



HEC-RAS 2D Mesh Refinement

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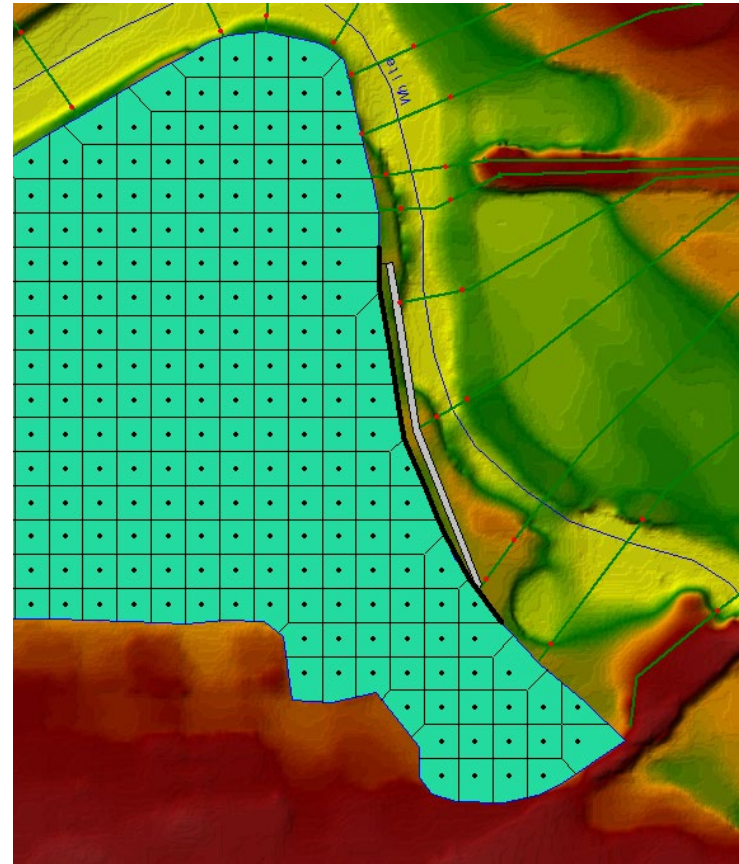
USACE, Institute for Water Resources, Hydrologic Engineering Center





Overview

- Common Terms
- How to Create a Mesh
- Limitations
- Fixing Mesh Problems
- Hydraulic Property Tables



