

# From Modeled to Mapped: How to Delineate a Floodplain

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Illinois State Water Survey  
PRAIRIE RESEARCH INSTITUTE

# Overview

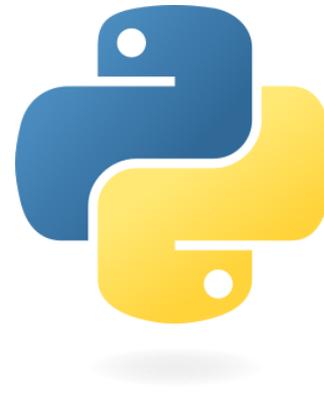
- How this started
- Outputs from stream models
- Overall delineation process
- Super simple stream (example)
- Dealing with tributaries
- Additions we've made to the tools
- Future plans

# Disclaimer

I might be getting old...

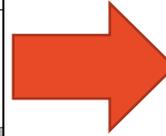
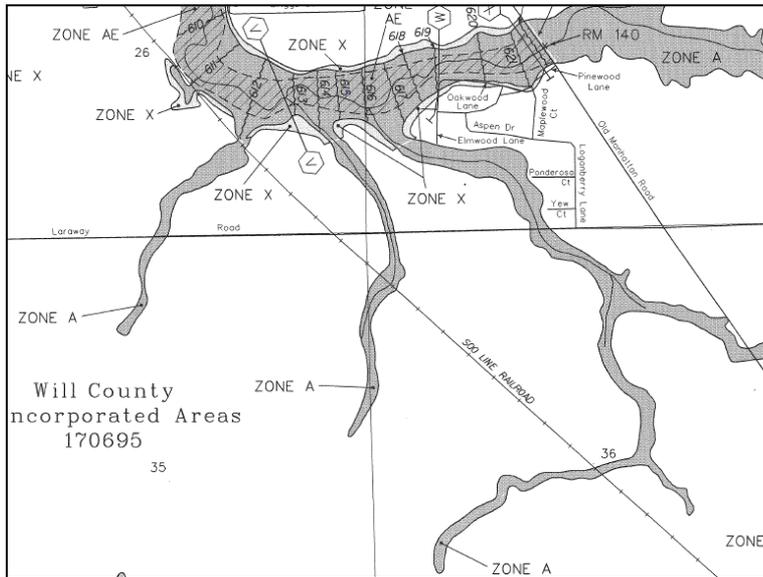


