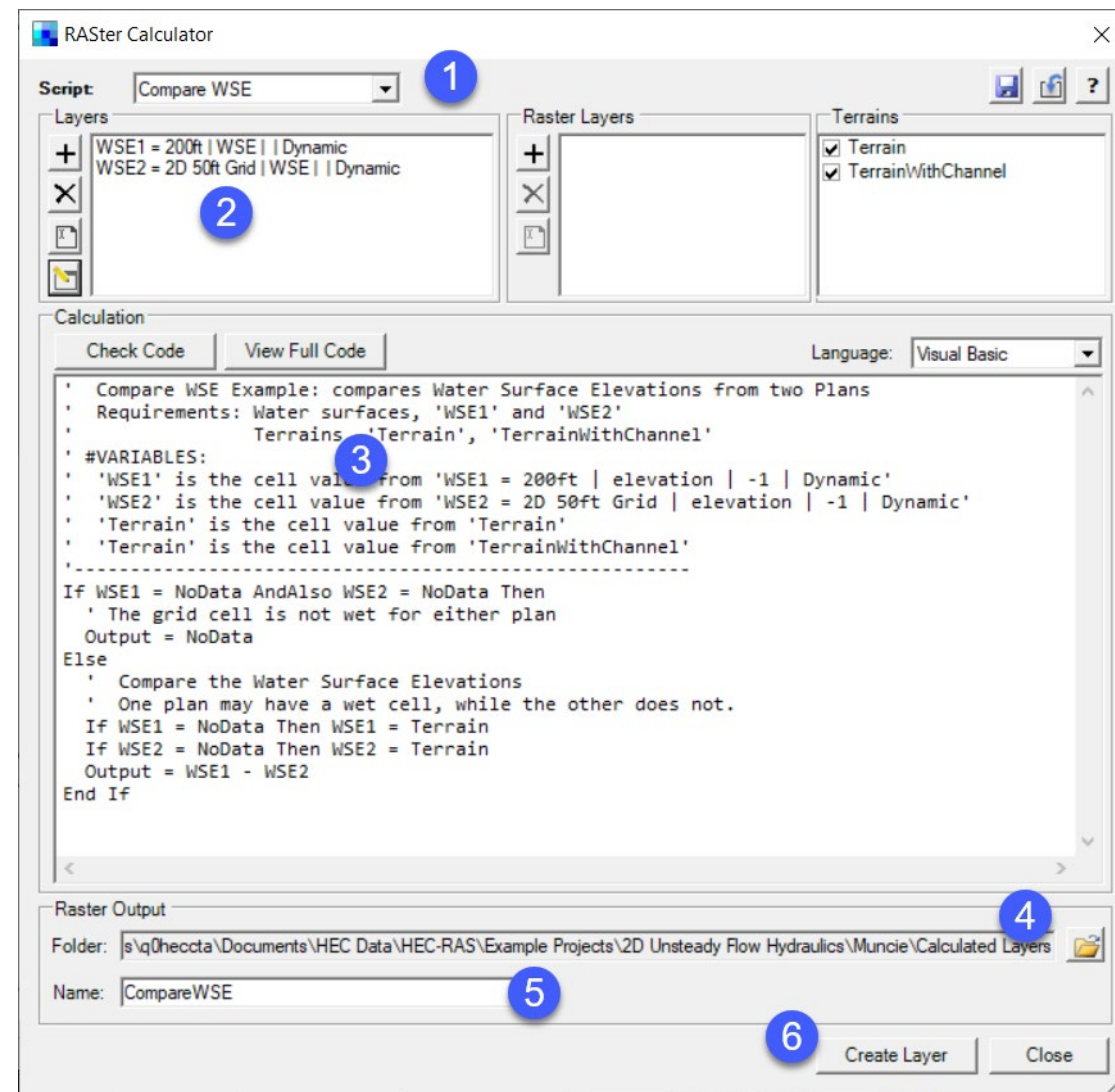
Dynamic Mapping - Animation





Calculated Layer

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





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

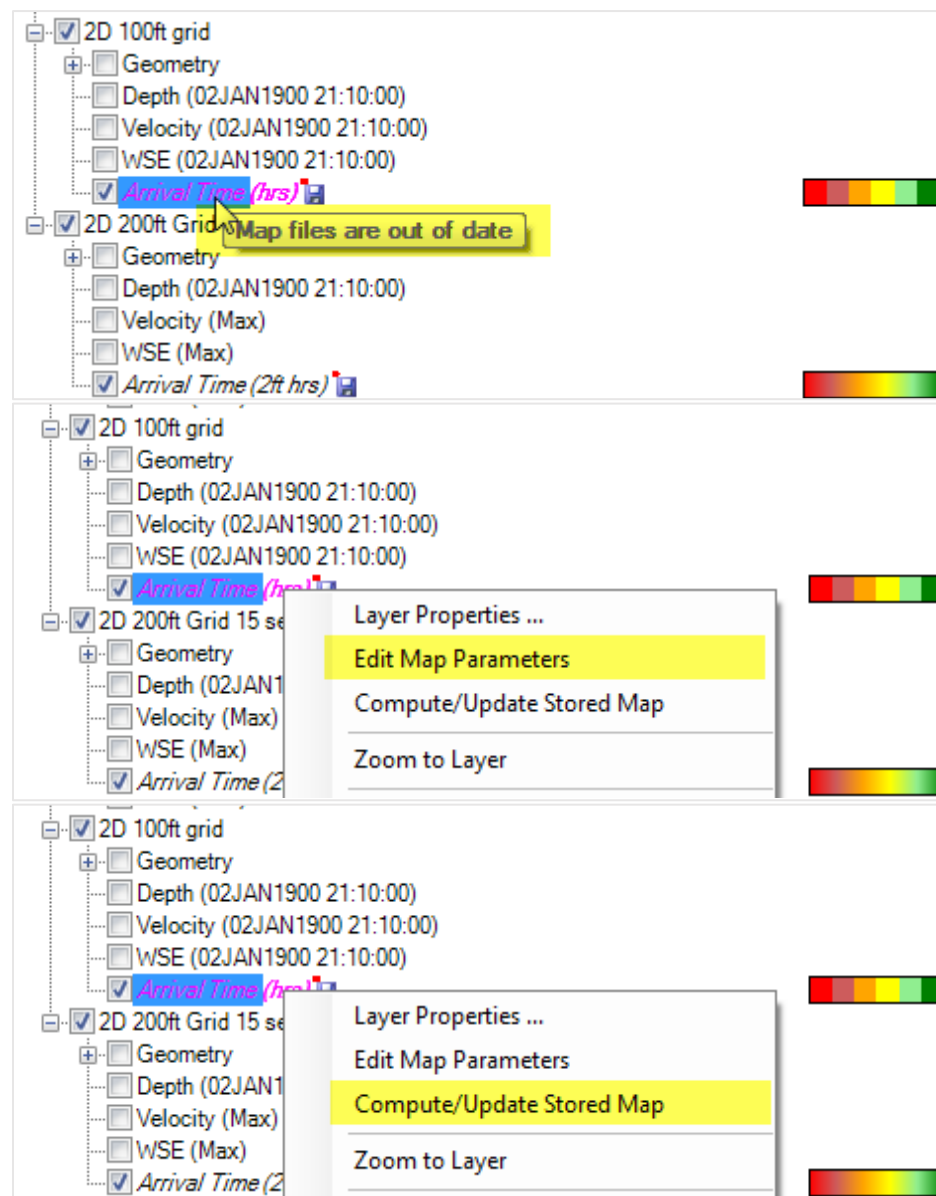


Stored Maps

- Map status message on cursor tool tip

Right-click options:

