HEC-RAS 2D
Mesh Generation
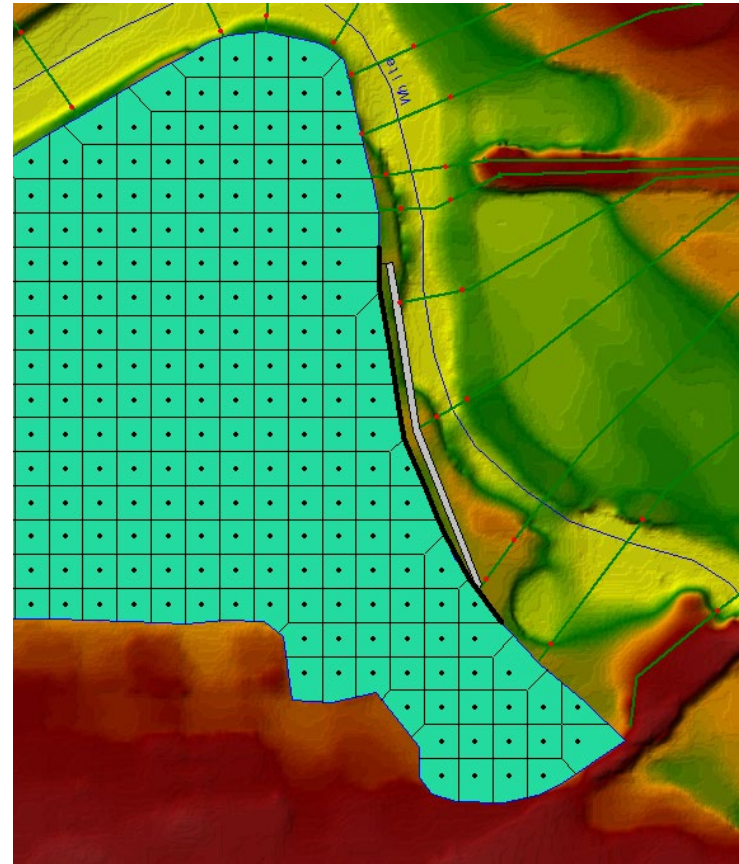
Mark Jensen

Cameron Ackerman, PE, D.WRE

USACE, Institute for Water Resources, Hydrologic Engineering Center
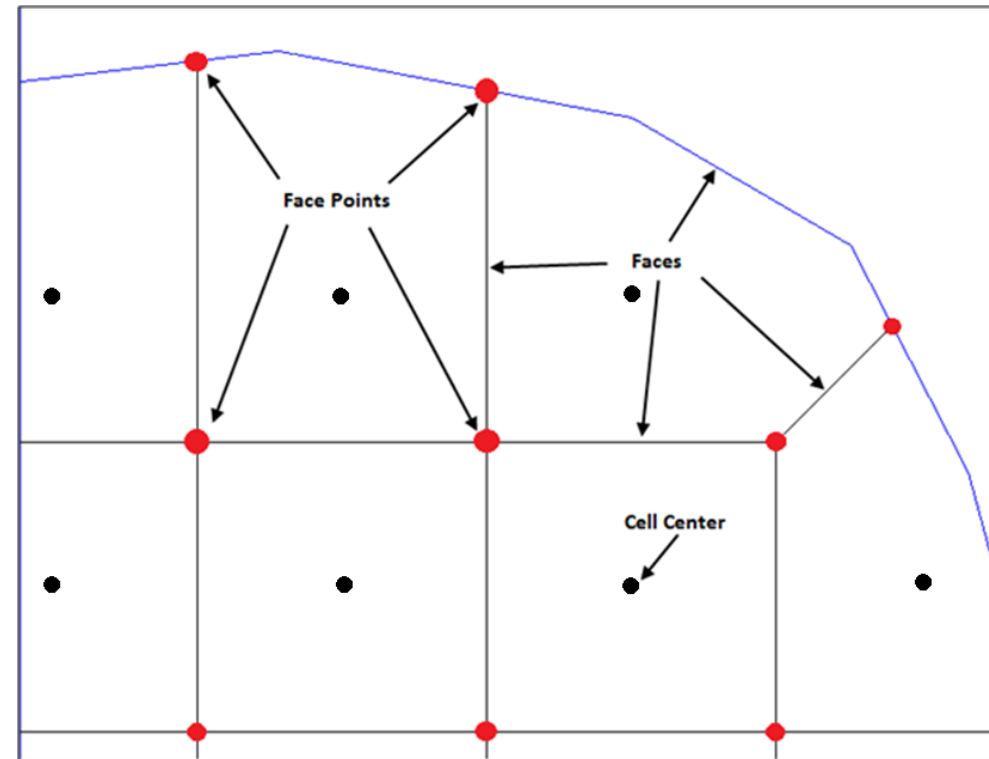
Overview

