HydroAS User's Conference September 2022

Key Advances in 2D Hydraulic Modeling SMS Interface Features



- Python based tools
- Standard layout
 - Includes help pane

Arcs to Polygons

Input coverage:

-- None Selected --

Average element/cell width:

	0.0	
listory	Number of elements/cells (must be even):	
	2	
Toolbox (Beta)	Bias (0.01-100.0):	
Tools History	1.0	
ADCIRC Coverages Arcs to Polygons - Convert arcs to polygons using a buffer width,	Output coverage:	
Trim Coverage - Trim arcs in a coverage using a polygon coverage. Datasets Lidar		Example 6 Two centerlines merging into a single centerline converted to polygons
 Rasters Blend Raster to Edges - Blend the secondary raster into the edges o Bounds to Polygon - Generate a coverage with an exterior polygon Clip Raster from Elevations - Clip a raster where the raster elevation 		At the junction of more than two arcs, the two that
 Cop raster non-clevations - Cop a rester where the rester elevation Dataset to Raster - Convert dataset values into a raster. Edit Elevations - Edit a rasters elevations from the Z values of point Extend Raster - Extend a raster to the extent of polygons in a cover. 		OK Cancel Help
 Fill Nodata - Fill nodata values in a raster, creating a new raster. Interpolate Priority Rasters - Interpolate multiple rasters to a UGrid wit Merge Elevation Rasters - Merge two elevation rasters with priority. Nodata to Polygon - Generate a coverage with polygons for the activ 		
 Raster Difference - Tool to calculate the difference between two raste Raster to Grid - Tool to create a grid from a raster, using every pixel in 	the raster.	
 Trim Raster - Trim a raster to the extent of polygons in a coverage, with WSE Dataset Raster - Tool to make a WSE (water surface elevation) rational Unstructured Grids 	이 주제 NASE TRANSFERS T	
 Instructured ones 		
Run Tool		
	Close	

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Example 6 - Tributary Arcs to Polygons

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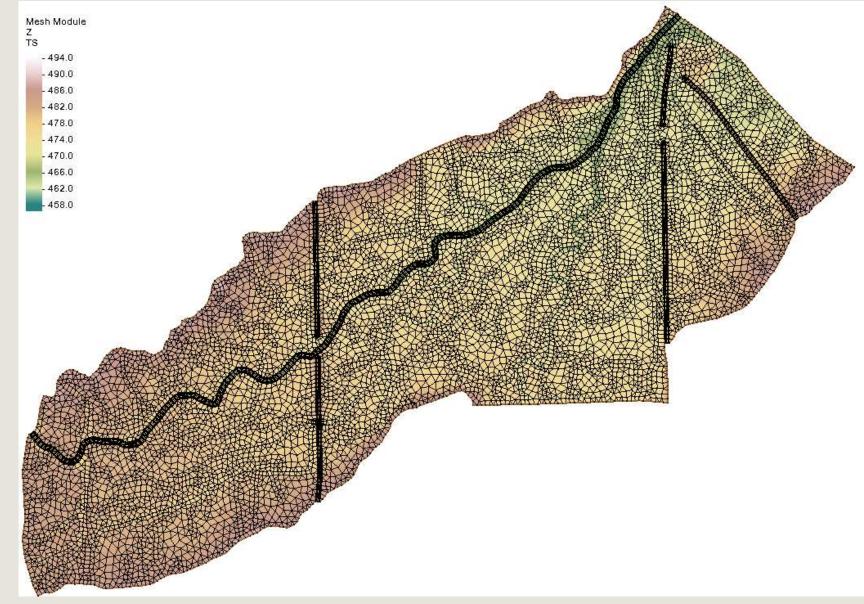


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Demonstration of Tools via Mesh Generation Workflow

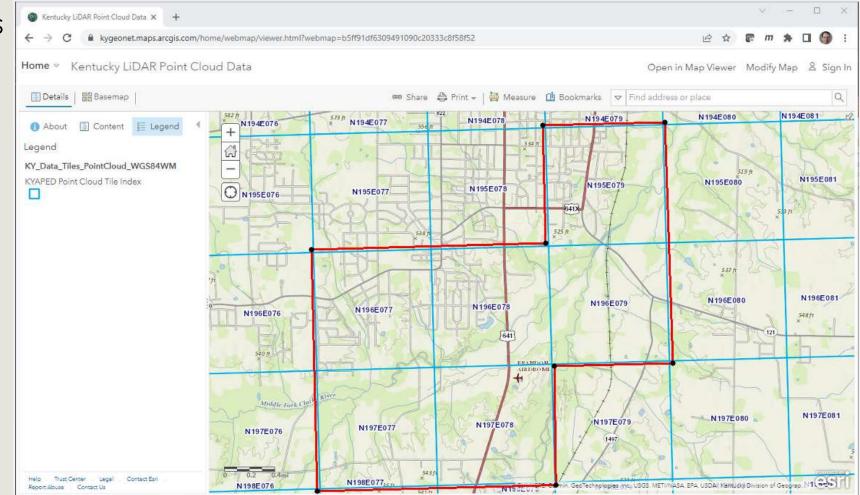
- Lidar tiles
- Raster terrain
- Domain definition
- Feature manipulation
- Mesh quality review

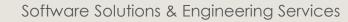




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- Lidar management in SMS
 - Download from data depot
- LASIb library functions