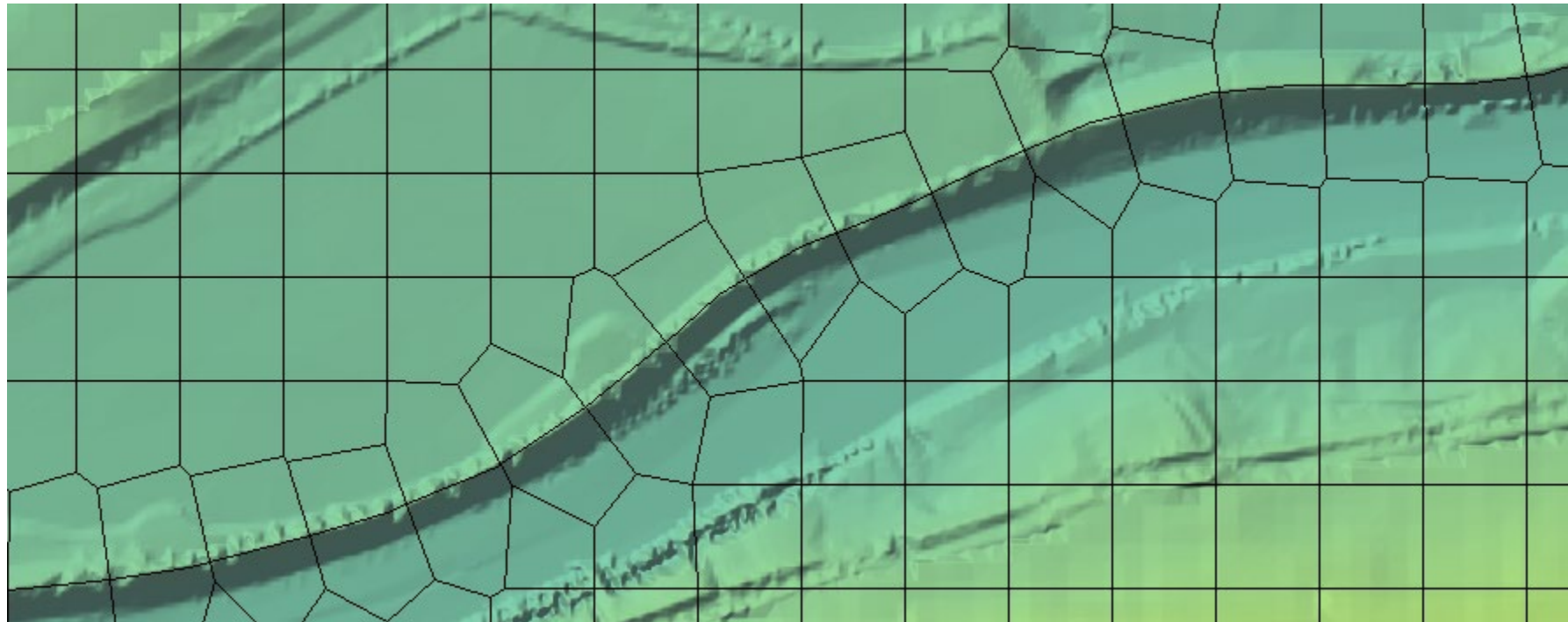


- 2D Flow Areas
- Perimeters
- Computation Points
- Break Lines
- Refinement Regions



Breaklines

- Breaklines enforce Cell Faces inside of the Mesh.
- Place along linear features that control water movement





Breaklines

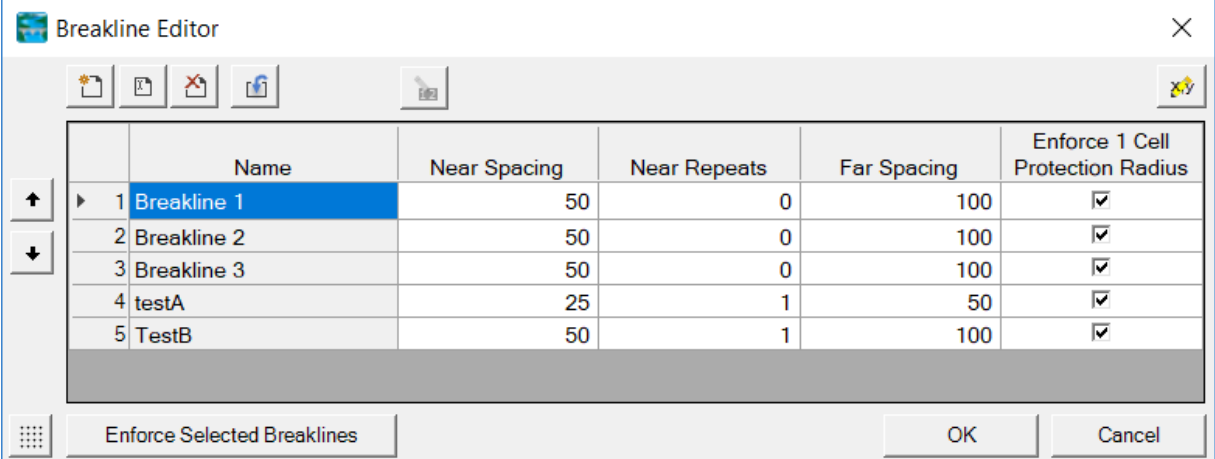
- “Snapping” is part of mesh generation
 - Faces snap to breaklines if they are close enough
- “Enforcing” changes the cell points around a breakline
 - Improves the snapping of the 2D faces to the breaklines
 - Not perfect, might require tighter cell spacing and/or hand graphical editing



Breakline Properties

- Near Spacing – Initial cell size (approx.) along the breakline.
 - Default value is 2D Area point spacing
- Near Repeats – Repeats cell insertion using Near Spacing a multiple away from the breakline.
- Far Spacing – Max cell size (approx.) of newly added cells.
 - Default value is 2D Area point spacing

- Enforce 1 Cell Protection Radius – Once enforced cells near to the breakline will not be removed through the enforcement of additional breaklines.
 - Include cells added/edited by hand.



	Name	Near Spacing	Near Repeats	Far Spacing	Enforce 1 Cell Protection Radius
▶	1 Breakline 1	50	0	100	<input checked="" type="checkbox"/>
	2 Breakline 2	50	0	100	<input checked="" type="checkbox"/>
	3 Breakline 3	50	0	100	<input checked="" type="checkbox"/>
	4 testA	25	1	50	<input checked="" type="checkbox"/>
	5 TestB	50	1	100	<input checked="" type="checkbox"/>

Buttons: Enforce Selected Breaklines, OK, Cancel



Breakline Process

- All points within a computed buffer are removed.
- Cells are added uniformly along the side of breakline.
- Buffer for point removal is computed as:
 - Near Spacing * Near Repeats
 - + Double Near Spacing size n times until reach Far Spacing size
(However, take 75% of last cell size so as to not delete too far)

	Name	Near Spacing	Near Repeats	Far Spacing	Enforce 1 Cell Protection Radius
1	Breakline 1	50	0	100	<input checked="" type="checkbox"/>
2	Breakline 2	50	0	100	<input checked="" type="checkbox"/>
3	Breakline 3	50	0	100	<input checked="" type="checkbox"/>
4	testA	25	1	50	<input checked="" type="checkbox"/>
5	TestB	50	1	100	<input checked="" type="checkbox"/>

- A breaklines' area of influence is stopped by a neighboring breakline (will not proceed to opposite side).