- Common Terms

- How to Create a Mesh

- Limitations

- Fixing Mesh Problems

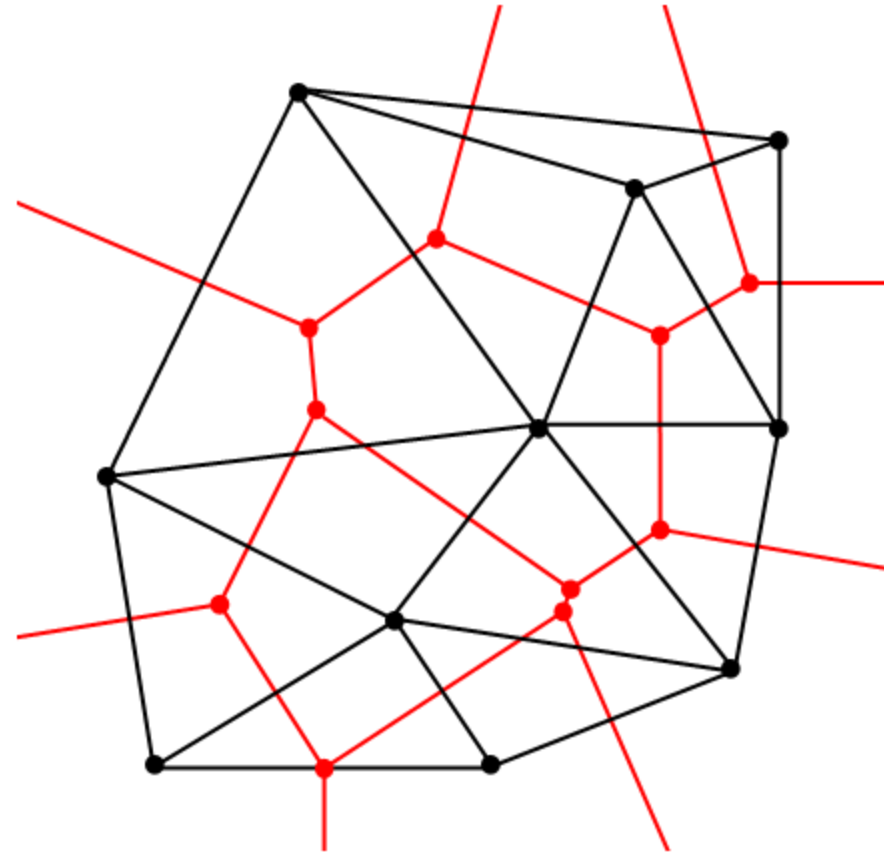- Hydraulic Property Tables

Finite Volume Mesh

- Naming Convention
  - Face Points
  - Faces
  - Cells
  - Computation Points (center)

Mesh Generation

- Define mesh boundary and triangula[...]
dots)

- Face Points (red dots) are triangle ci[...]

- Faces (red lines) connect face points[...]

- Faces are also "Enforced" with inter[...]

Create 2D Flow Area Mesh in RAS Mapper

- Meshes are generated from a set of computation points with consideration to polygons and breaklines.

- Steps/Features used to create a mesh:
  - Perimeter Polygon
  - Computation Points
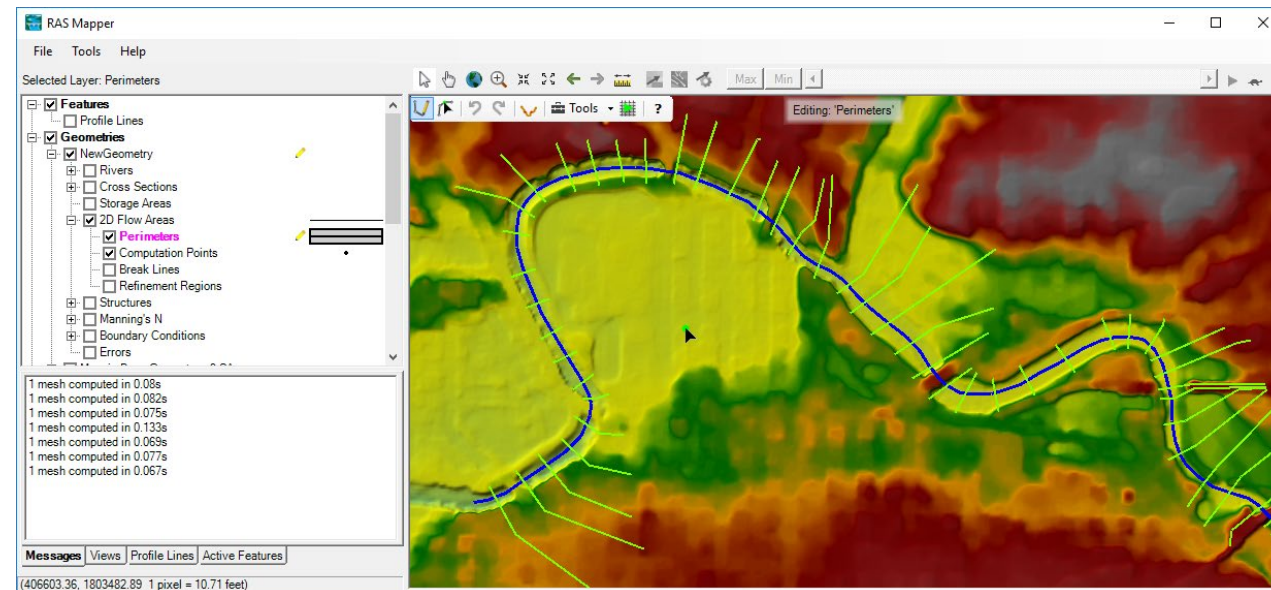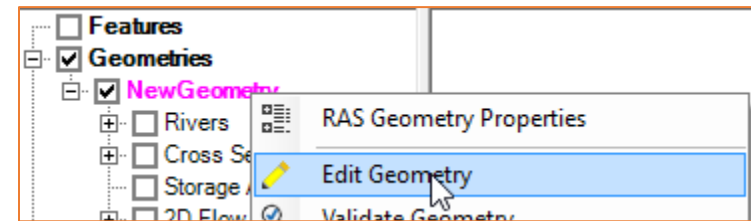 - Breaklines (Optional)
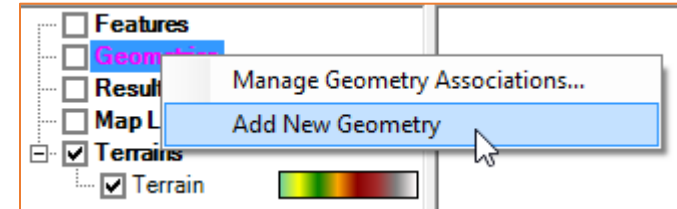 - Refinement Regions (Optional)
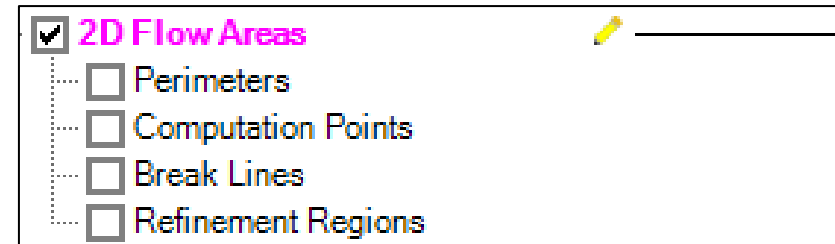
- Creating a good mesh is an iterative process!