Lidar Data Display

	Lidar Display Options - N195E079_LAS_Phase2.laz	×
1955/79_LAS_Phane2.lar	Points Display points All one color Color by dassification	Exclude point options (Excluded points are not displayed, exported or used in interpolation.) Exclusion extents: Options Exclude by Classification
1212 1254 1254 1250 1260 <t< th=""><th> Contours Options Point size: Max number of points displayed: 50000 Total number of points in file: 12317210 </th><th>○ Return type Classification Color ☑ 1 - Unclassified ▼ ☑ 2 - Ground ▼ ☑ 7 - Low Point (Noise) ▼</th></t<>	 Contours Options Point size: Max number of points displayed: 50000 Total number of points in file: 12317210 	○ Return type Classification Color ☑ 1 - Unclassified ▼ ☑ 2 - Ground ▼ ☑ 7 - Low Point (Noise) ▼
	Bounding box Dystons	✓ 17 - Bridge ▼ 5010 ✓ 18 - High Point (Noise) ▼ 655
		OK Cancel Apply Help

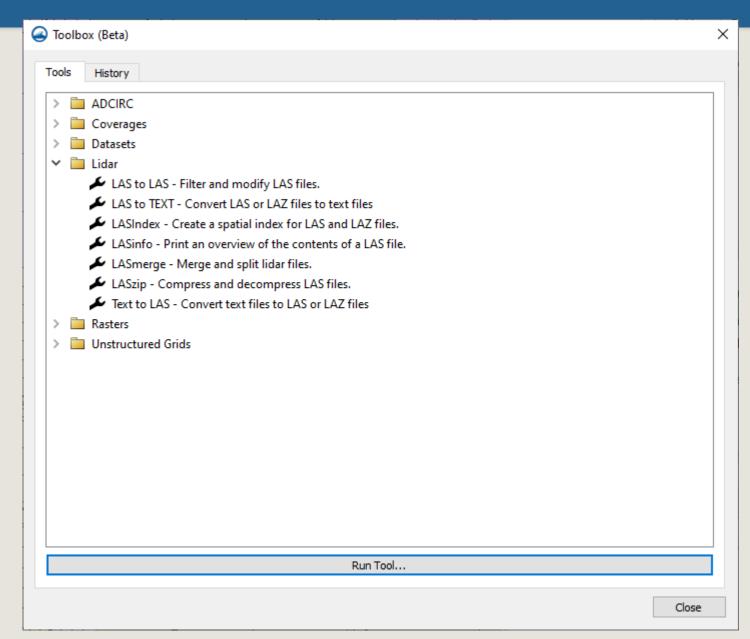
Filter Lidar and Conversion to Raster

	Cidar Exclusion Ext Exclude points outside	range	Update			Rasters 612.0 600.0 494.0 488.0 482.0 476.0 470.0 464.0 458.0			27	Acu		
	Min	Max						100				
x	4159240.1953558	4168972.292790	3					The second	A HEAL	~	1	
Y	3378162.5466264	3384784.620718)									
z	414.4	511.0					h int	48.	5	- 1 p	5	
	Help	ОК	 Interpolate Lidar to Number of cells in X: Number of cells in Y: Cell size: Don't fill NODATA cells Fill NODATA cells with Interpolate 	2311 1863 5.0	×	Sec. 1						
			ок	Cancel	Help		and the	TF				