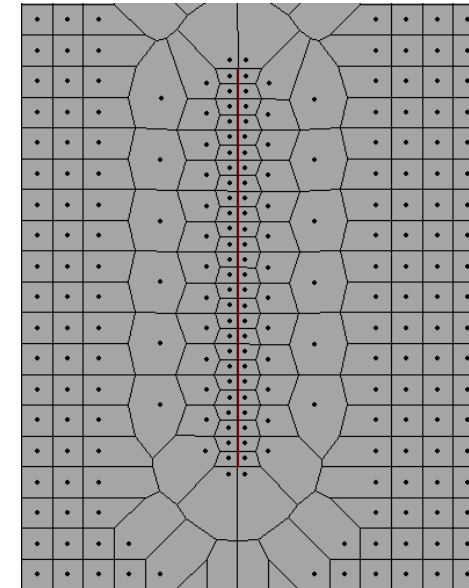
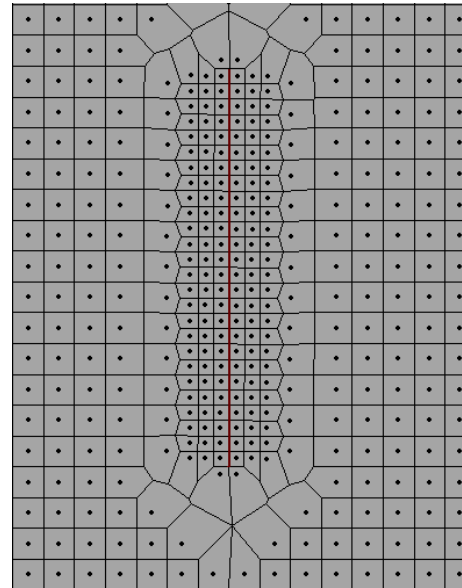
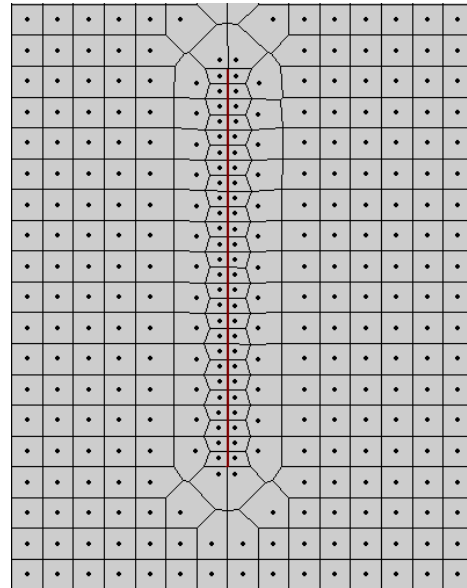
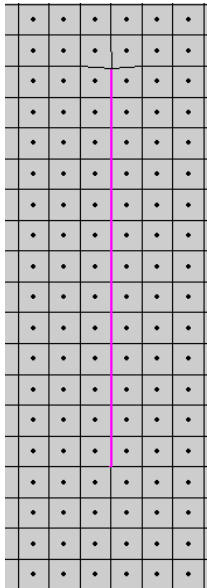
Breakline Examples

- Grid spacing = 100

Near Spacing	Near Repeats	Far Spacing
50		

Near Spacing	Near Repeats	Far Spacing
50	2	

Near Spacing	Near Repeats	Far Spacing
50		200

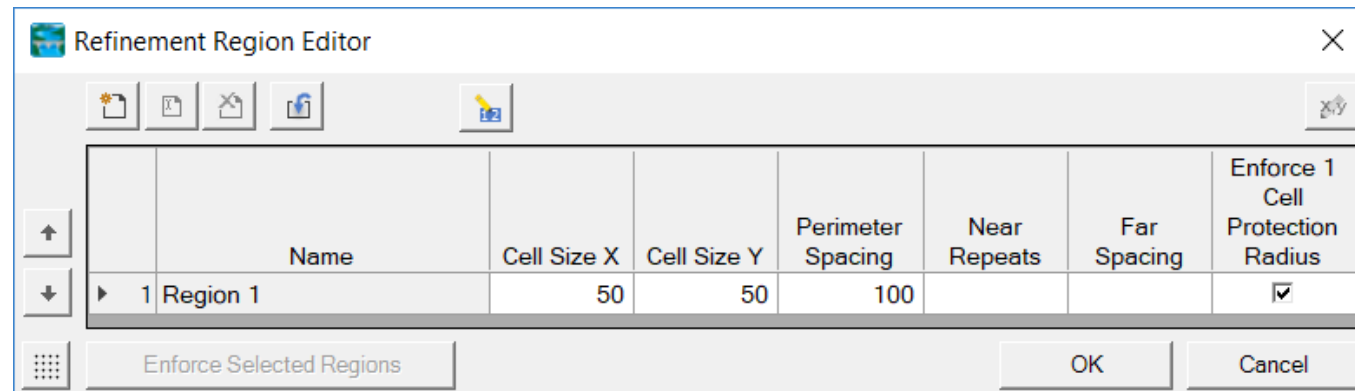




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- 

Refinement Regions

- Cell Size X,Y – Internal cell size dimension
- Perimeter is treated like a breakline
 - Perimeter Spacing, Near Repeats, Far Spacing, Cell Protection same as for breaklines
- Internal cell size used for perimeter spacing, if not defined