- Edit Map Parameters
- Compute Map





Results Layer Properties

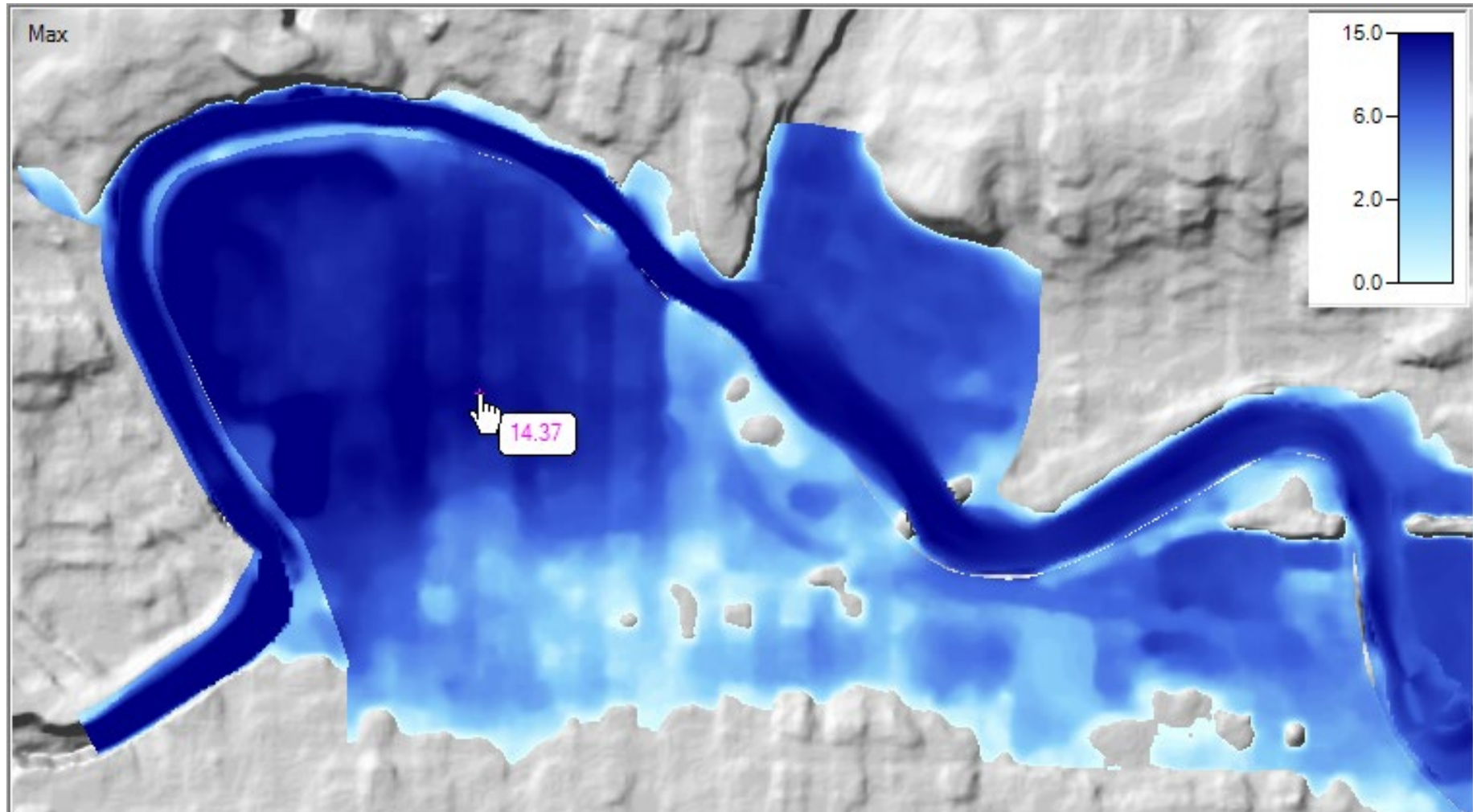
The screenshot displays the HEC-RAS interface with the 'arrival time - Layer Properties' dialog box open. The 'Visualization and Information' tab is active, showing options for 'Vector' and 'Surface' visualization. The 'Surface' section is checked, and the 'Discrete' option is selected. A color ramp is visible, ranging from 0.0 (red) to 16.0 (green). The 'Additional Options' tab is also open, showing the 'Select Surface Fill' dialog box. This dialog box allows for setting the 'Surface Symbol Settings', including the 'Color Ramp' (set to 'Arrival Time') and 'Keep user values with color ramp change' (checked). The 'Surface Symbol' section shows 'Max: 16.00', 'Interval Type: Linear', 'Min: 0.00', and 'No. Values: 6'. A table below provides the color values for each interval.

Value	Color	Red (0-255)	Green (0-255)	Blue (0-255)
0.00	Red	255	0	0
2.00	Red-Orange	205	92	92
4.00	Orange	255	165	0
8.00	Yellow	255	255	0
12.00	Light Green	144	238	144
16.00	Green	0	128	0

Messages: Creating Post Process completed [65 ms]
Stored map 'Arrival Time (hrs)' created.
Stored map 'Arrival Time (2ft hrs)' created.