**ArcMap**



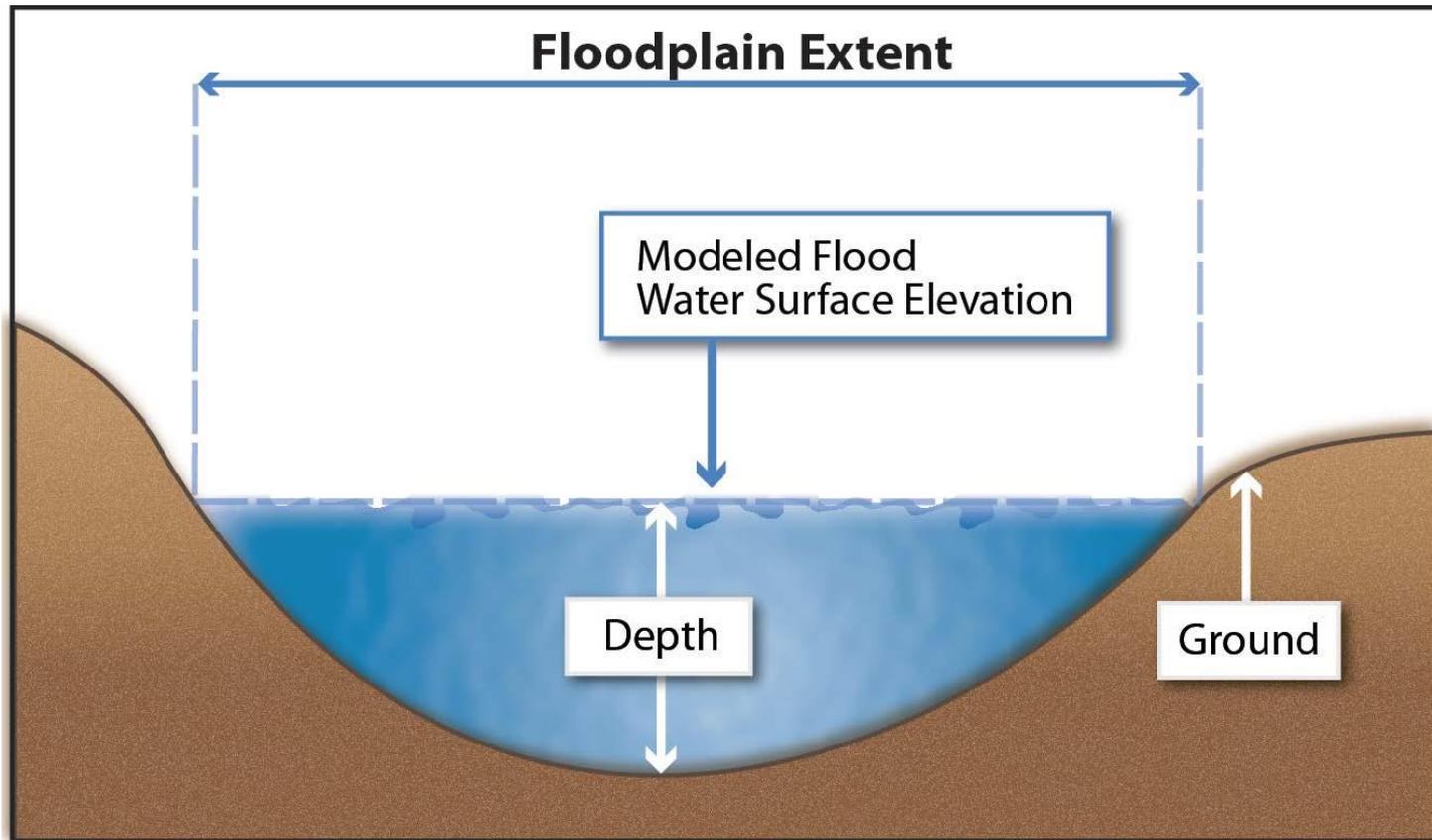
**Python 2**

# Back in the Day...



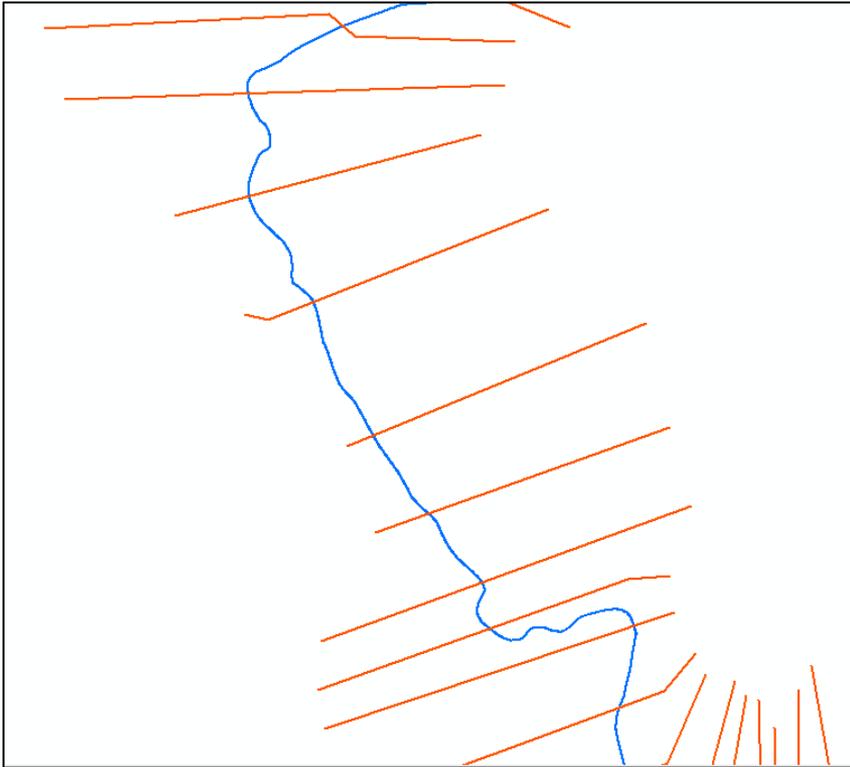
Digital = Yes  
Realistic = Not Always

# New Stream Studies

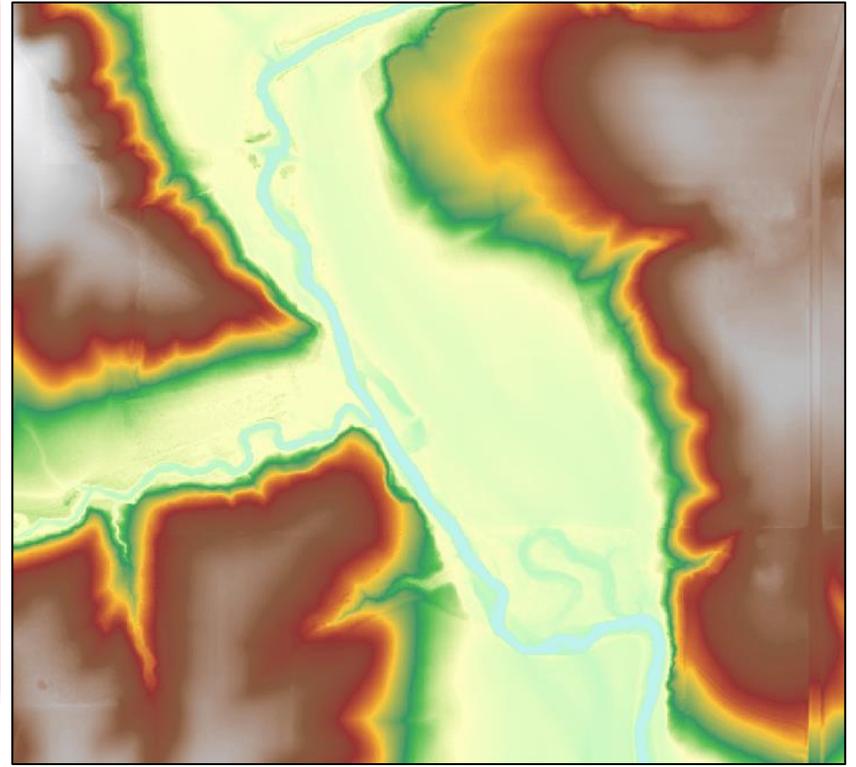


# New Stream Studies

1-D



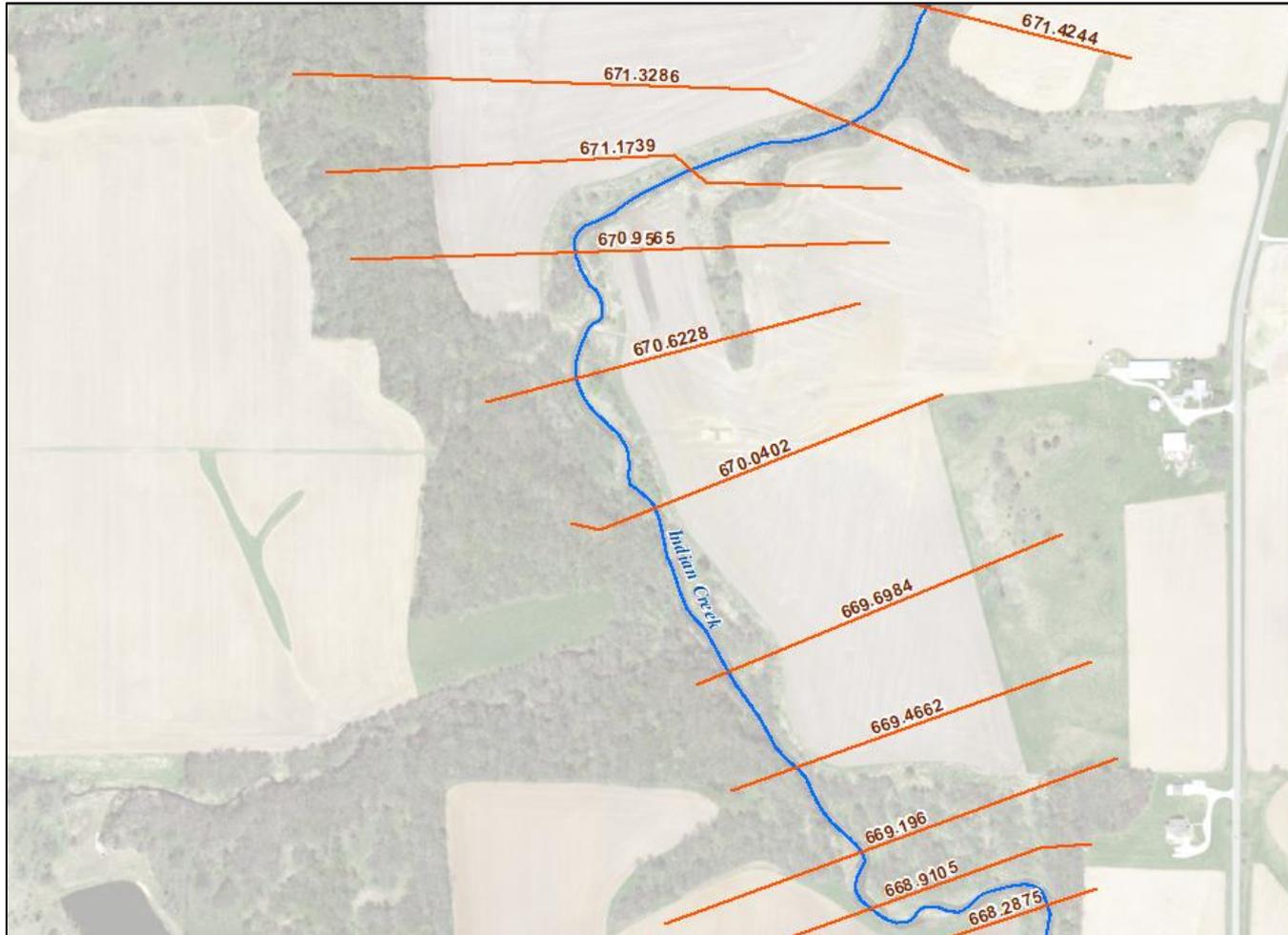
2-D



# New Study Model Outputs



# New Study Model Outputs

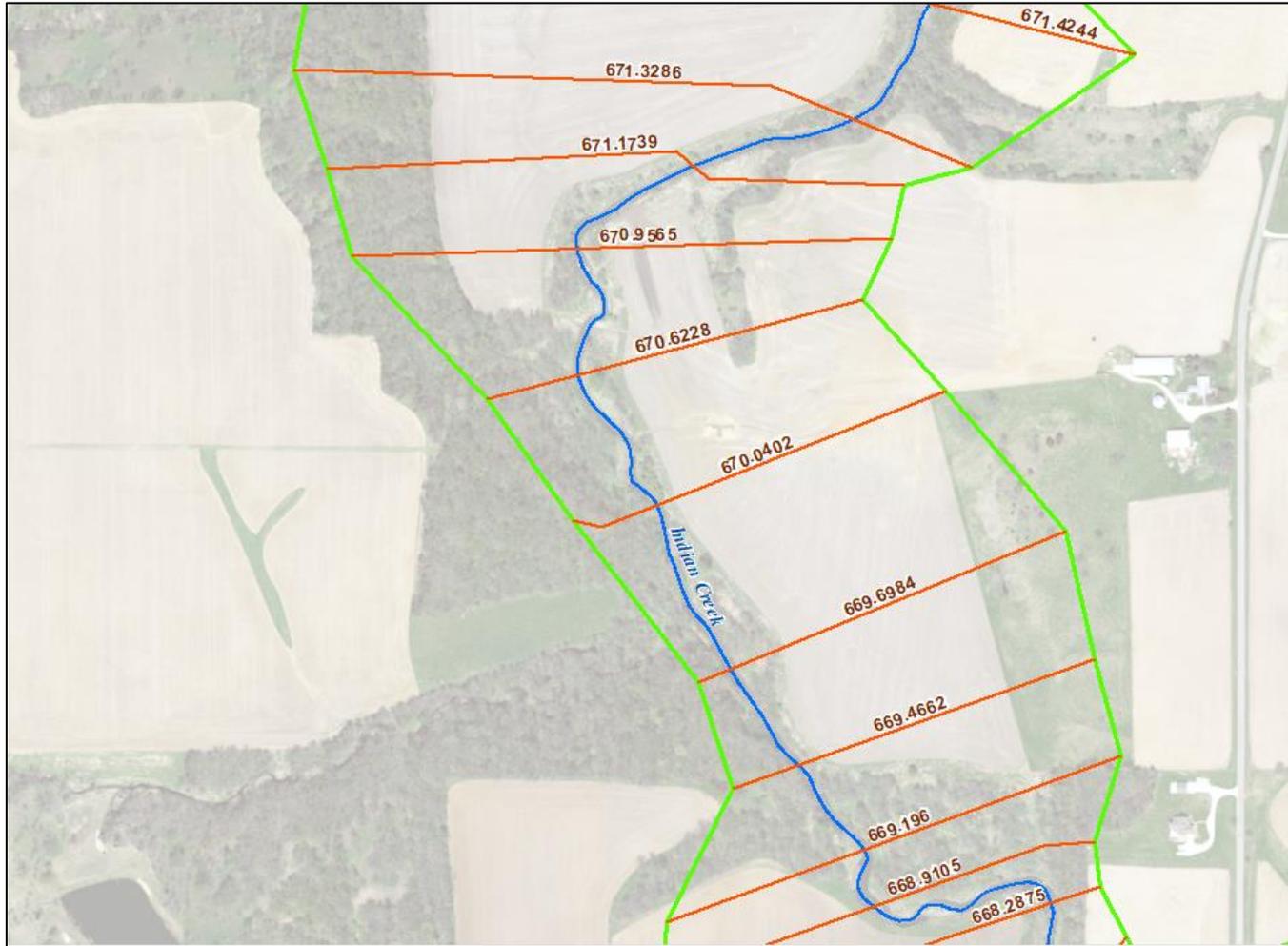


# New Study Model Outputs

The screenshot shows a GIS application window titled 'Table' with a toolbar and a table titled 'XSCutlines'. The table contains 28 rows of data for 'Indian Creek' and 7 columns of water