Editor Access

- Create a New Geometry

- Edit Geometry

- Edit Toolbar

- Select Layer

Editing

- Add New Feature
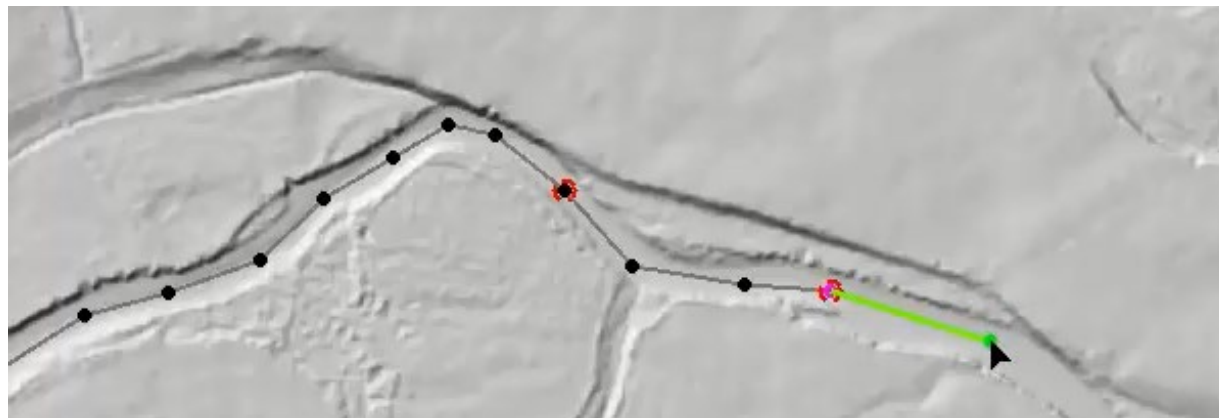- Select/Edit Feature
- Undo/Redo
- Plot Profile
- Tools
- Help

Add New Feature

- Left-click to start adding a new point, line, or polygon

- Double-click to end a line or polygon

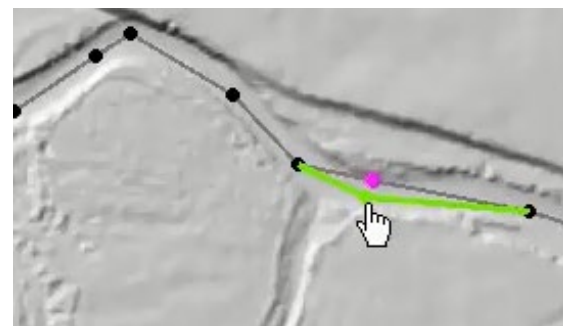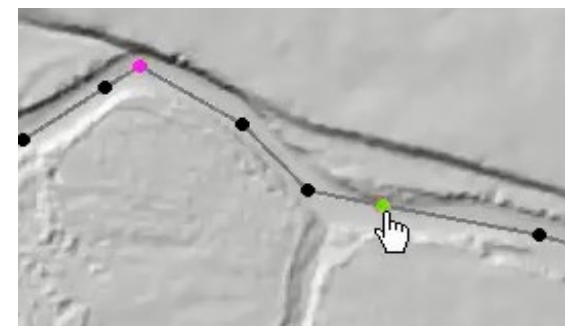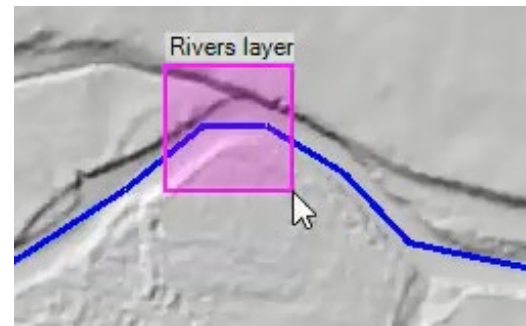- Pan by switching to Pan tool, Shift key, Middle Mouse, or right-click to re-center.
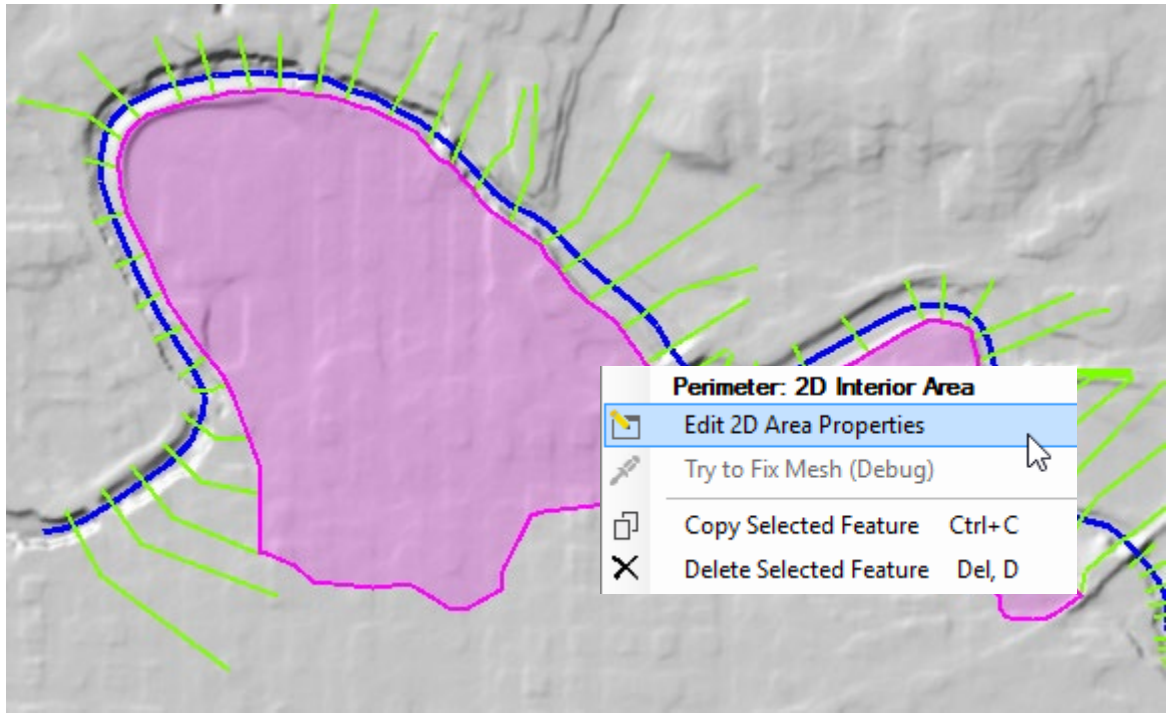
Select / Edit