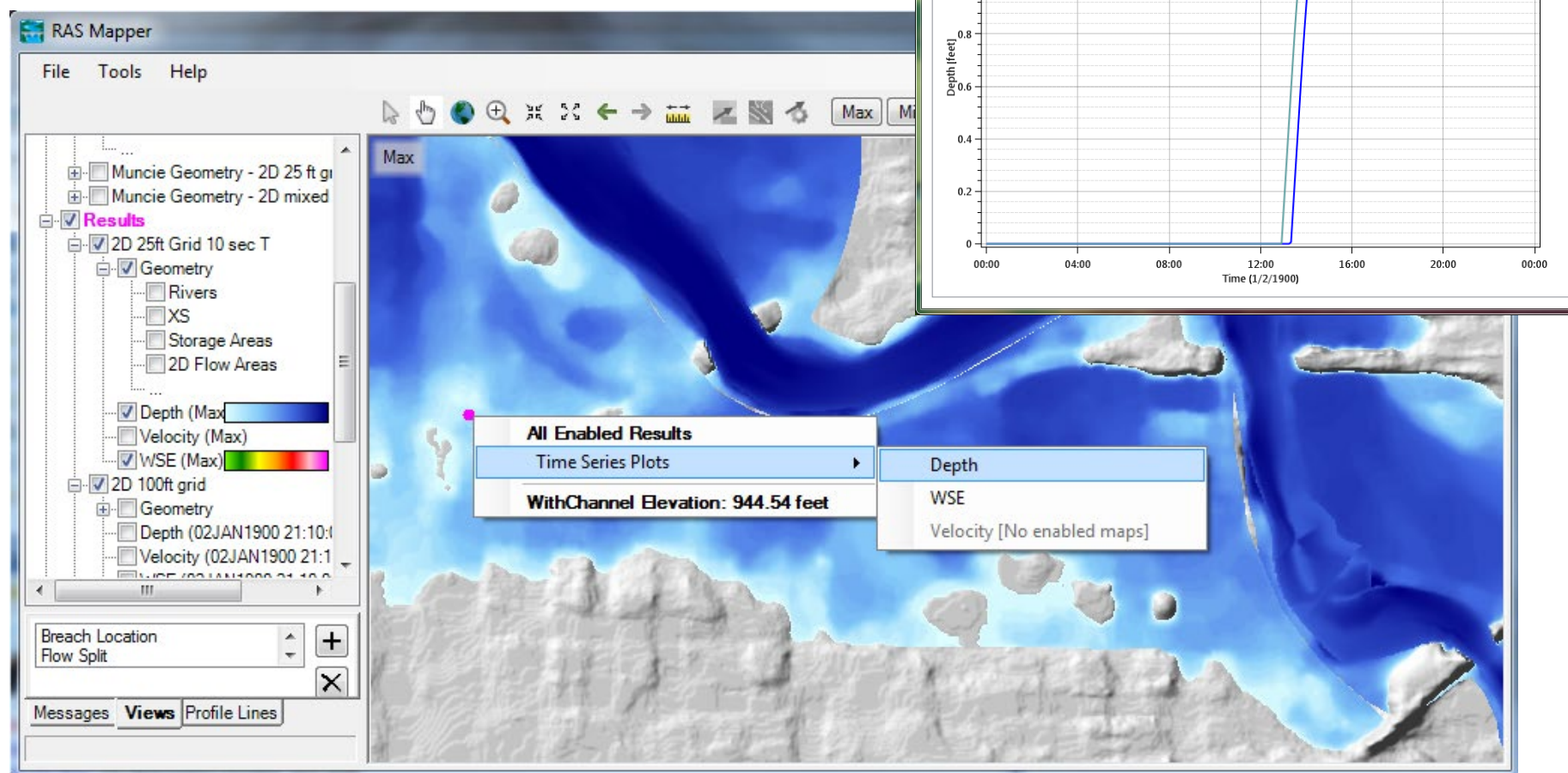
Results Visualization





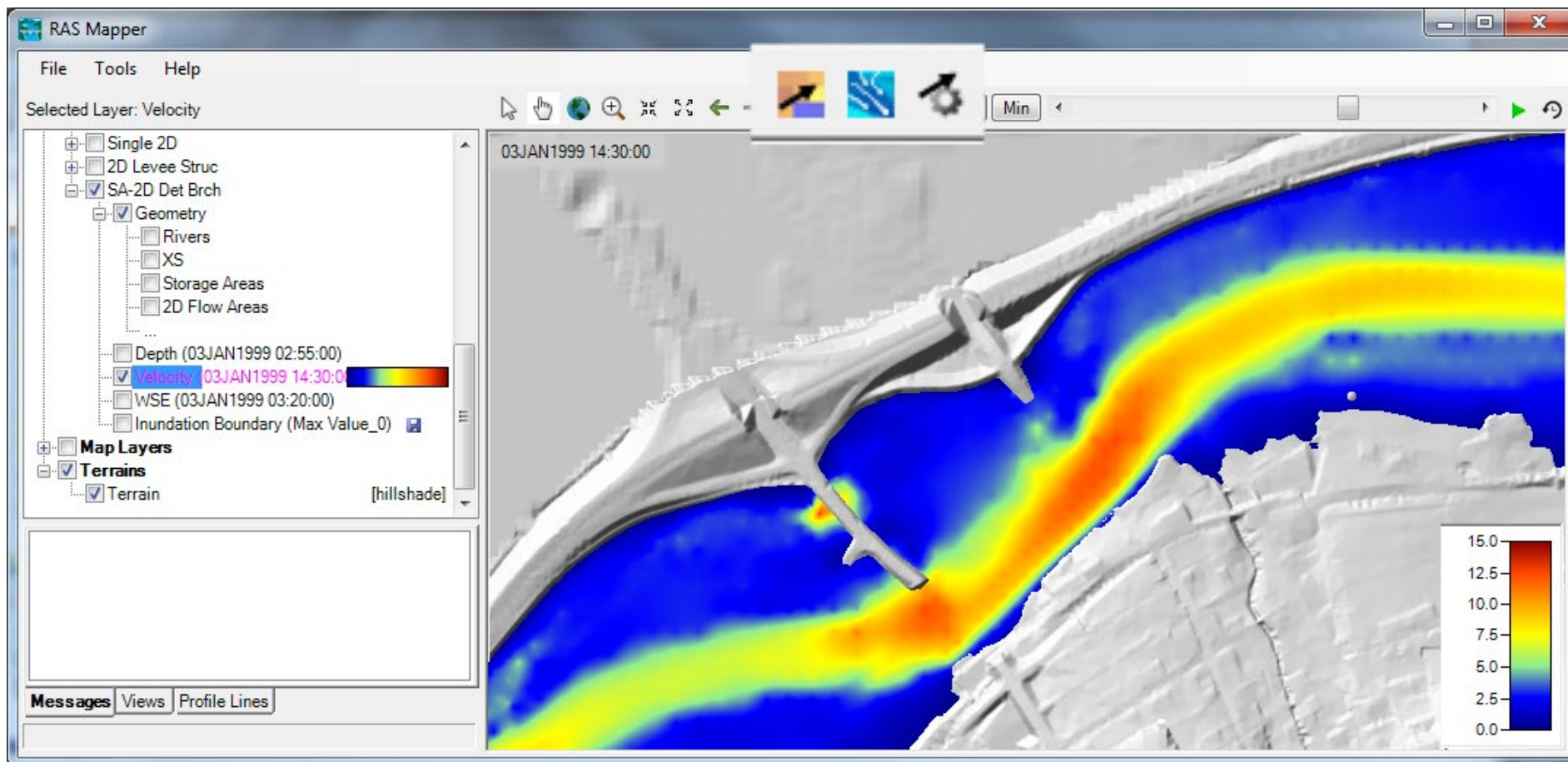
Results Query