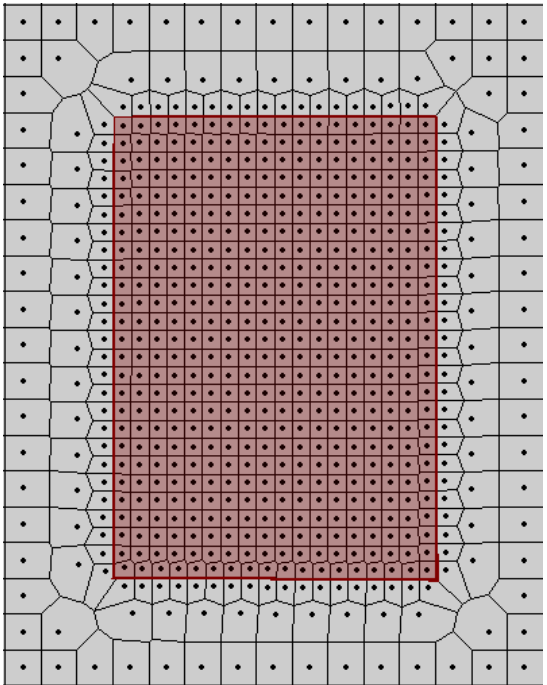




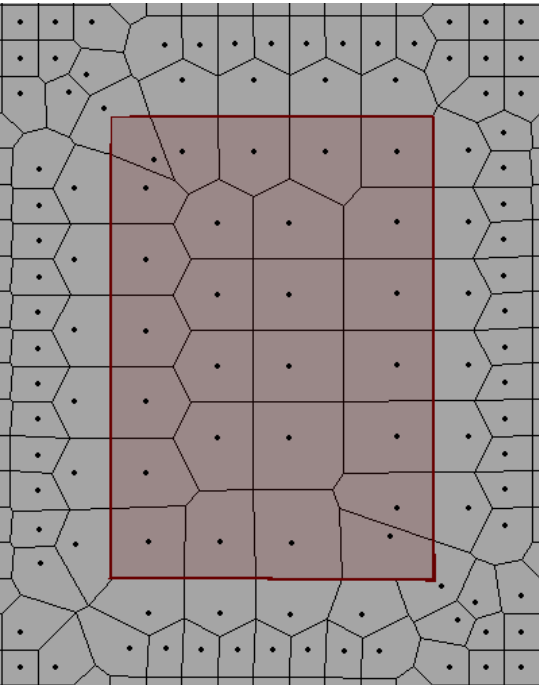
Refinement Examples

- Grid spacing = 100

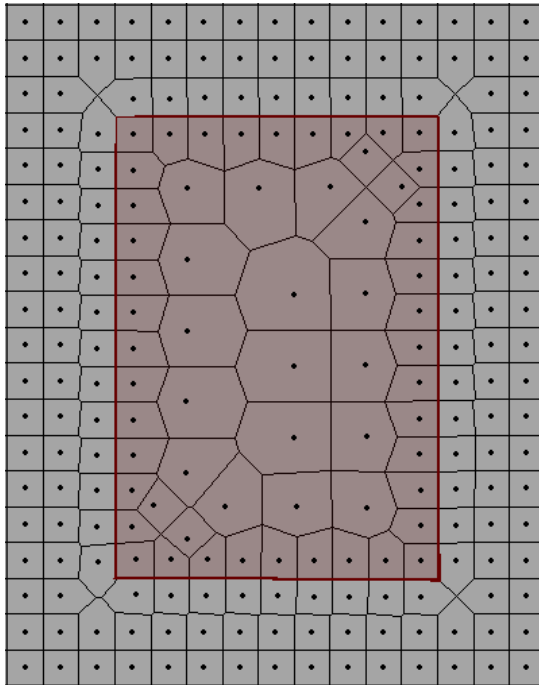
Cell Size X	Cell Size Y	Perimeter Spacing
50	50	