- Select / Edit tool is used to select feature(s) and then begin editing (move, add points, delete, etc).
    - Double-click to Start Editing (Open feature)
    - Double-click to End Editing (Close feature)

- Mouse hover indicates action
    - Green point indicates: Move, Insert, Delete point
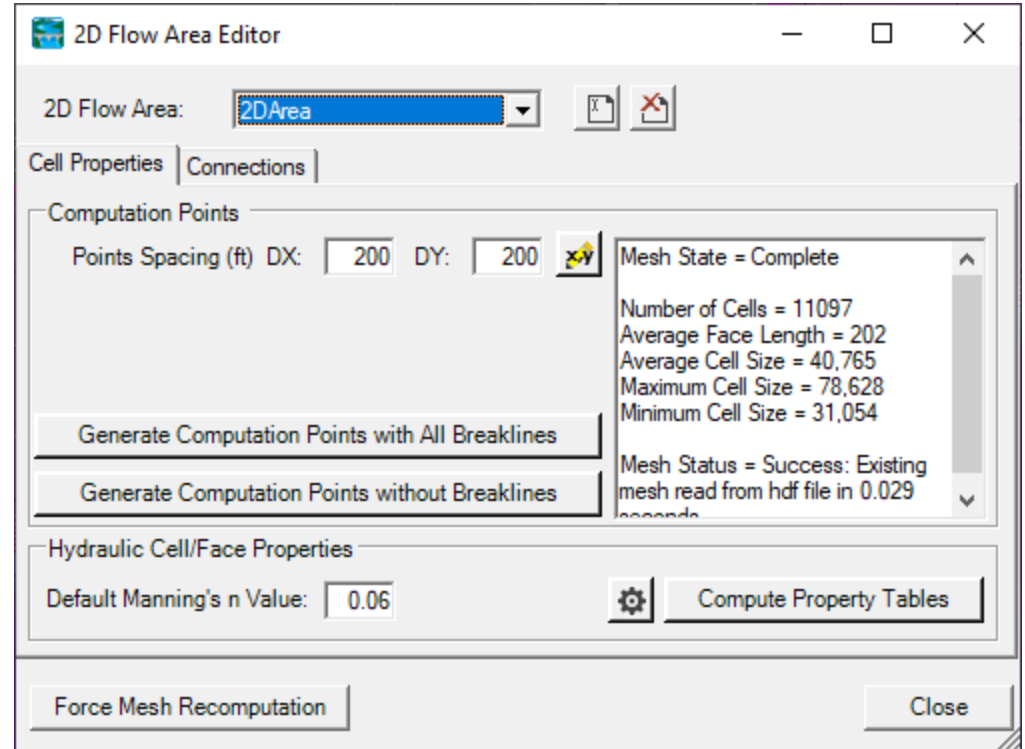
2D Flow Area

☑ 2D Flow Areas
    ☑ Perimeters
    ☐ Computation Points
    ☐ Break Lines
    ☐ Refinement Regions

- Draw Perimeter

- 2D Flow Area Editor

Computation Points

☑ 2D Flow Areas
   ☑ Perimeters
   ☑ Computation Points
   ☐ Break Lines
   ☐ Refinement Regions

- Generate Computation Points at an even interval
  - Breaklines and Refinement Regions area enforced

- Default n Value

- Hydraulic Table Property Tolerances

Computation Points

- Mesh is generated from resultant set of computation points.

Create 2D Flow Area Mesh from an existing Storage Area

- **Converting Existing Storage Area**
  - Click convert button
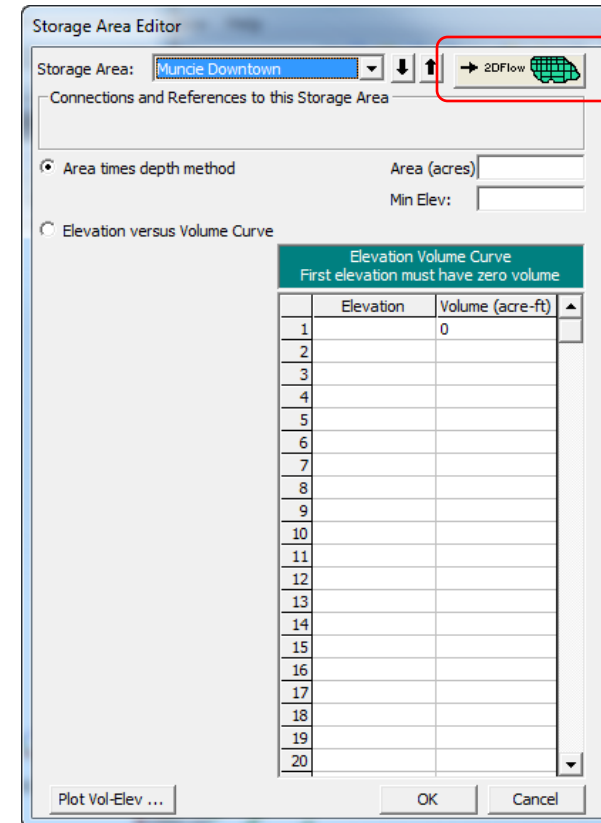
Hydraulic Property Tables