- Time Series



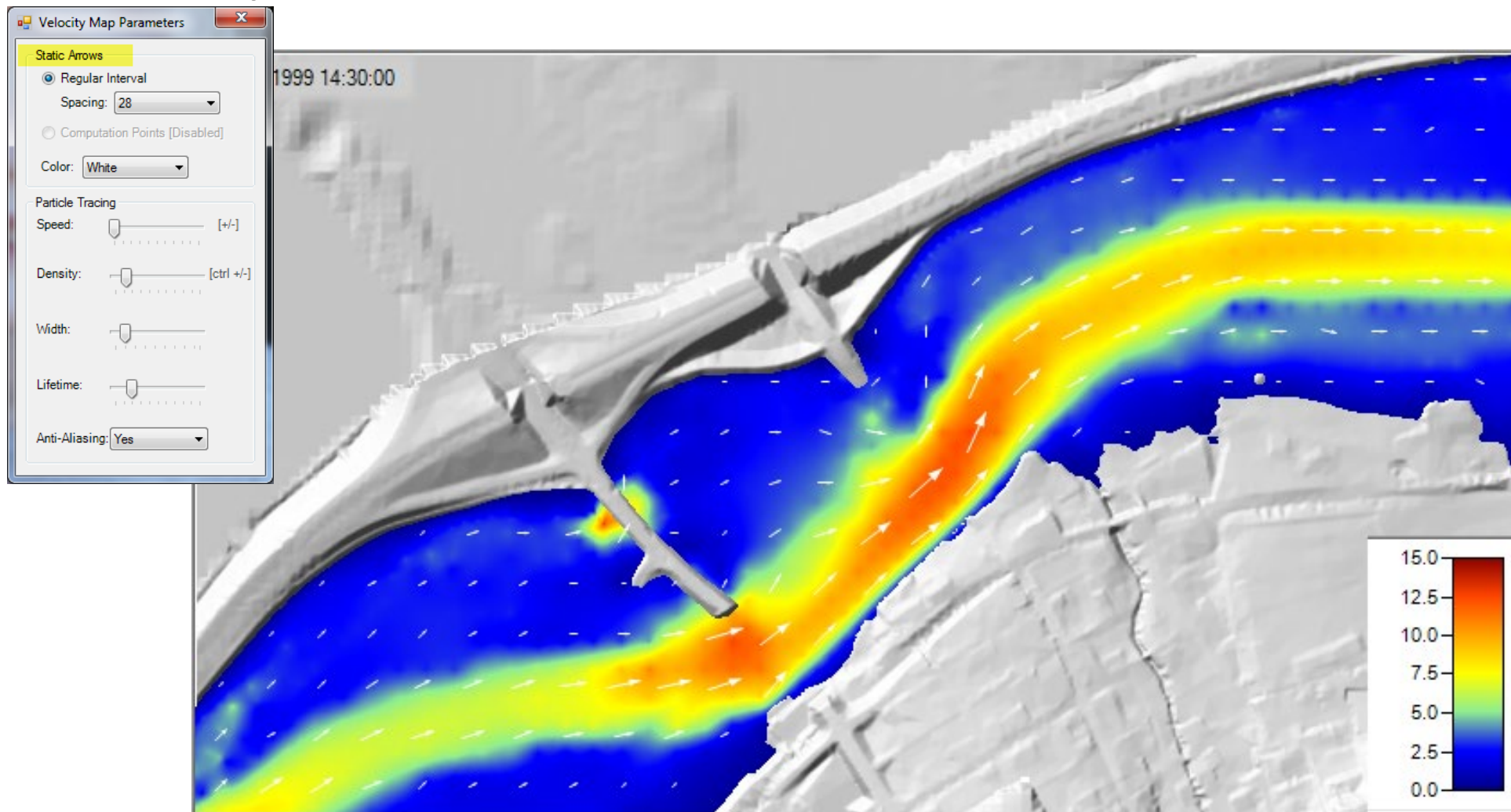


Velocity Results



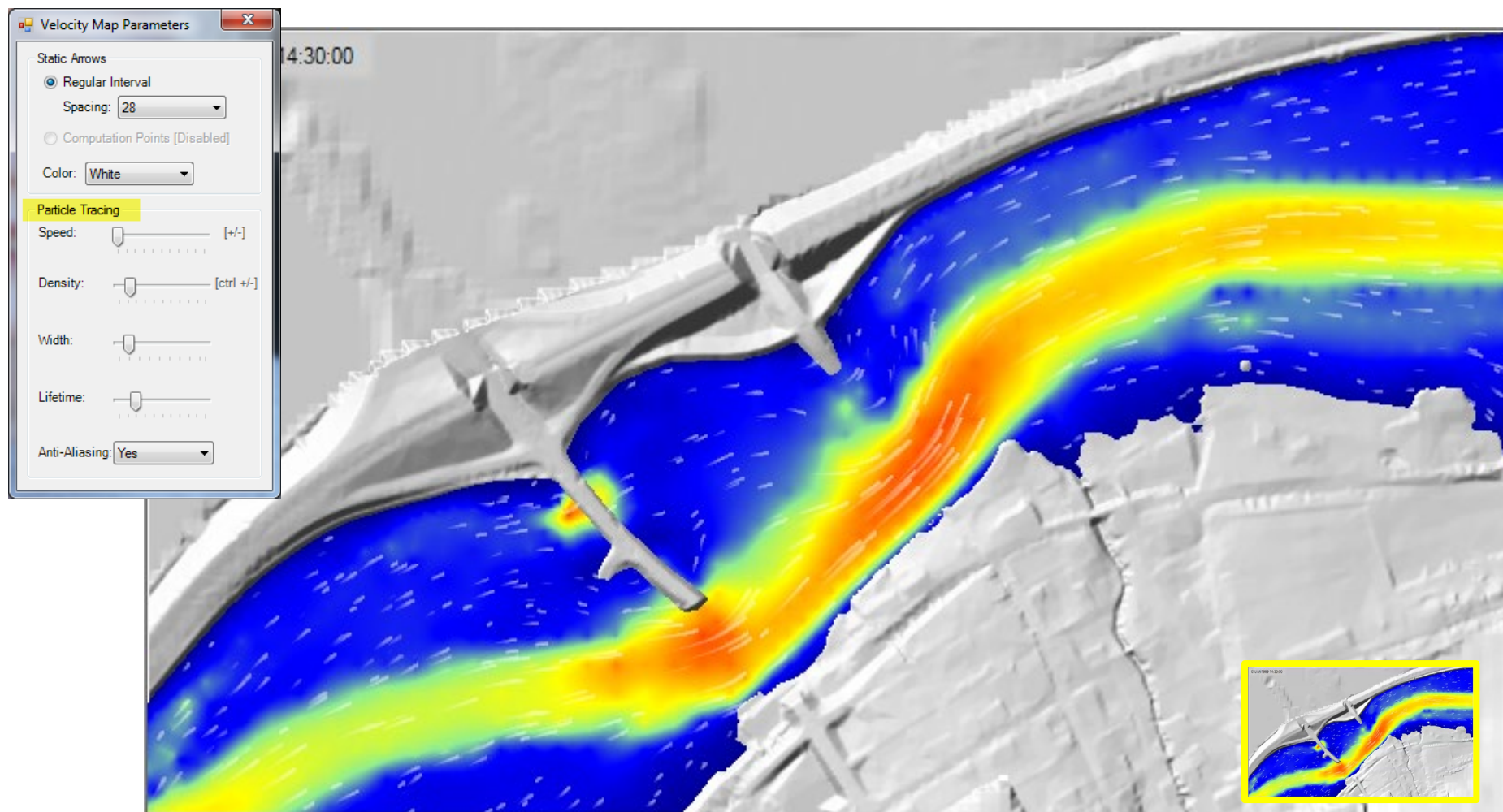