Cell Size X	Cell Size Y	Perimeter Spacing
200	200	

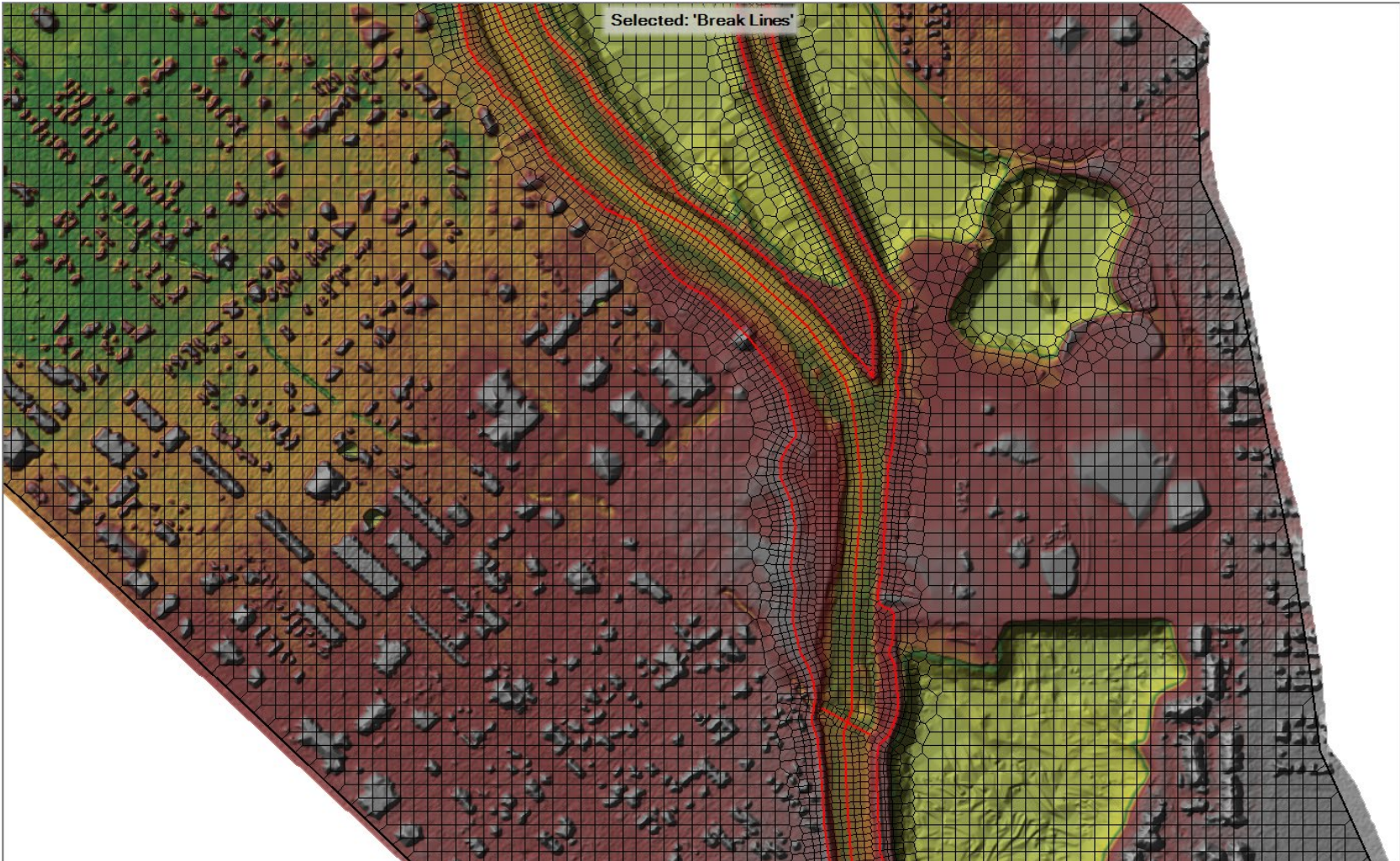


Cell Size X	Cell Size Y	Perimeter Spacing
200	200	100





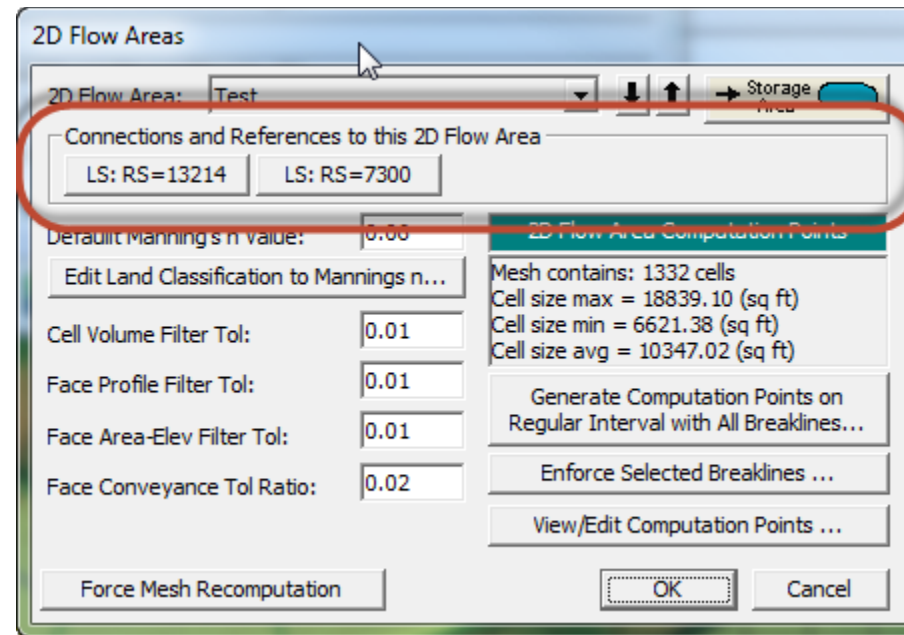
Refinement Regions and Break Lines to Align Channel Cells