- Computation engine uses hydraulic property tables to represent the geometry of the system
- Cells
  - Elevation/Volume
- Faces
  - Elevation/Area
  - Elevation/Wetter Perimeter
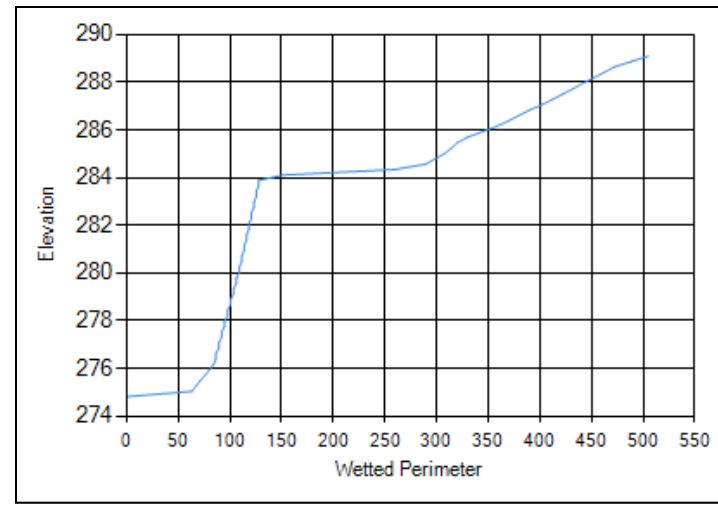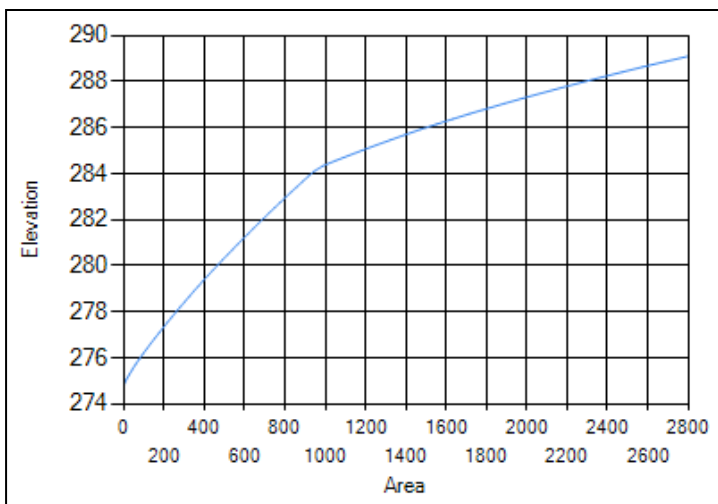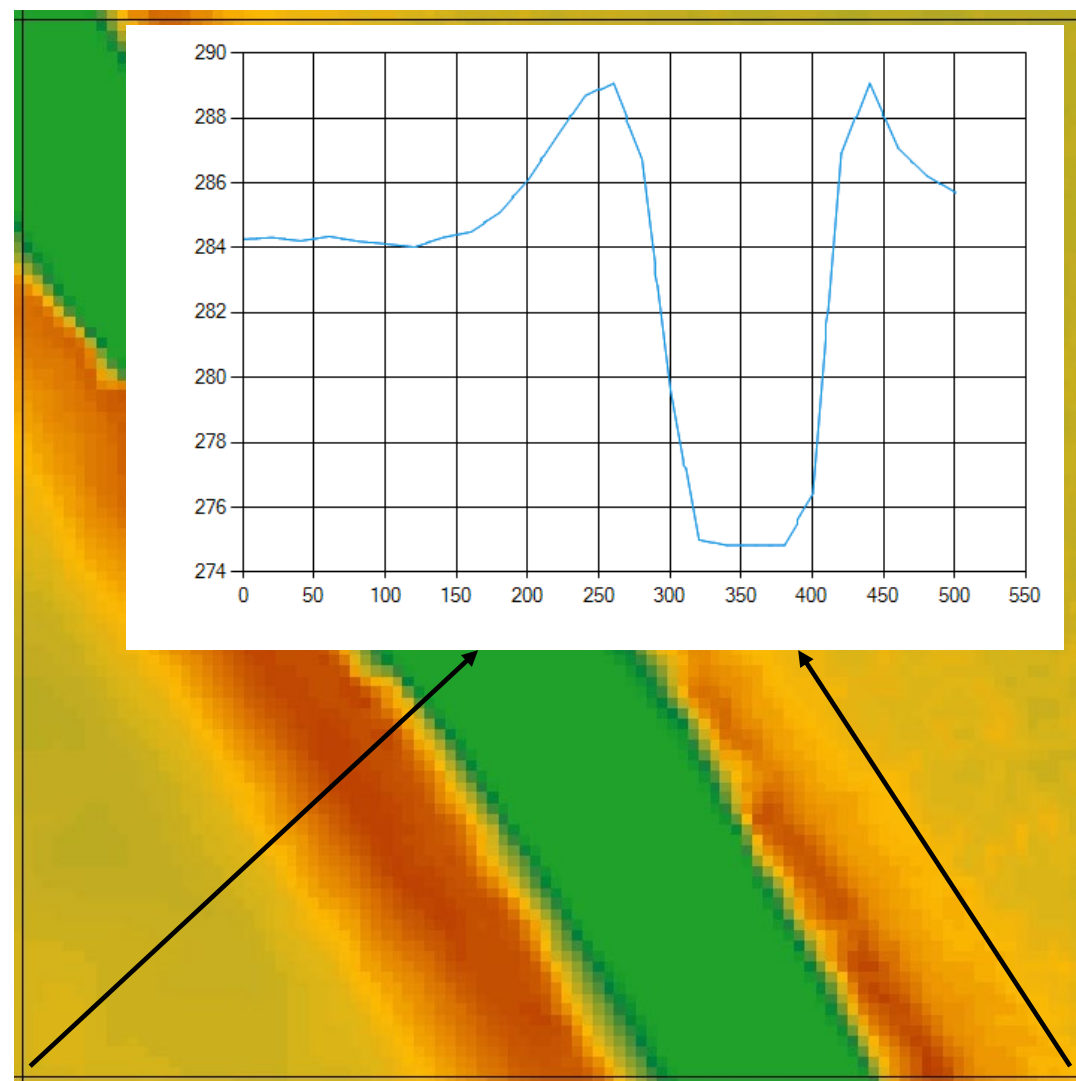 - Elevation/Manning's n
  - (all from station elevation profile)