Lidar Tools

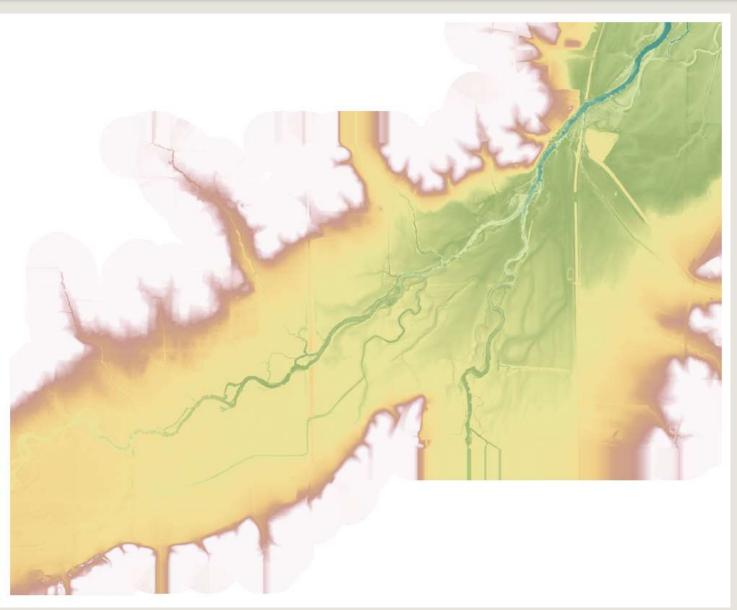
Data conversions





Raster Tools in the Toolbox

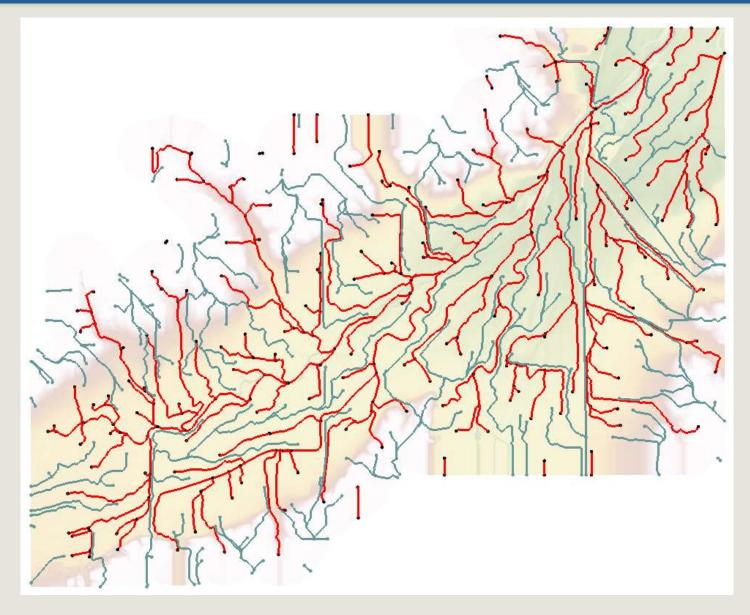
- Fill holes (blend)
- Edit low flow channel
- Bounds/Holes to polygons
- Blend between rasters
 - Can be multi-source
- Conversion of other data to raster
- Interpolate from raster(s)





Feature extraction from Raster

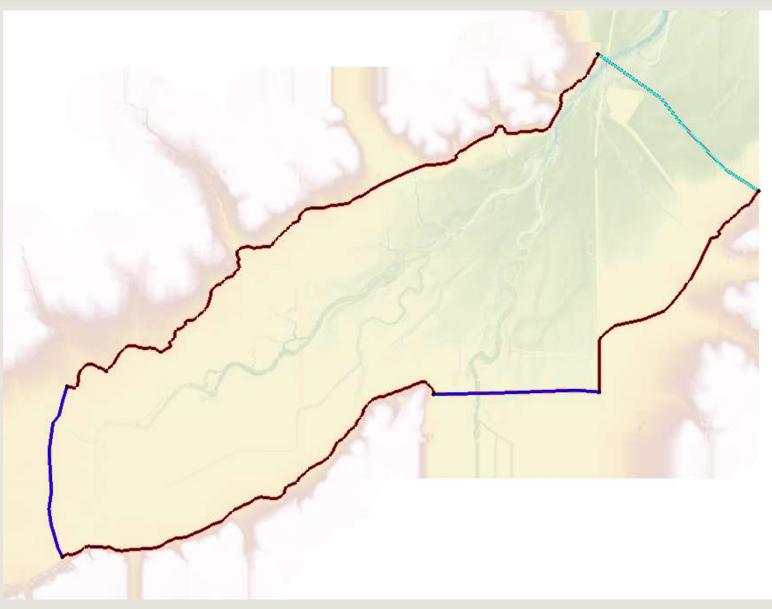
TOPAZ





Define Domain

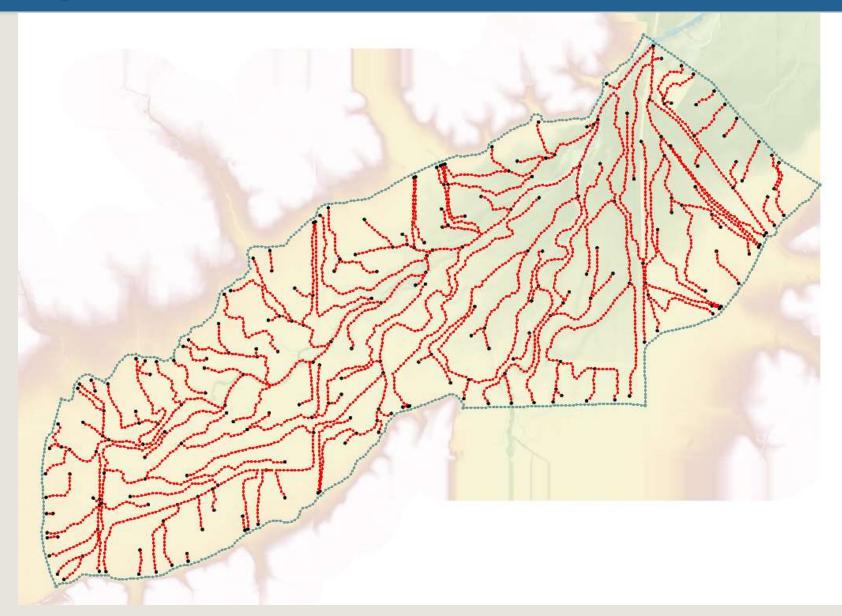
- Lateral Sides
 - Digitize (manual)
 - Extract contour and clean
- Define BC locations
 - Use best judgement





Coverage Tools – Trim coverage

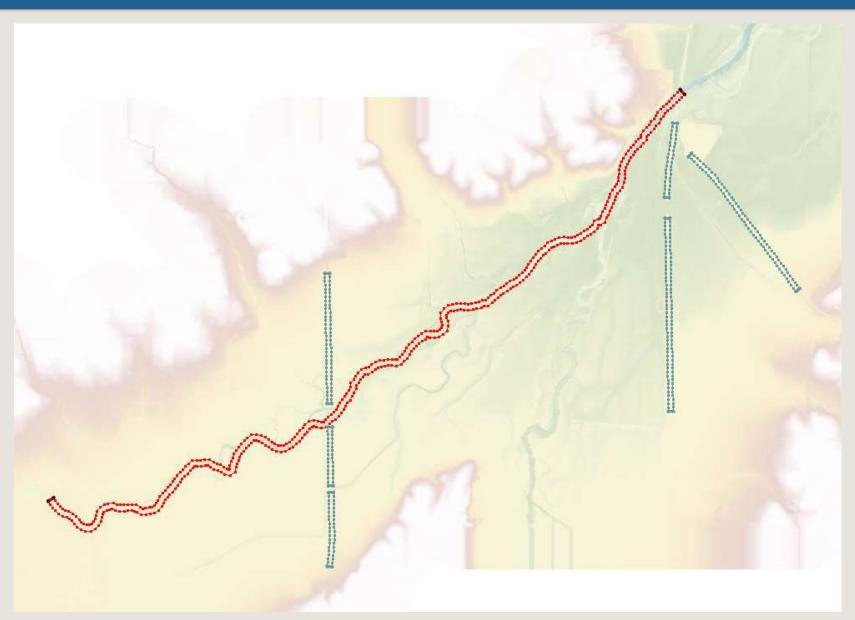
- Apply toolbox tool
 - Inside or Outside
 - Buffer distance
- Mesh generation is iterative
- Minor manual edits