2D Flow Area Editor Geometry Editor

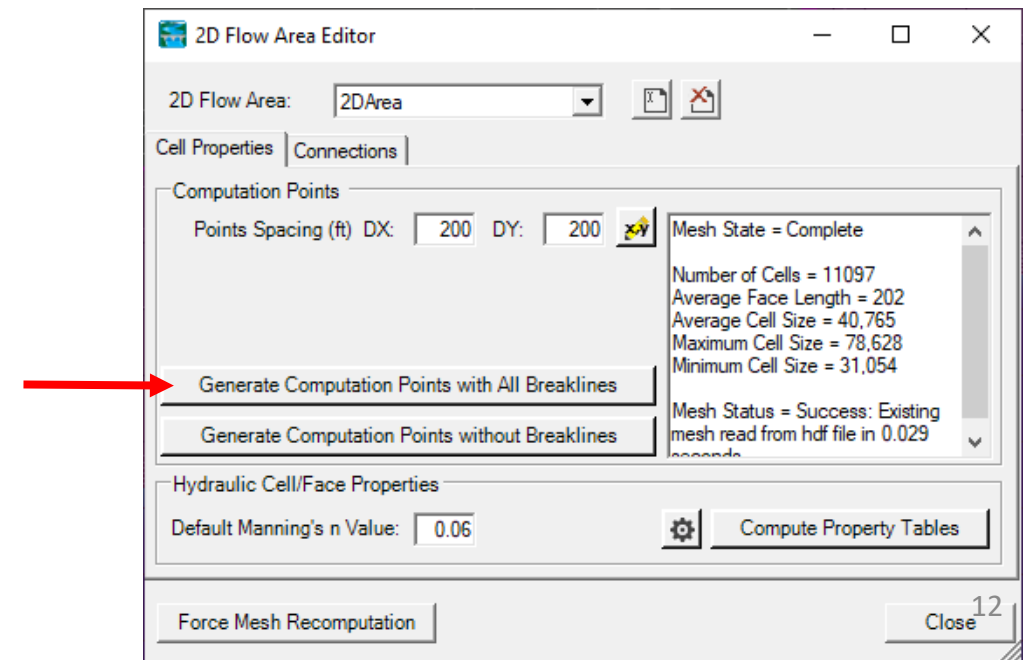
- Connections
 - Similar to Storage Area
 - Quick Link to Connections