Velocity Arrows



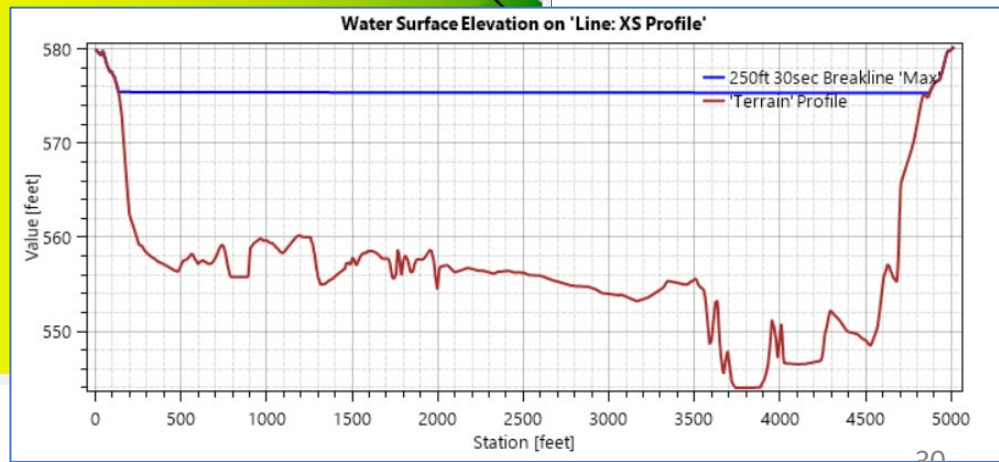
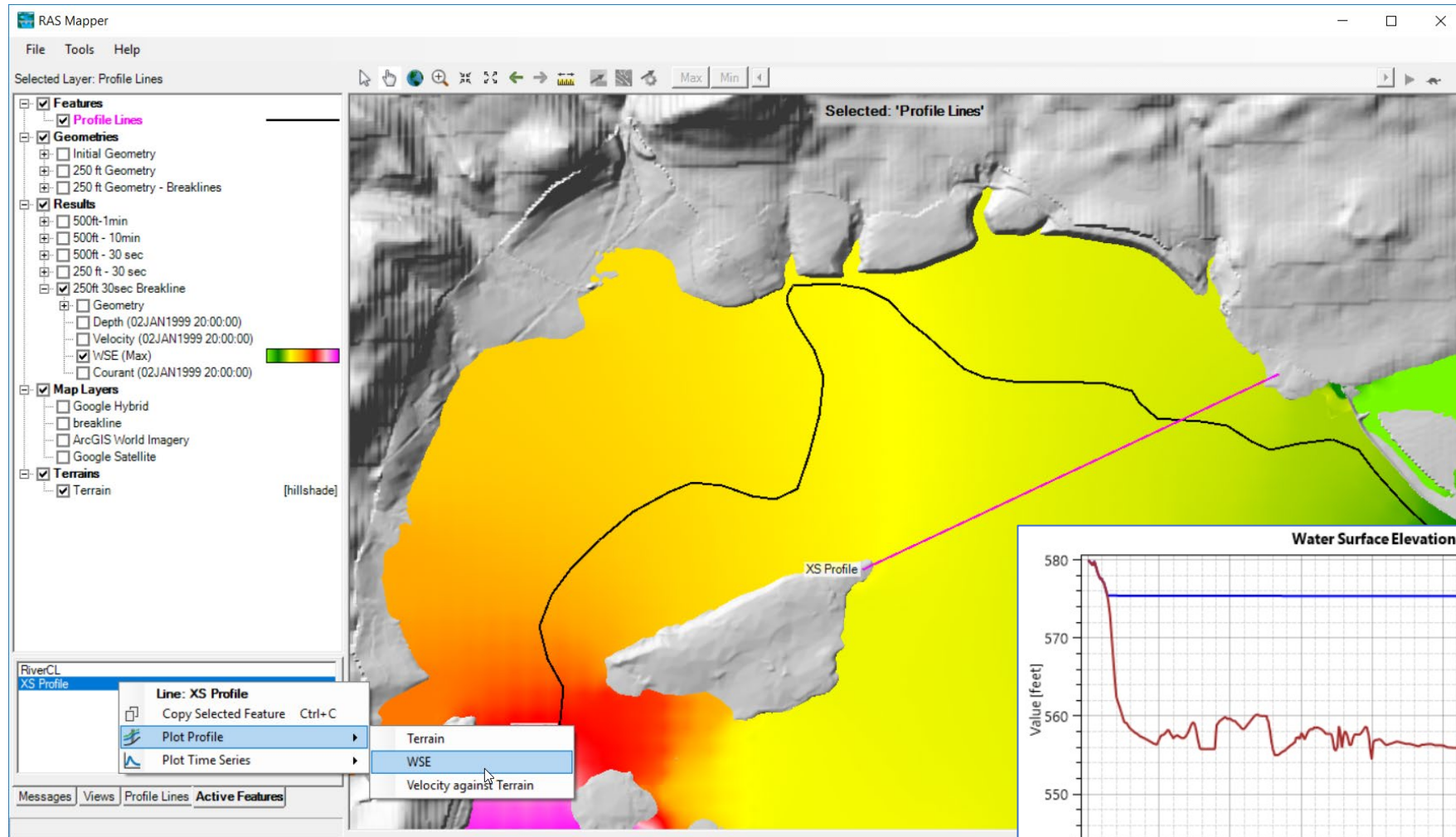