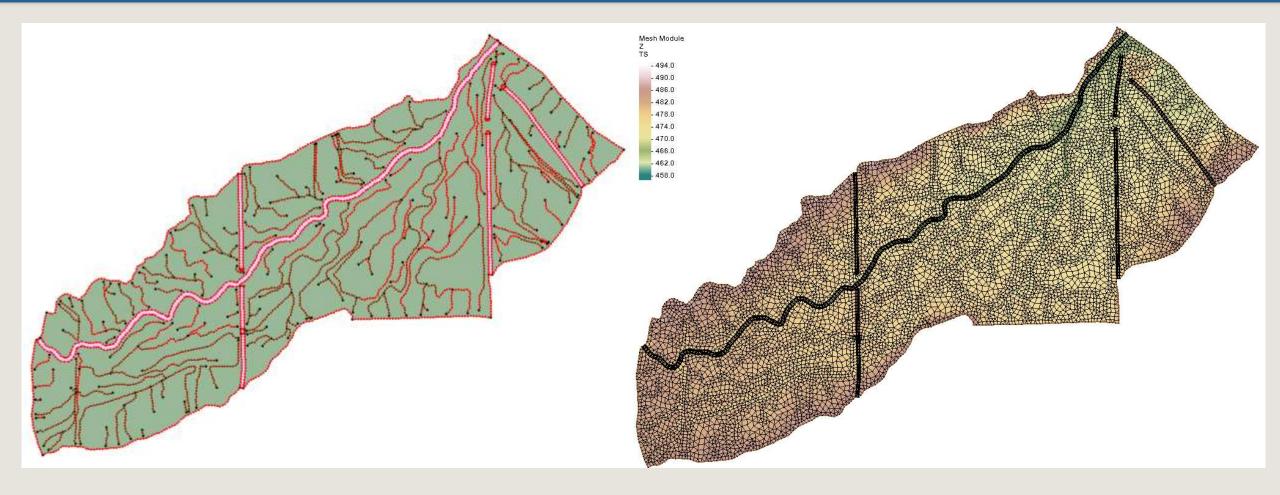
Coverage Tools – Arcs to Polygons

- Key hydraulic features
 - Channels
 - Embankments
- Creates polygons for each





Combine Domain Boundary, Networks, and Hydraulic Feature Polygons





- Coverage defining bridge parameters
- Create Bridge Footprint tool
 - Creates coverage and mesh
- Incorporate footprint into "Mesh Generator"
- Generate mesh with hole for bridge
- Merge bridge mesh into hole
- Can also be used to create box culvert mesh

nput coverage:	
Map Data/Pre/3D Bridge/Uniform Skew Param	~
Bridge width:	
40.0	
Bridge wrapping width:	
8.0	
Specify number of segments	
☑ Has abutments	
Pier type:	
Wall	~
Wall width:	
3.0	
Element wrapping width:	
2.0	
Wall pier length:	
30.0	
Wall pier number of side elements:	
6	
Pier end type:	
Square	~
Output grid:	
Uniform Skew	
Output coverage:	
Uniform Skew	