Computation Points

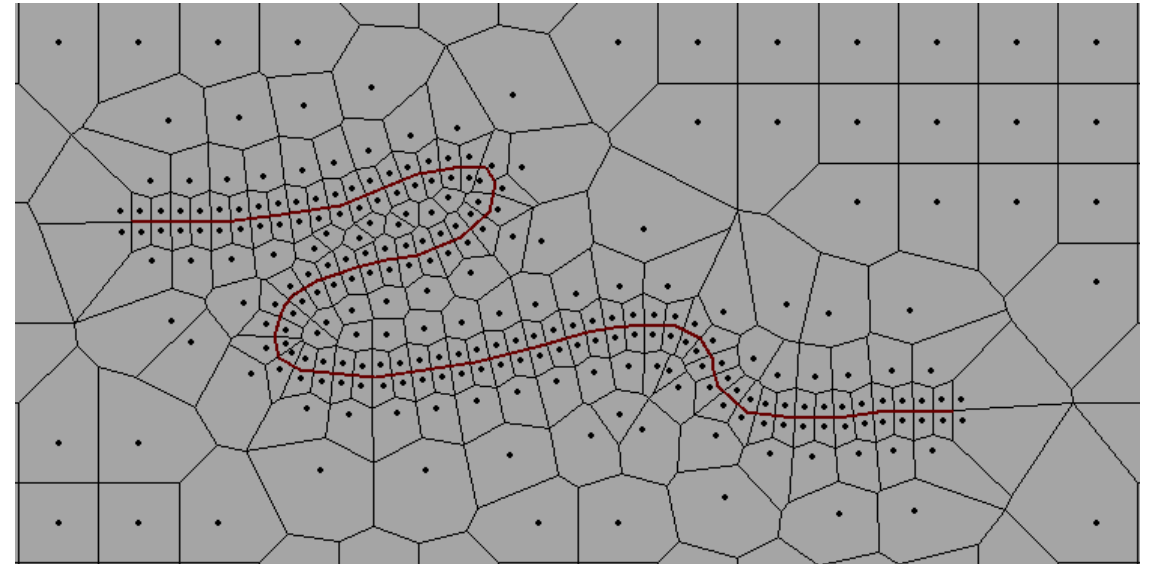
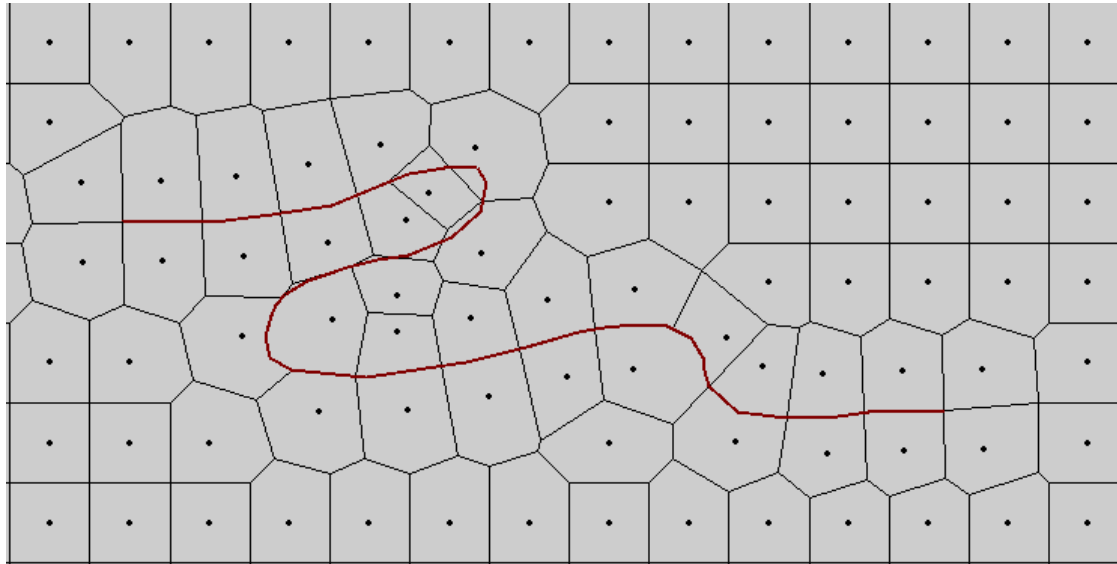
- Final mesh is based on final computation point set.
- Enforcement of Breaklines and Refinement Regions modifies existing computation points.
- Can enforce a breakline once, change parameters and enforce again.
 - Each iteration modifies the previous points.
- Point Regeneration will automatically use Breaklines and Refinement Regions.