Velocity Tracing





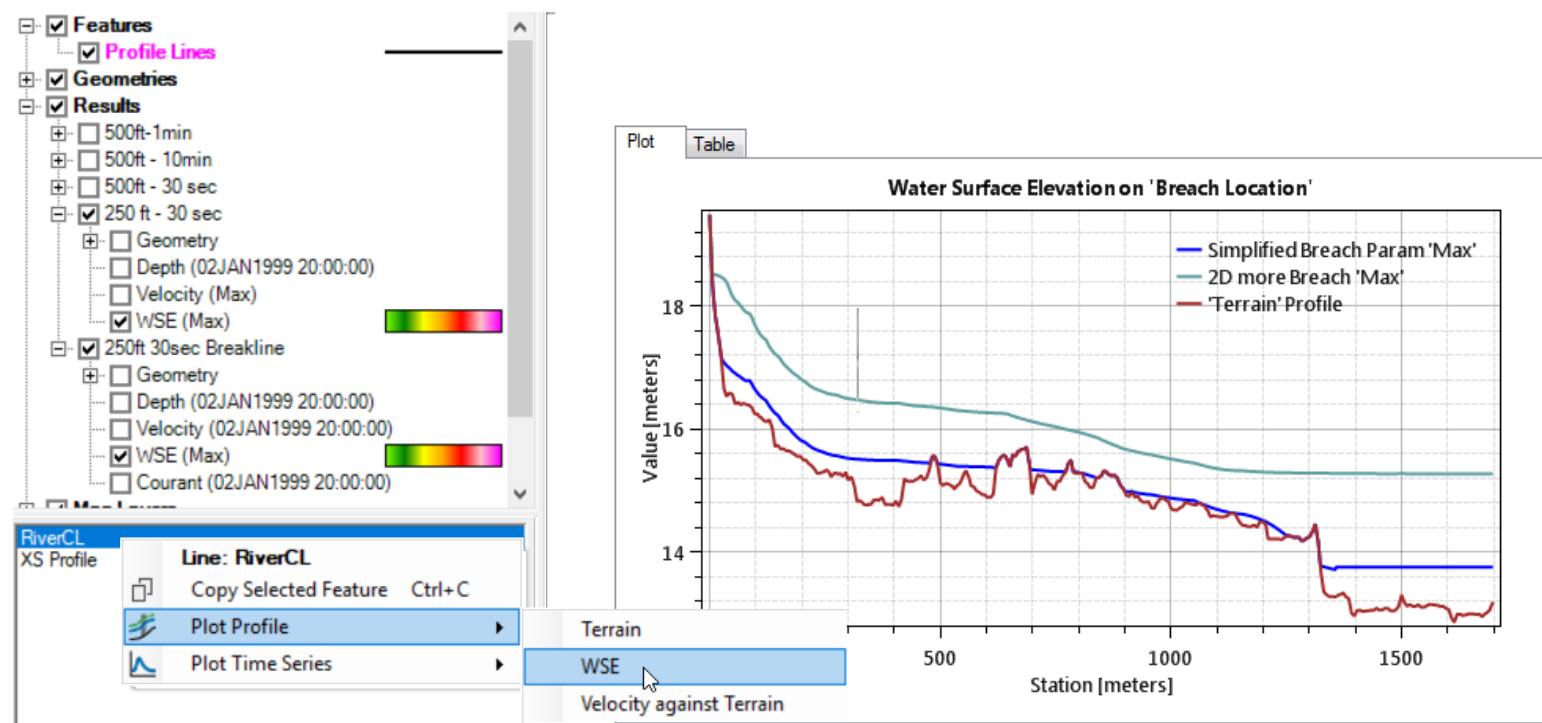
Profile Lines





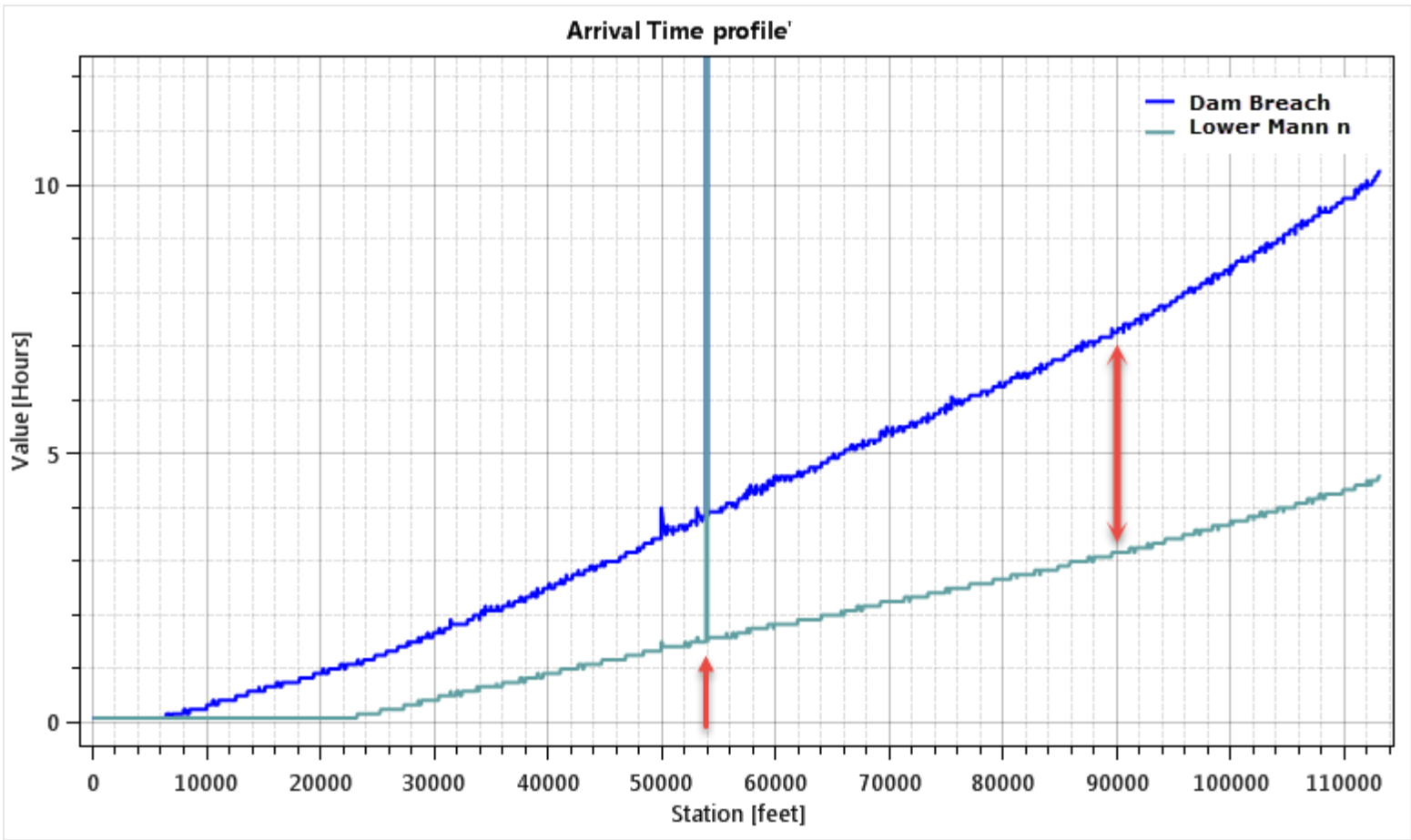
Profile Line - Comparison

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