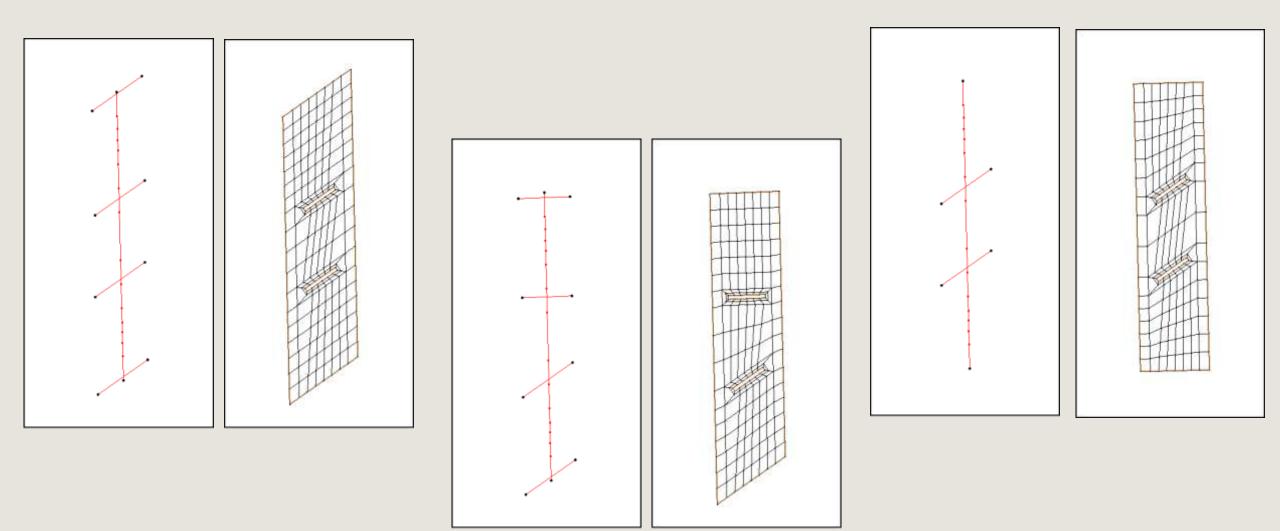
Input parameters

- Input coverage This can be any coverage but it represents a single bridge. The coverage will have no polygons or feature points (points that are not part of any arcs). The longest arc is interpreted as the bridge centerline. All other arcs in the coverage should cross, but not intersect this arc (intersecting would result in splitting both arcs). All other arcs (which cross the bridge centerline) are assumed to define the location of a wall pier or pier group, unless the "Has abutments" toggle is selected. In this case, the arcs that intersect the centerline closest to the ends of the centerline arc define the orientation of the bridge abutments at the ends of the centerline. See the figure in the examples below.
- Bridge width Enter the total width of the bridge from upstream face to downstream face. The units (foot/meter) correspond to the display projection of SMS.
- Bridge wrapping width Enter the width of a rows of cells created just upstream and just downstream of the bridge footprint. These will be quadrilateral cells to cleanly represent the flow entering/leaving the bridge region. This width is usually specified to transition from



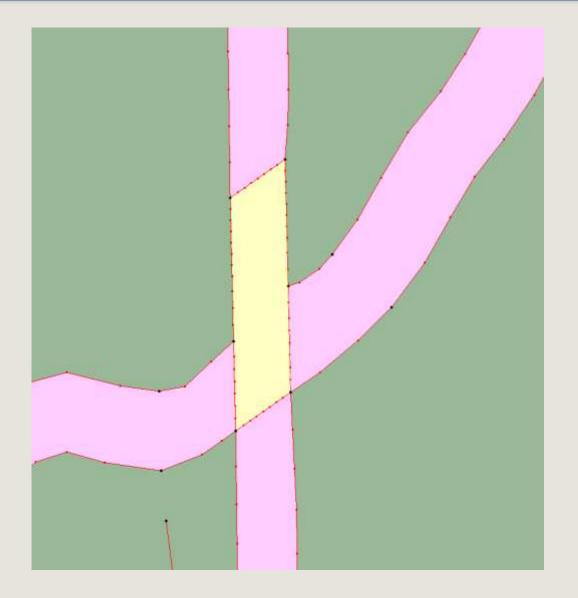
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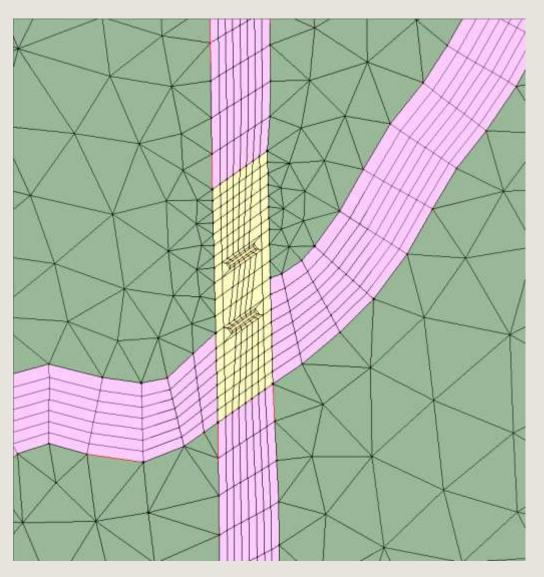
Examples of Bridge Mesh Options





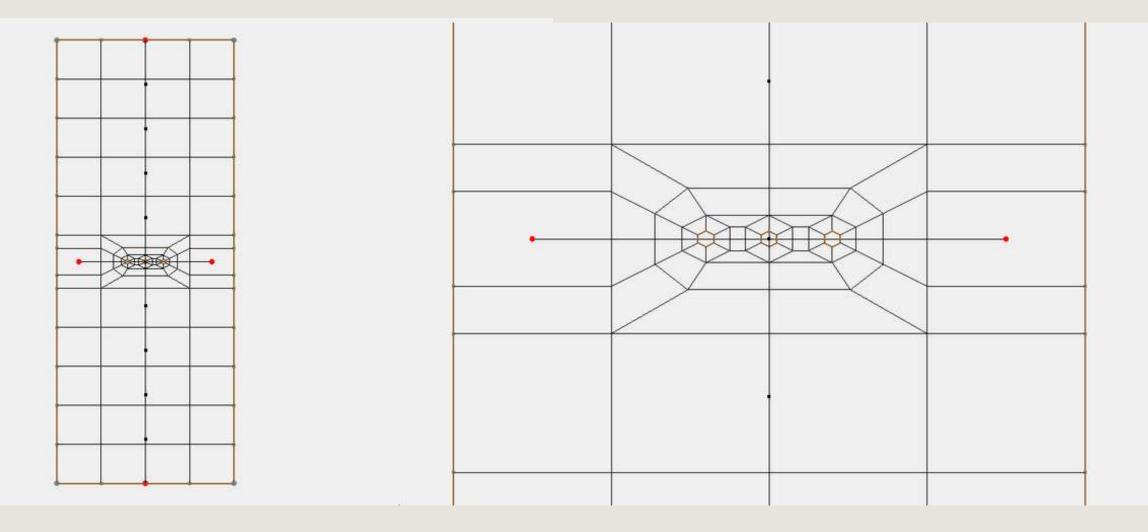
Bridge Mesh Incorporated into Domain Mesh