Benefits of Hydraulic (Sub-grid) Tables

• Can model small channels in larger cells
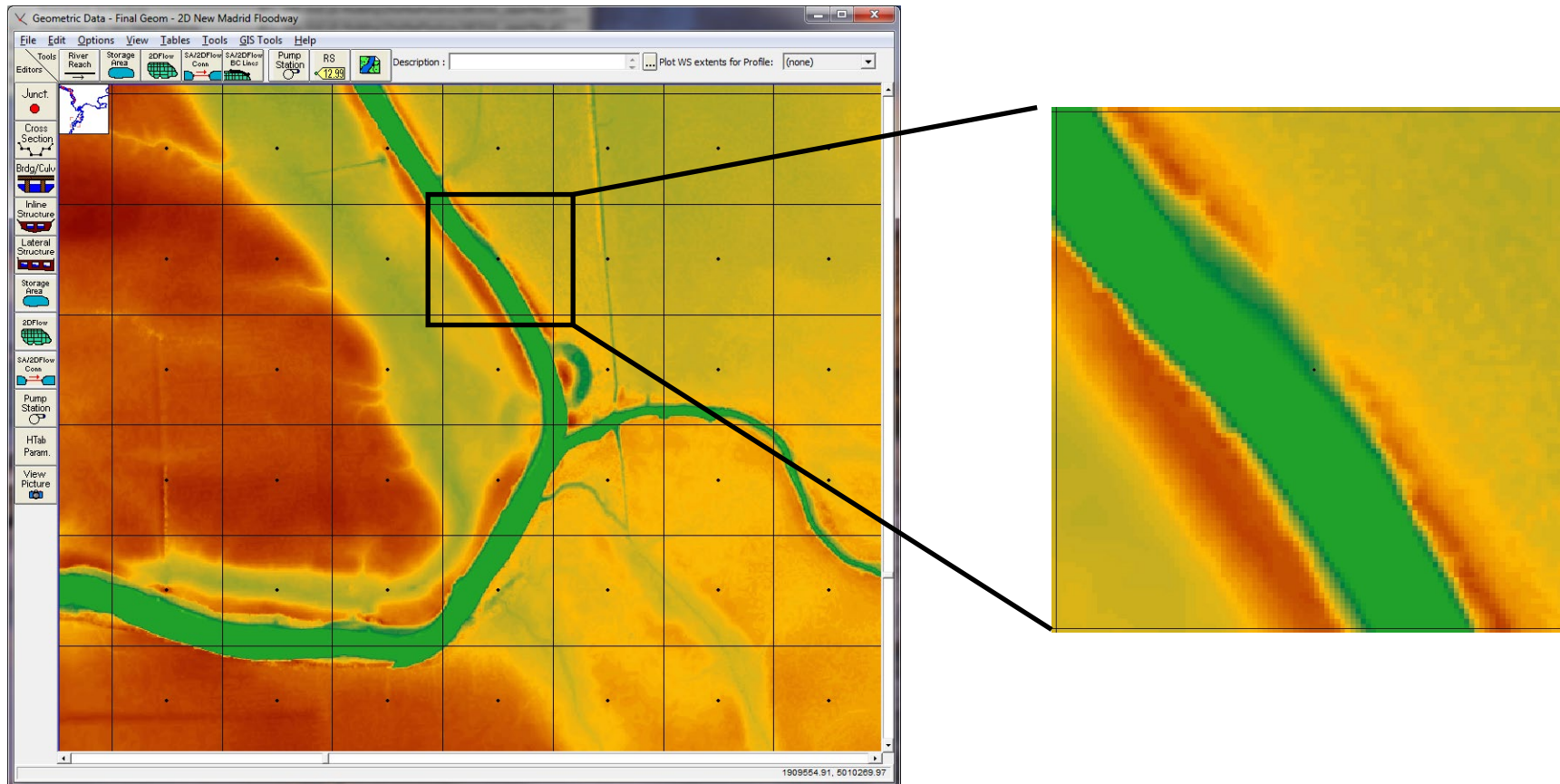