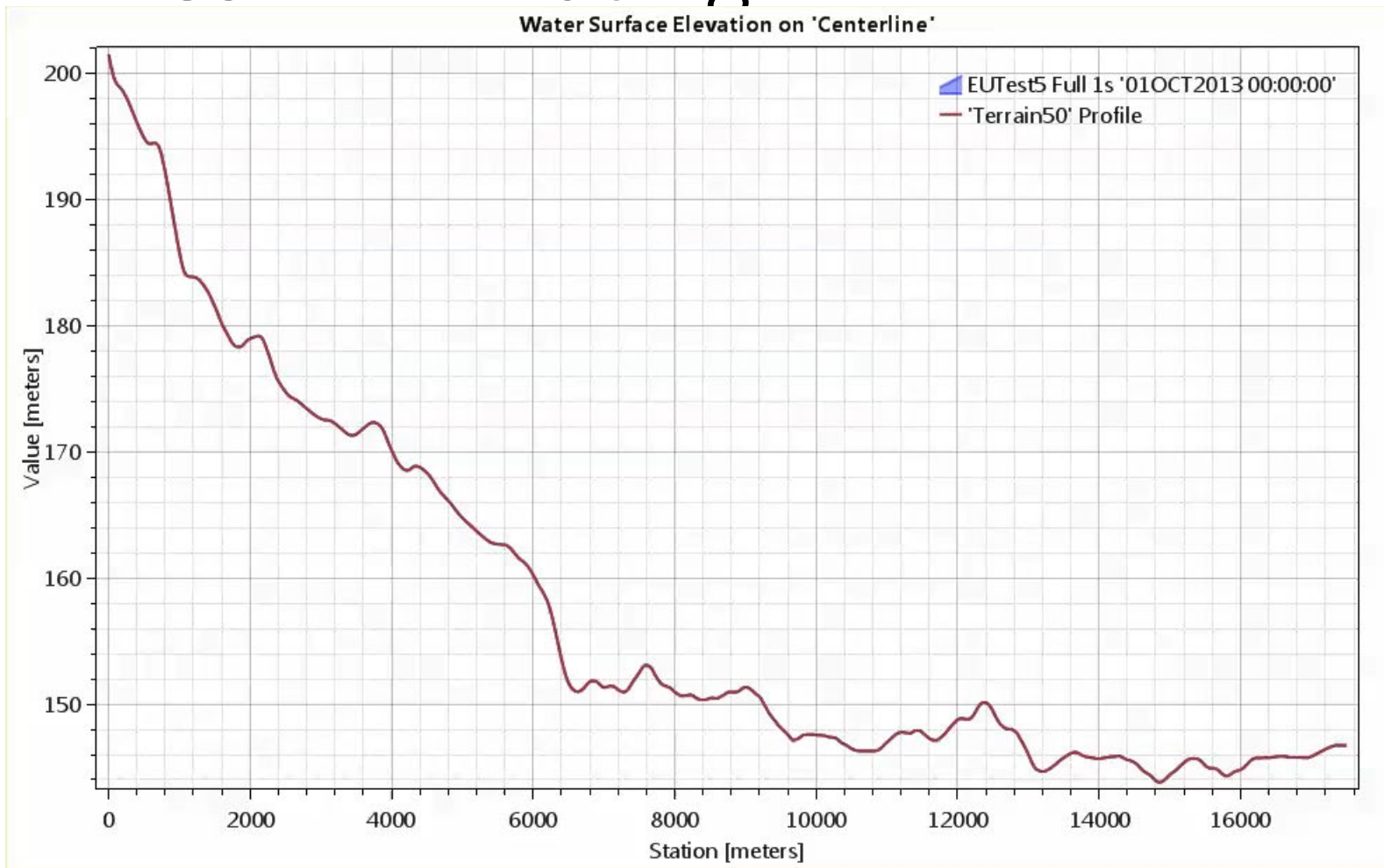


Profile Lines - Comparison



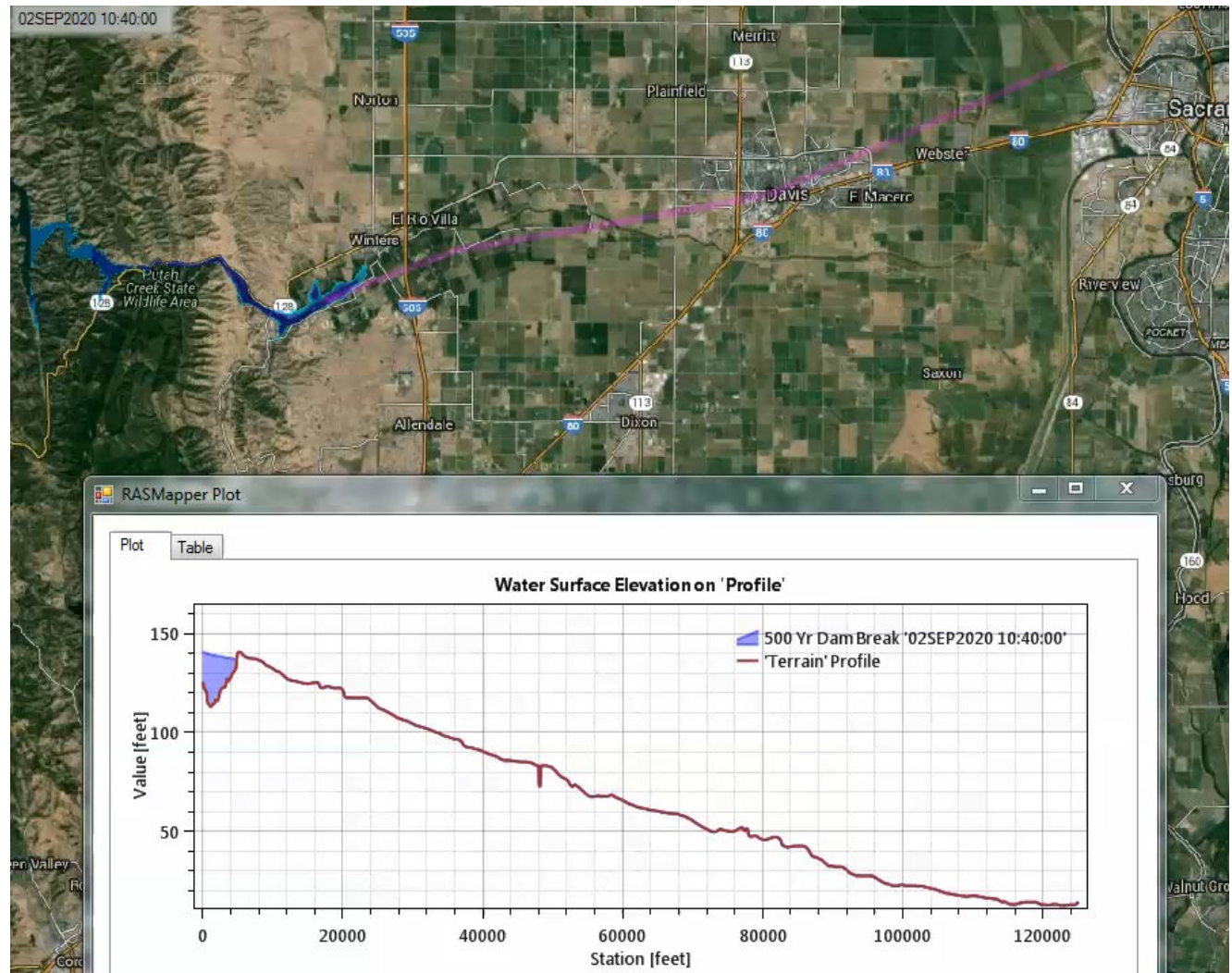


Profile Lines - Animating



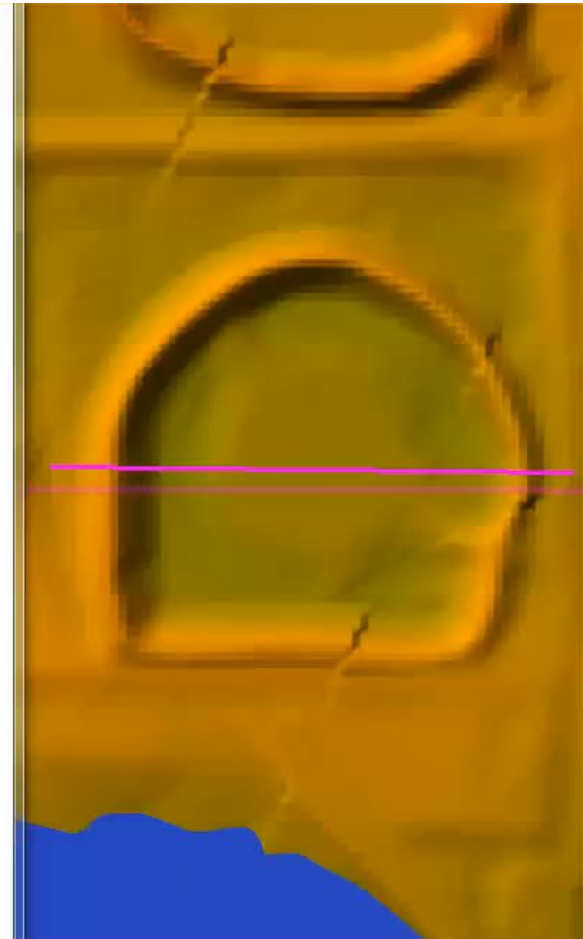
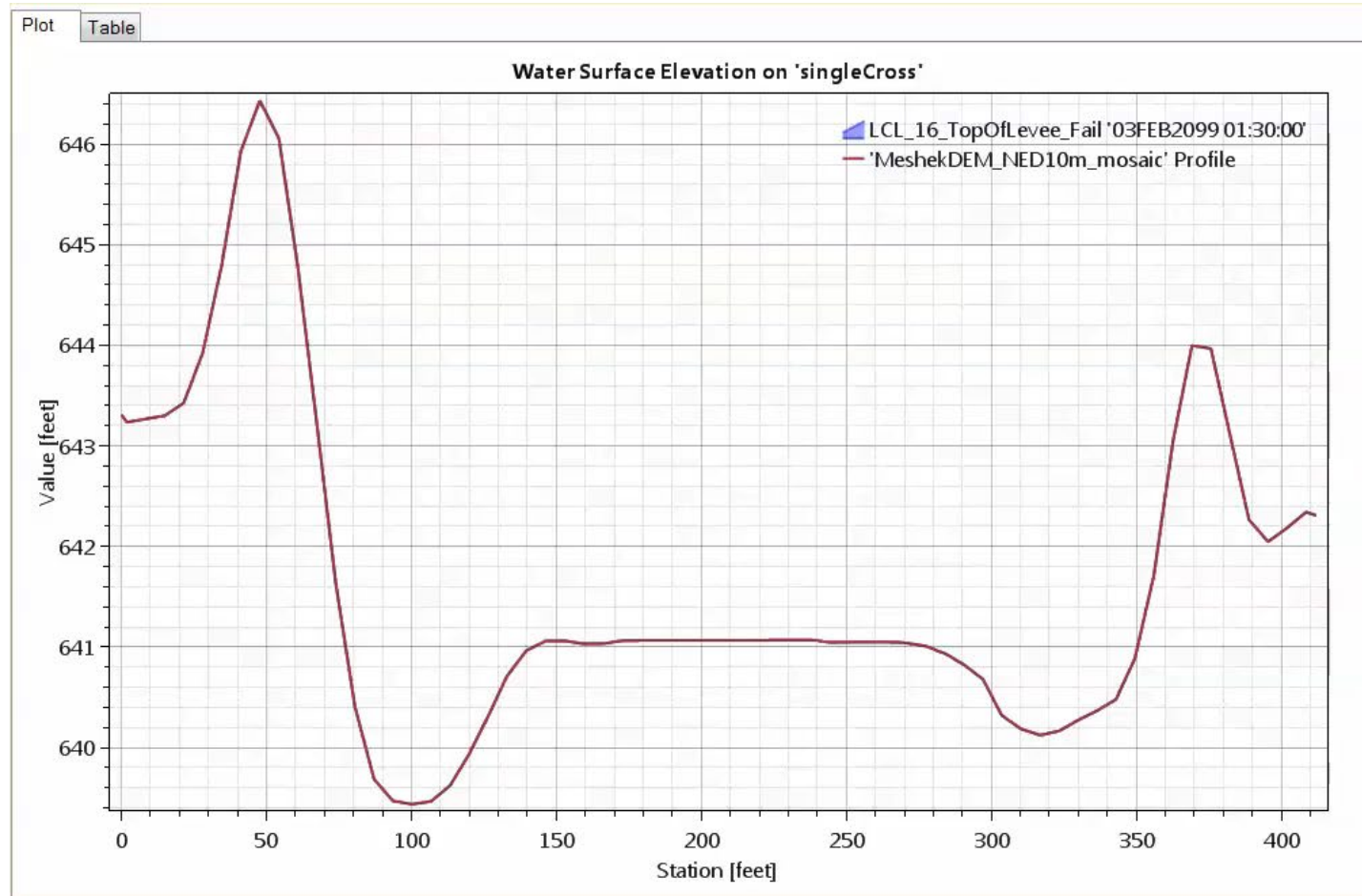