Bridge Mesh – Pier Groups





Dataset Tools

- Equivalent to Dataset Toolbox
- Python functionality
- History

Fools	History	
> 🗖	ADCIRC	
> 🗋	Coverages	
¥ 🗋	Datasets	
	Advective Courant Number - Compute the advective courant number dataset.	
	Advective Timestep - Compute the advective timestep dataset.	
	差 Angle Convention - Convert between angle conventions.	
	Canopy Coefficient - Compute a canopy coefficient from a landuse raster.	
	Chezy Friction - Compute Chezy friction from a landuse raster.	
	🖌 Compare Datasets - Compare two datasets.	
	🖌 Convert Cell Dataset to Point Dataset - Convert a cell dataset to a point dataset.	
	🖌 Convert Point Dataset to Cell Dataset - Convert a point dataset to a cell dataset.	
	Directional Roughness - Convert a land use raster (NLCD, C-CAP, etc) to a directional roughness data set.	
	🗲 Filter Dataset Values - Assign dataset values based on conditionals.	
	🖌 Geometry Gradient - Compute geometry gradient data sets.	
	🖌 Gravity Waves Courant Number - Compute the gravity wave courant number dataset.	
	🖌 Gravity Waves Timestep - Compute the gravity wave timestep dataset.	
	≁ Landuse Raster to Mannings N - Convert an landuse raster (NLCD, C-CAP, etc) to a Mannings N dataset.	
	≁ Map Activity - Builds a dataset with values from one dataset and activity from another.	
	🖌 Merge Datasets - Merge two transient datasets.	
	🖌 Point Spacing - Calculate point spacing for a grid.	
	Primitive Weighting - Compute the primitive weighting coefficient.	
	🗲 Quadratic Friction - Compute quadratic friction from a landuse raster.	
	Sample Timestens - Create a dataset with sampled time steps from another dataset	
	Run Tool	



Toolbox History Function

- Re-run tools
- Saved with project
- Searchable
- Editable
- Input/Output

022-08-03 Fill Nodata 2022-08-03 13:24:40	
	^
Fill Nodata 2022-08-03 13:24:40	
7 Trim Coverage 2022-08-03 15:17:46	
Trim Coverage 2022-08-03 15:38:23	
Arcs to Polygons 2022-08-03 15:41:15	
/ 🚊 Input:	
O input_coverage: Map Data/Pre/Extracted/Main Channel CL trimmed	
O element_width: 10	
O number_elements: 8	
O bias: 2	
O output_coverage: Main Channel Polygon	
Output:	
Trim Coverage 2022-08-03 15:43:51	
Trim Coverage 2022-08-03 15:58:09	
Arcs to Polygons 2022-08-03 16:03:15	
Trim Coverage 2022-08-03 16:03:43	
022-08-04	
Create Bridge Footprint - Uniform Skew	
V Create Bridge Footprint - Skew Piers	
Run Tool From History	
Delete	
	 Input: input_coverage: Map Data/Pre/Extracted/Main Channel CL trimmed element_width: 10 number_elements: 8 bias: 2 output_coverage: Main Channel Polygon Output: Trim Coverage 2022-08-03 15:43:51 Trim Coverage 2022-08-03 15:58:09 Arcs to Polygons 2022-08-03 16:03:15 Trim Coverage 2022-08-03 16:03:43 022-08-04 Create Bridge Footprint - Uniform Skew Create Bridge Footprint - Skew Piers



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Themes

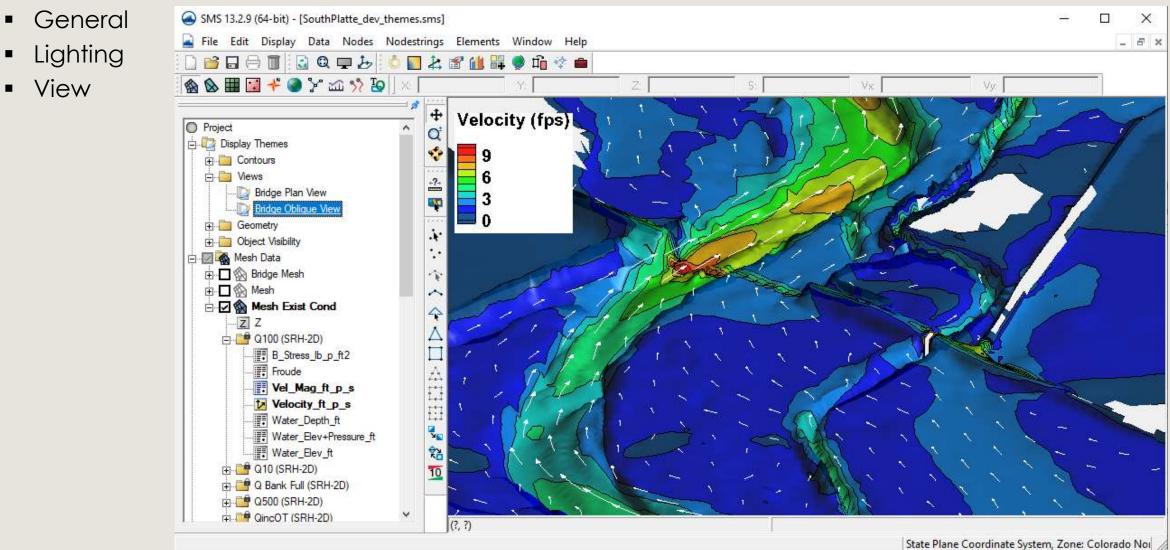
- Types of theme
 - General Theme (view, lighting, etc.)
 - Geometry Theme (module display attributes/options)
 - Object Theme (project explorer objects)
 - Contour Theme (can be associated with dataset names)
 - Vector Theme
- Stored with project
- In Project Explorer
- Use one type at a time
- Tutorials