level outputs (WSEL\_10, WSEL\_25, WSEL\_50, WSEL\_100, WSEL\_500, WSEL\_100P) and a final column 'I'. The 'WSEL\_100' column is highlighted. The background map shows a creek with elevation markers: 671.3286 and 671.4244.

	Water	WSEL_10	WSEL_25	WSEL_50	WSEL_100	WSEL_500	WSEL_100P	I
	Indian Creek	662.5991	663.1017	663.4337	663.7402	664.379	665.4405	N
	Indian Creek	663.2186	663.7464	664.0992	664.4274	665.1024	666.2255	N
	Indian Creek	663.7519	664.3094	664.6804	665.0219	665.7212	666.8784	N
	Indian Creek	663.8931	664.4655	664.8411	665.1901	665.9064	667.0874	N
	Indian Creek	664.8934	665.2896	664.873	665.25	666.0033	667.2181	N
	Indian Creek	664.8934	665.2896	665.5865	665.8933	666.5568	667.6808	N
	Indian Creek	665.2488	665.6879	665.9979	666.3162	666.9951	668.1378	N
	Indian Creek	665.7953	666.284	666.6132	666.9464	667.6556	668.8406	N
	Indian Creek	666.2971	666.8391	667.1956	667.5441	668.2762	669.4804	N
	Indian Creek	666.6469	667.1901	667.5439	667.8773	668.5851	669.7718	N
	Indian Creek	667.0397	667.5888	667.945	668.2875	669.0106	670.223	N
	Indian Creek	667.5959	668.171	668.5453	668.9105	669.6794	670.9504	N
	Indian Creek	667.8465	668.4354	668.8199	669.196	669.9858	671.2849	N
	Indian Creek	668.088	668.688	669.0812	669.4662	670.2789	671.6148	N
	Indian Creek	668.3159	668.9156	669.3105	669.6984	670.5206	671.8748	N
	Indian Creek	668.6613	669.2618	669.6538	670.0402	670.8608	672.2105	N
	Indian Creek	669.2134	669.8298	670.2284	670.6228	671.4622	672.8339	N
	Indian Creek	669.5251	670.1465	670.554	670.9565	671.8152	673.2242	N
	Indian Creek	669.7412	670.3599	670.7693	671.1739	672.0388	673.4609	N
	Indian Creek	669.8896	670.5086	670.9212	671.3286	672.2007	673.637	N
	Indian Creek	669.9755	670.5796	671.0095	671.4244	672.3015	673.7372	N
	Indian Creek	670.5696	671.2606	671.5916	671.928	672.6953	674.0316	N
	Indian Creek	671.1552	671.7877	672.1319	672.4553	673.2078	674.4396	N