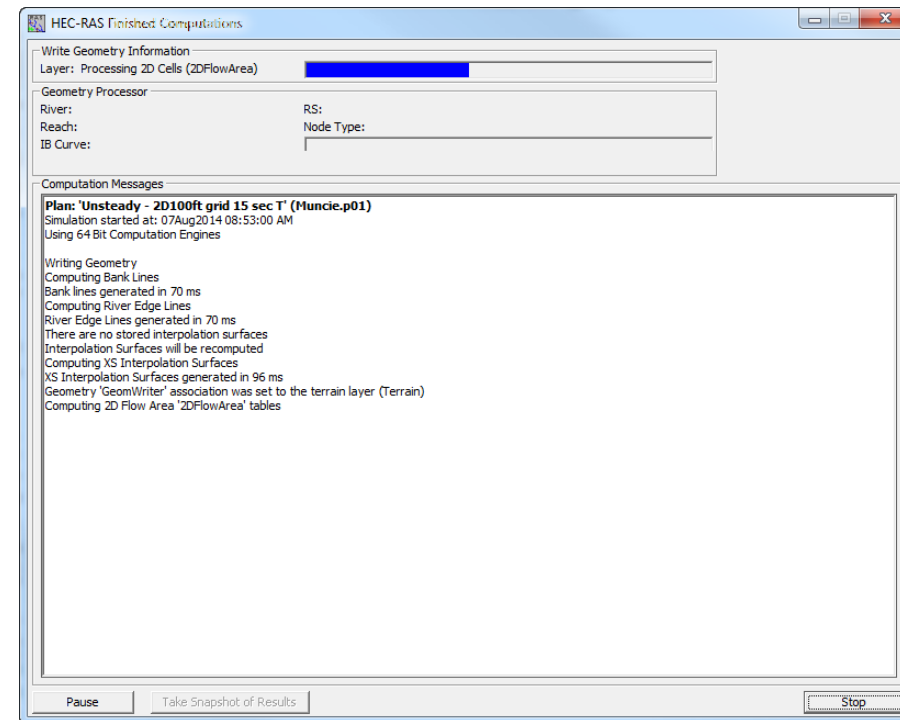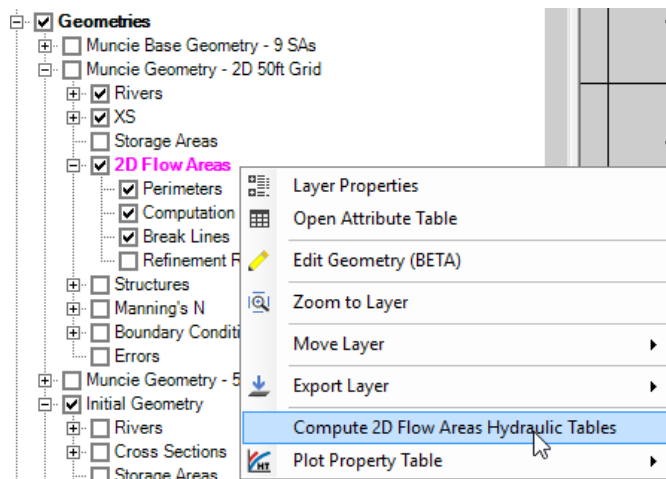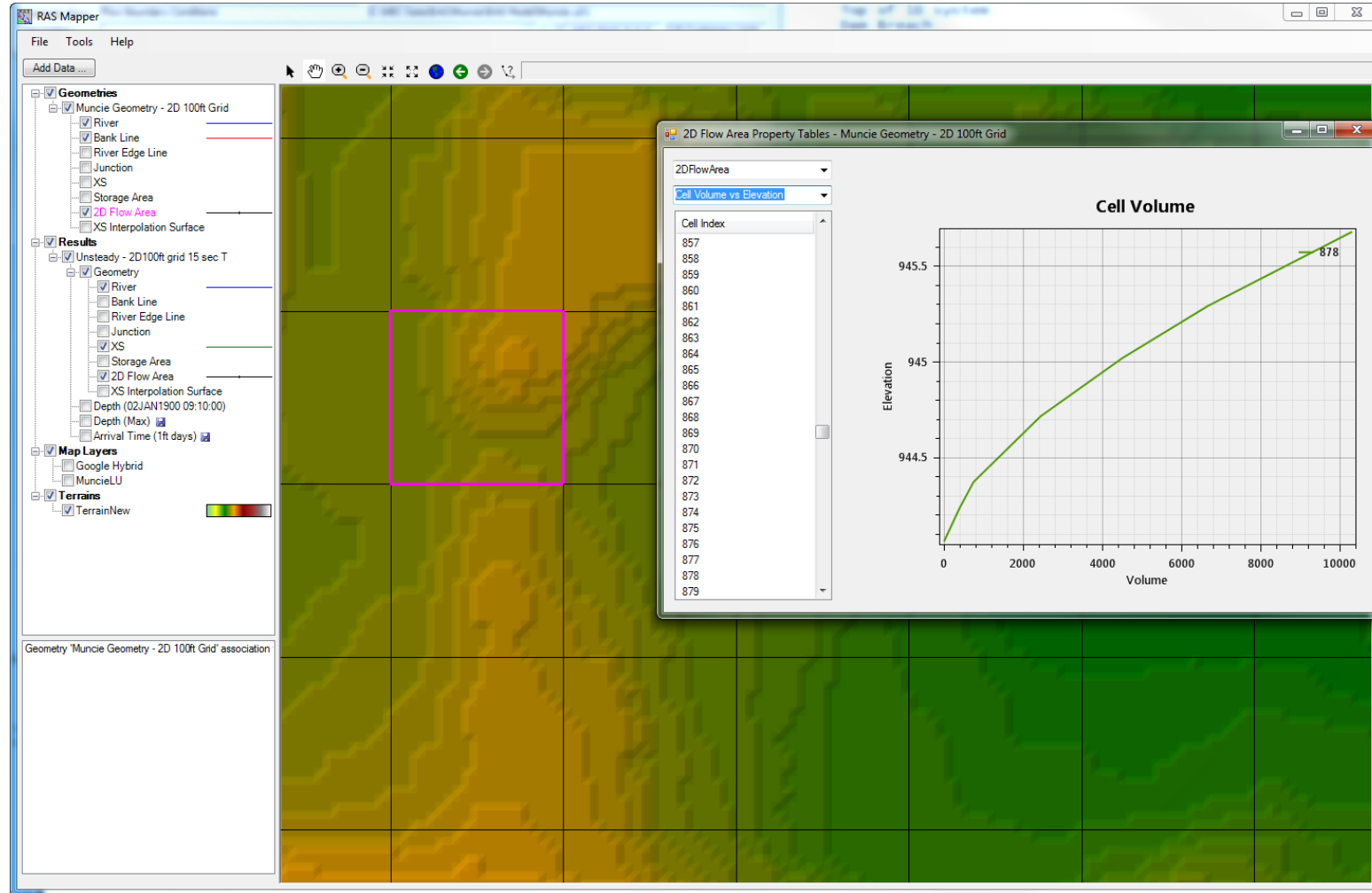
Benefits of Hydraulic (Sub-grid) Tables