	Display Theme Properties	×
Te	play Theme name: rrrain Load this theme when objects with the following names are selected in the Project Explorer: Z	Display options to include General (view, lighting, etc.) Geometry (scatter sets, mesh etc.) Object visibility Datasets Contours Vectors
	Delete Match exactly	OK Cancel Help



General Theme

Multiple Display Option Tabs



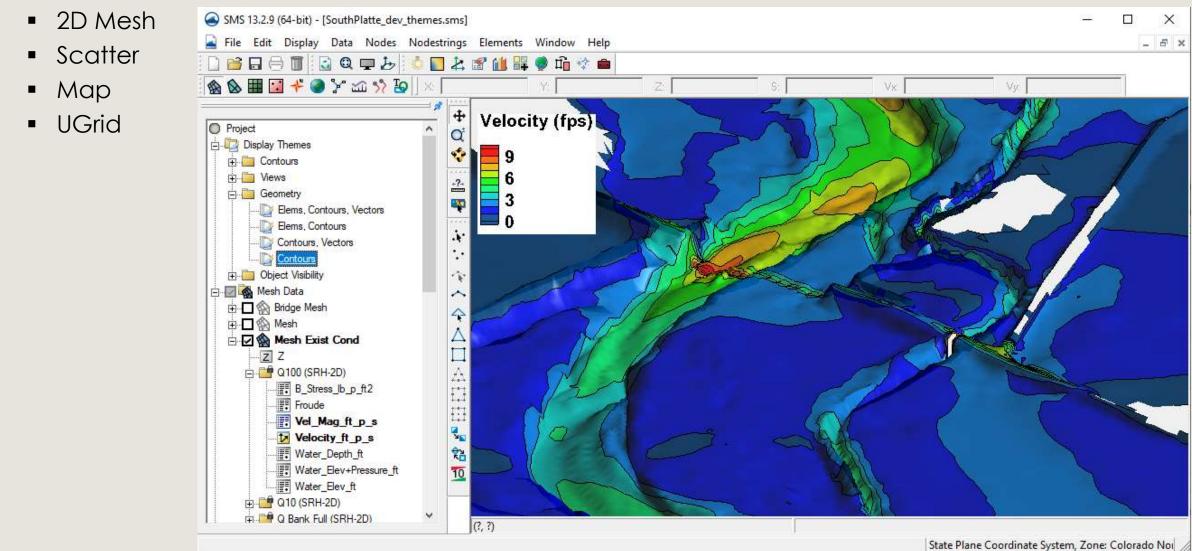
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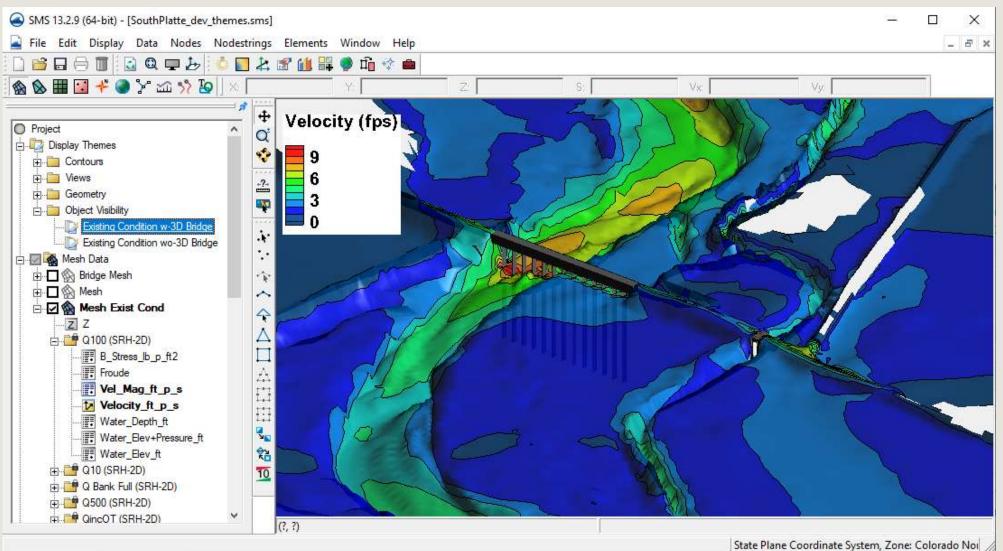
Geometry Theme