Profile Lines + Spatial Results



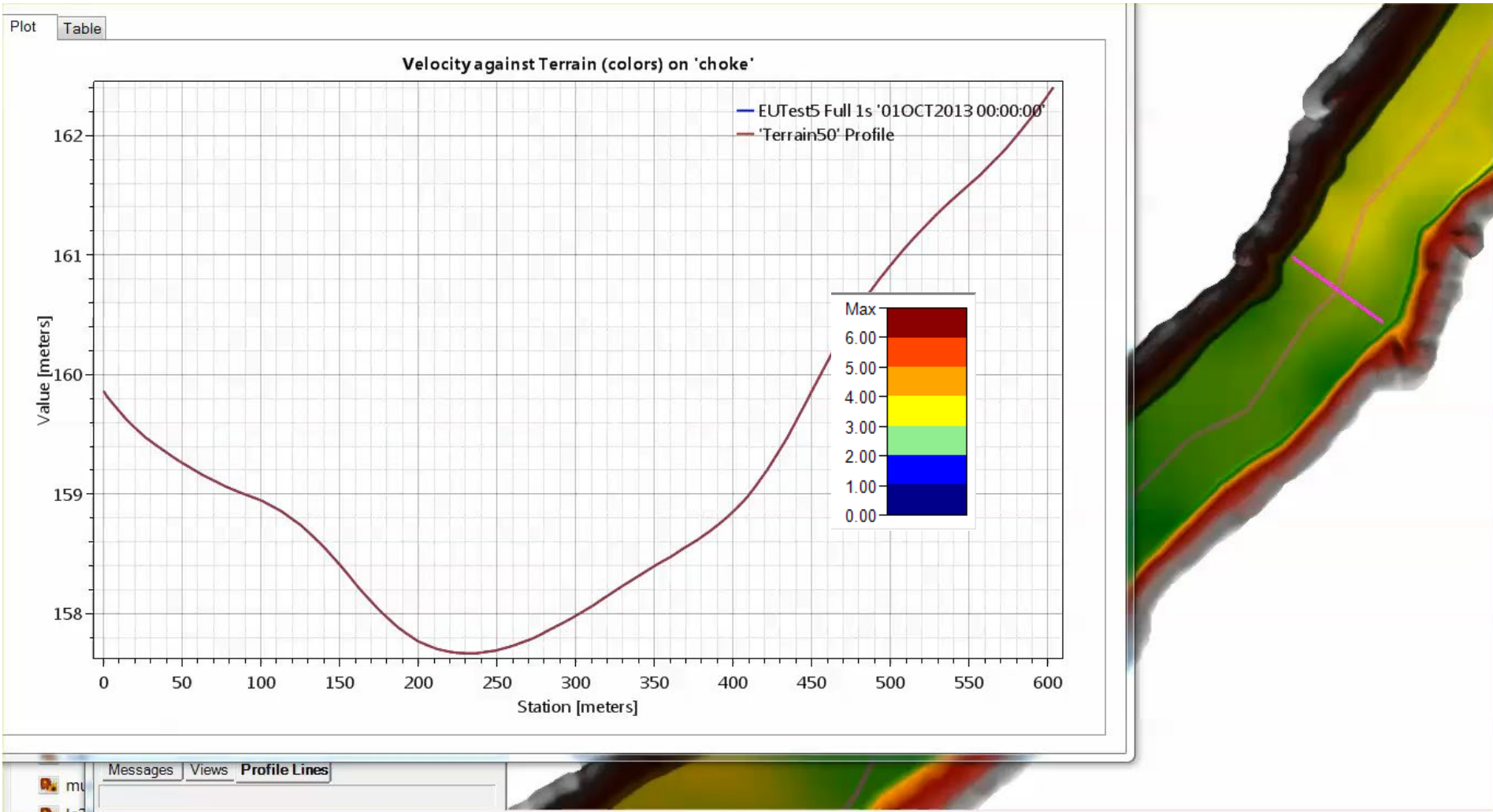


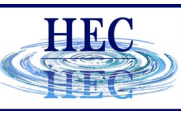
Profile Lines - Animating



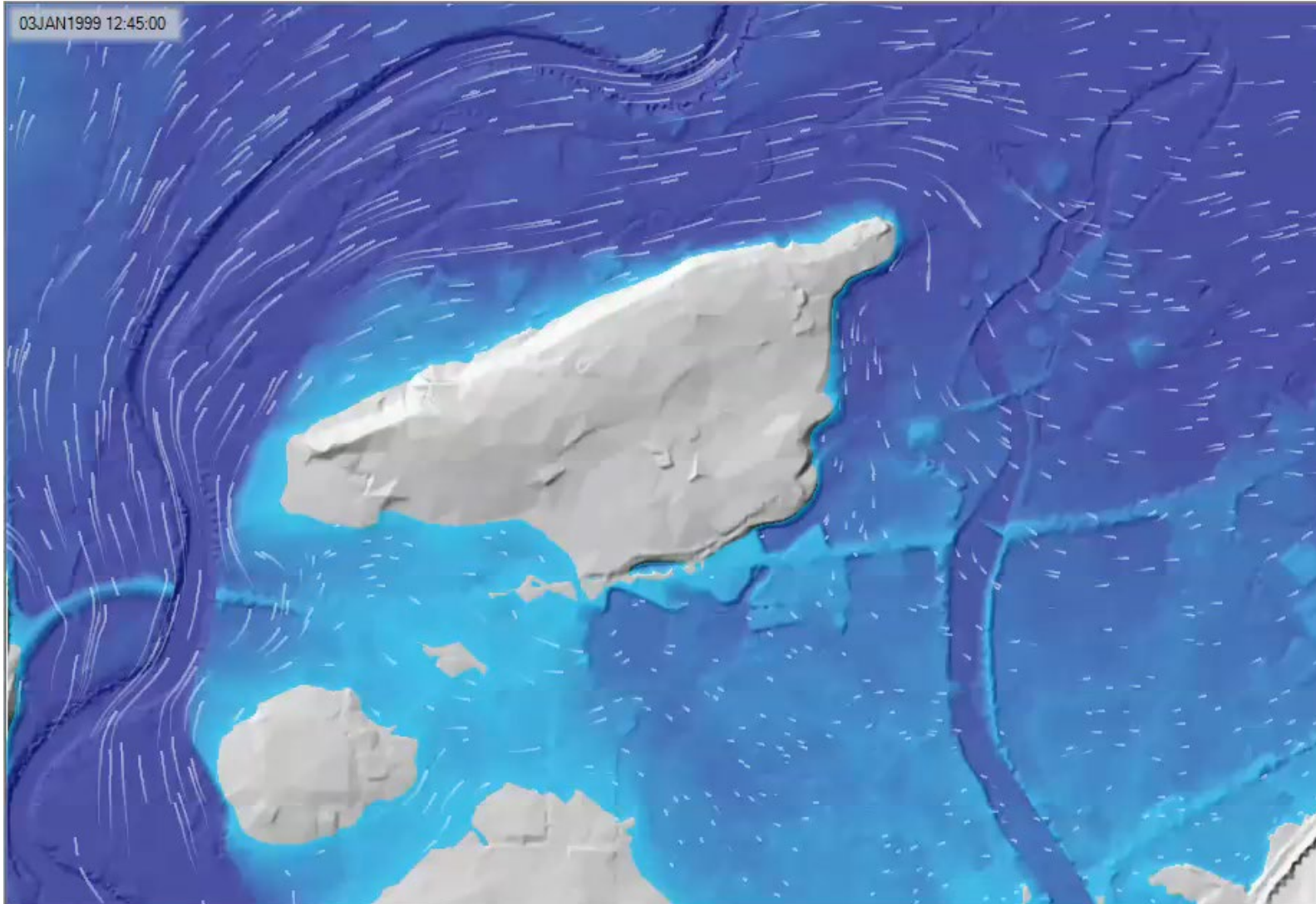


Profile Lines – Velocity





Velocity Trace Animation



Questions?