Hydraulic Property Tables

- Computed (once and stored in geometry *.hdf)
  - From RAS Mapper
  - Before unsteady-flow simulation

Cells

Faces

Face Profile

Face Elevation vs Area

Hydraulic Property Tables
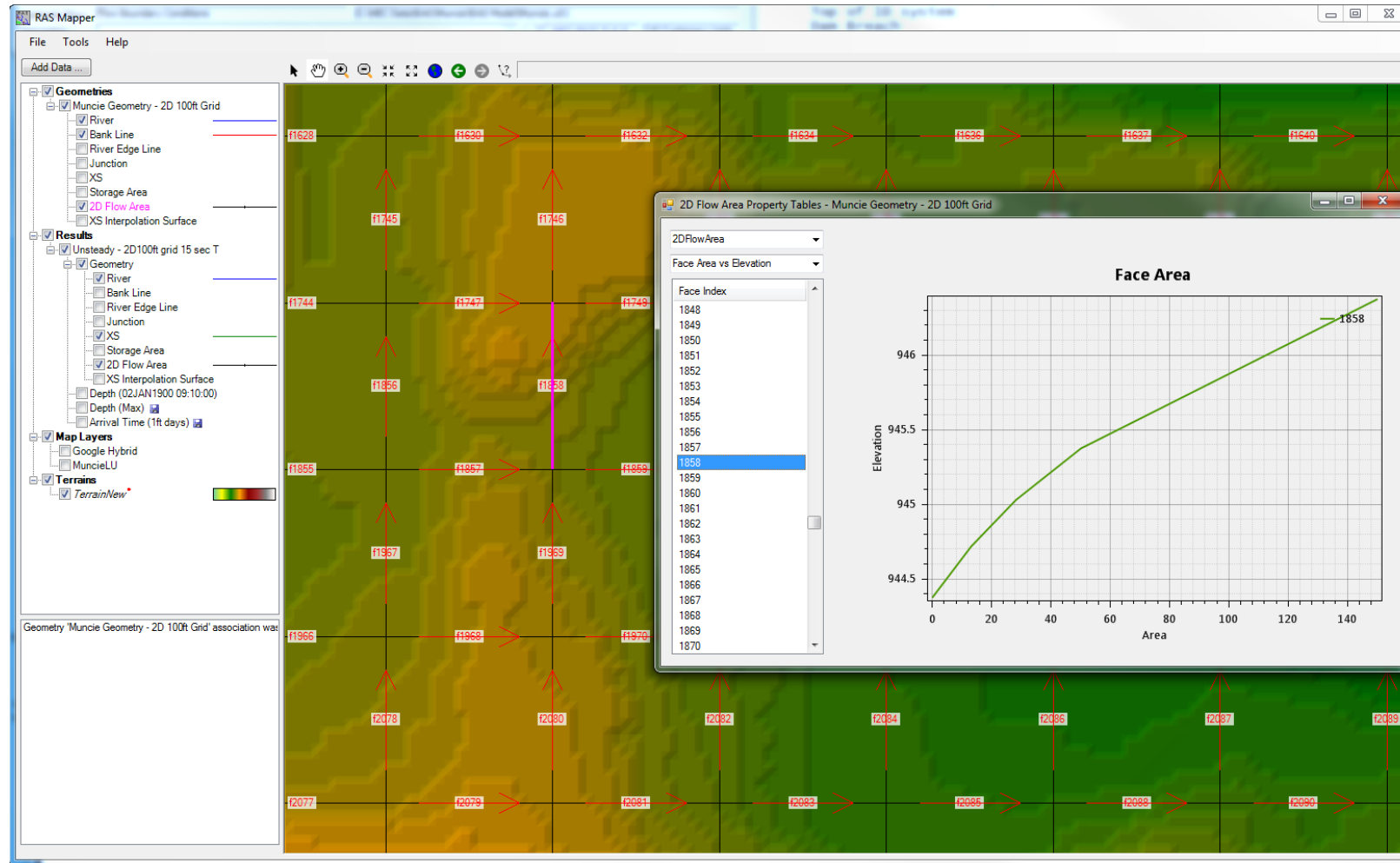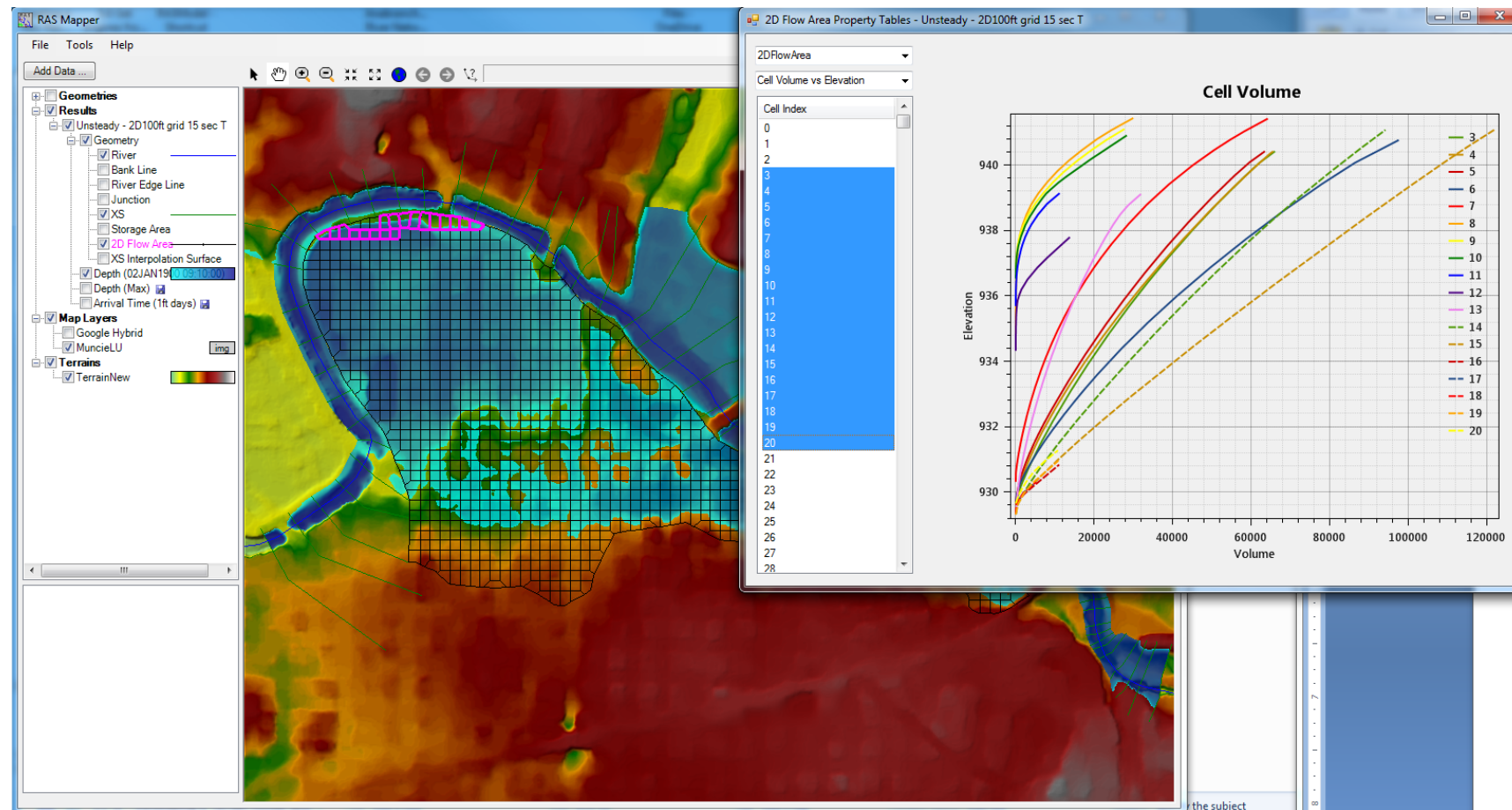
- View from RAS Mapper - '2DFlow Area' in 'Geometry' or 'Results'

Mesh Limitations

- One face between cells – even on perimeter

- Only one boundary condition per Face

- Except for Lateral structures
  - Lateral structures can stop and start on the same 2D external Face, when connecting 1D reach to a 2D area.

Questions?