Fixing Problems

- If cell spacing is too large, cell faces may not be enforced



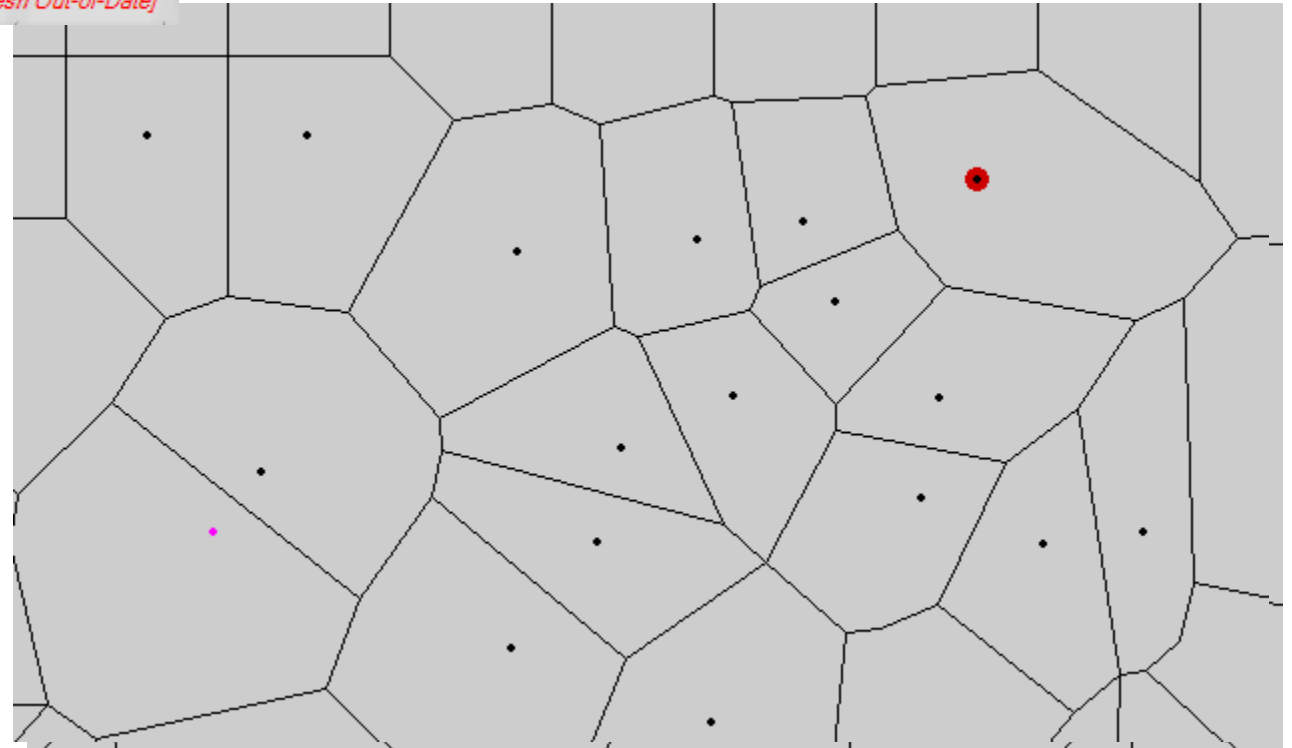


Fixing Problems

- More than 8 sides on a cell.

2D_Area: 2 Error(s) - Maximum 8 Faces per Cell [Displaying Local Mesh] [Full Mesh Out-of-Date]

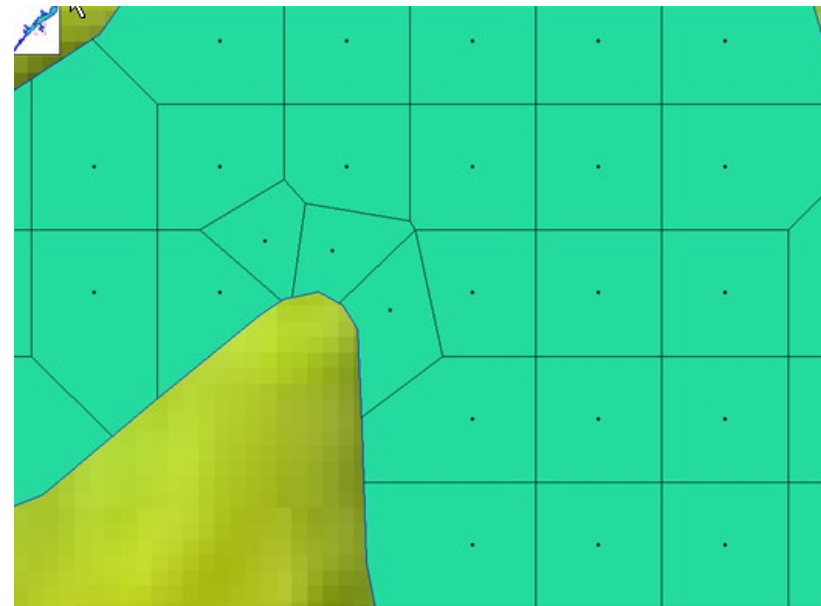
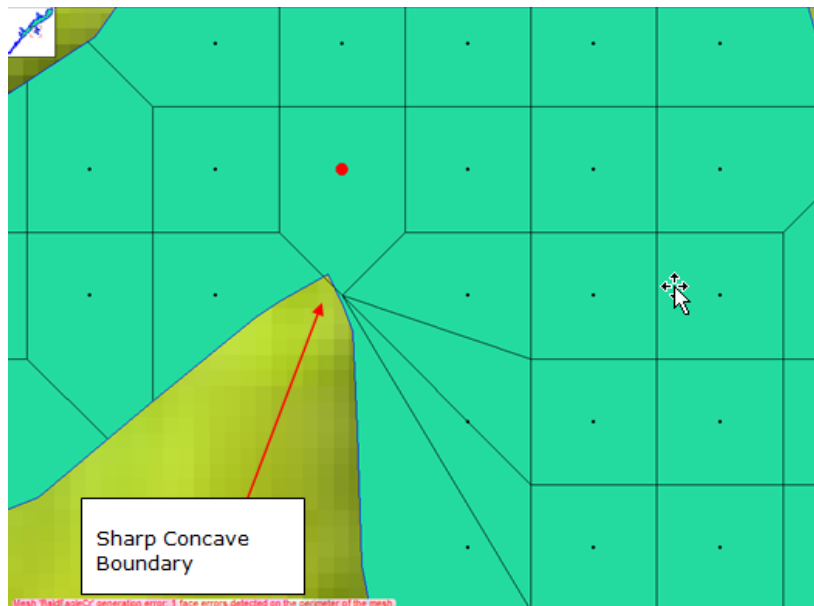
- Fix by Hand
- Auto “Try Fix” menu option





Fixing Problems

- Cells need to have exactly one Computation Point (Black Dot)
- Fix graphically by adding more points and/or moving points near perimeter



Questions?