Geometry Display Option Tabs



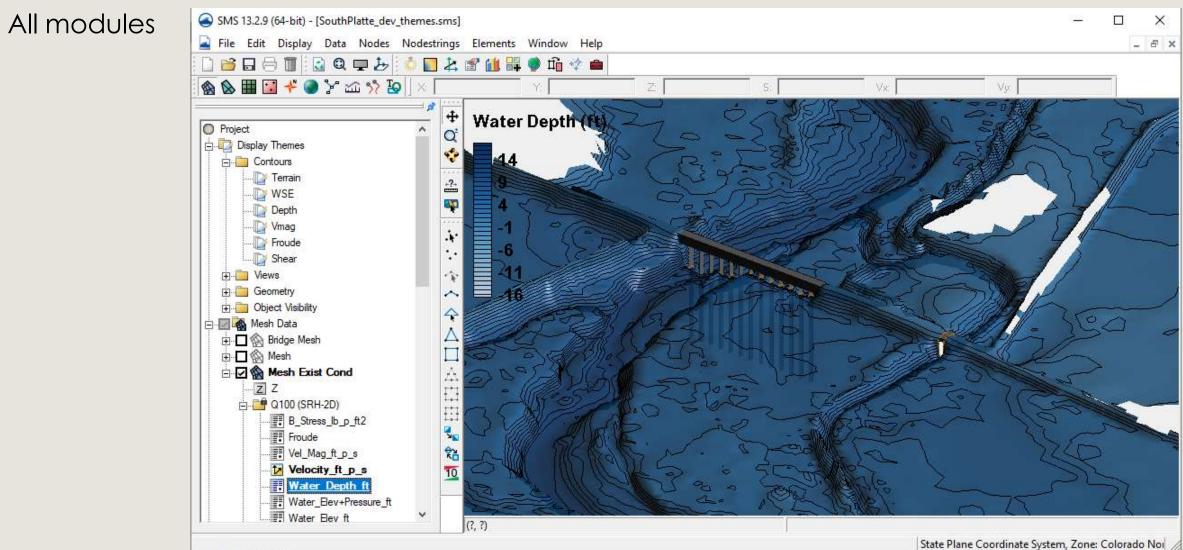
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Check boxes in the Project Explorer



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Contour and Vector Options



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Engineering With Nature (EWN) – Mesh editing tools

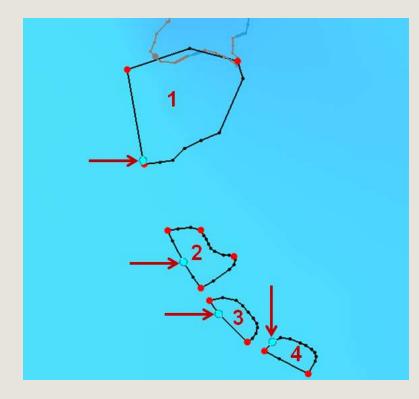
- Insert polygons
 - Berm
 - Dune
 - Island
- Insert void
 - Levee
 - Embankment
- Transition into existing mesh

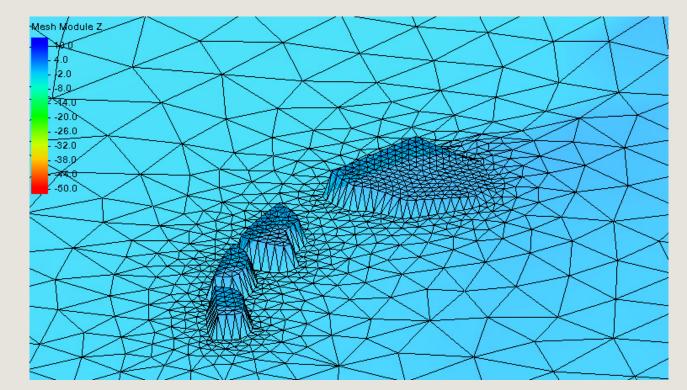
Name:	Island 1
Classification:	East coast beach/dune
	Insert feature
Manning's N:	0.089
Elevation (m):	Constant 🗸 0.0
Maximum transition distan	ce: Bounding box factor 🗸 1.5
Metadata Preview	
Element area change lim	Project/Mesh Data/Trimmed_mesh (subset) nit (fast 0.0 <> 1.0 slow): 0.5 ature Add new mesh to SMS on exit
Element area change lim Generate mesh with fea	nit (fast 0.0 <> 1.0 slow): 0.5
Element area change lim Generate mesh with fea	nit (fast 0.0 <> 1.0 slow): 0.5



Insertion Into Existing Mesh

- Specified
 - shape
 - Resolution
 - Transition







Feedback from Users

- Recent projects
- "CAD" style commands
 - Specify arc/line length
 - Trim/extend arc
 - Create horizontal/vertical segments
 - Drag an arc
- Larger "Plot" dialog
- Feedback encouraged

File	Edit	Display	Feature Objects	Window	Help	
	New					Ctrl+N
	Open.					Ctrl+0
	Open	As				1
	Add O	nline Map	JS			
	Impor	t from We	b			
	Map F	lood				
	Save N	lew Projec	t			
	Save N	Лар				
	Save A	s				
	Save A	s Package				
	Get In	fo				
	Info O	ptions				
	View D)ata File				
	Save S	ettings				
	Page S	etup				
	Print					Ctrl+P
	Layou	t (Beta)				
	1 D:\te	emp\NHI S	Structures Ex\AKZ	Update\KY	_MiddleForkClarksRiver.sms	
	2 D:\te	emp\NHI S	Structures Ex\NHE	C Slides\KY	_WestFortClark.sms	
	3 D:\te	emp\NHI S	Structures Ex\NHE	C Slides\Mi	iddle Fork Clark Ground (1).tif	
	4 D:\te	mp\NHI 9	Structures Ex\NHE	C Slides\Mi	iddle Fork Clark Filtered.laz	
	5 D:\te	mp\NHI S	Structures Ex\AKZ	Update\Gro	ound02.tif	
	More.					
	Exit					Ctrl+X



- Import from annotated cross section text file.
- Correct and edit cross sections
- Interpolate cross sections
- Convert cross sections to surface (TIN)



Thank you!

Questions?

Alan Zundel azundel@aquaveo.com



Software Solutions & Engineering Services