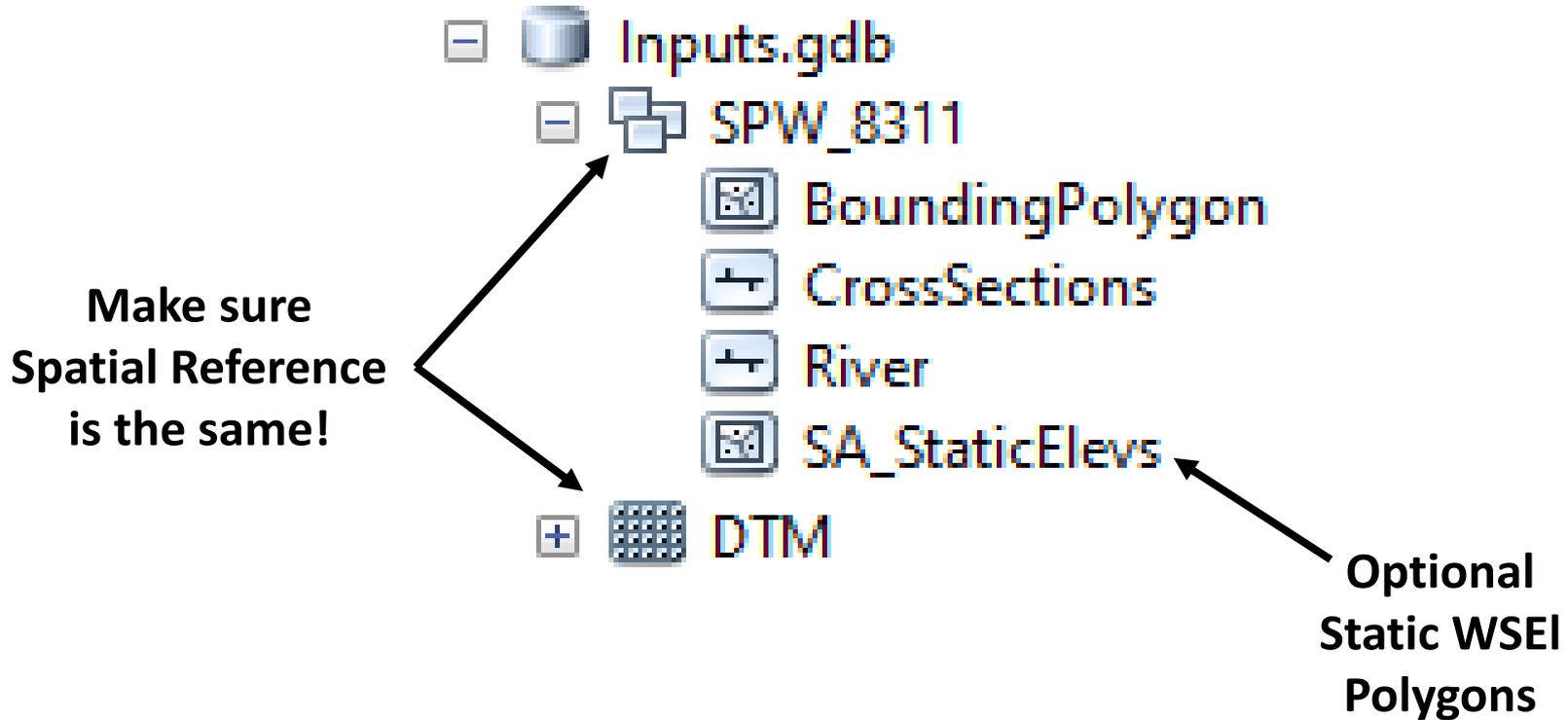
# New Study Model Outputs



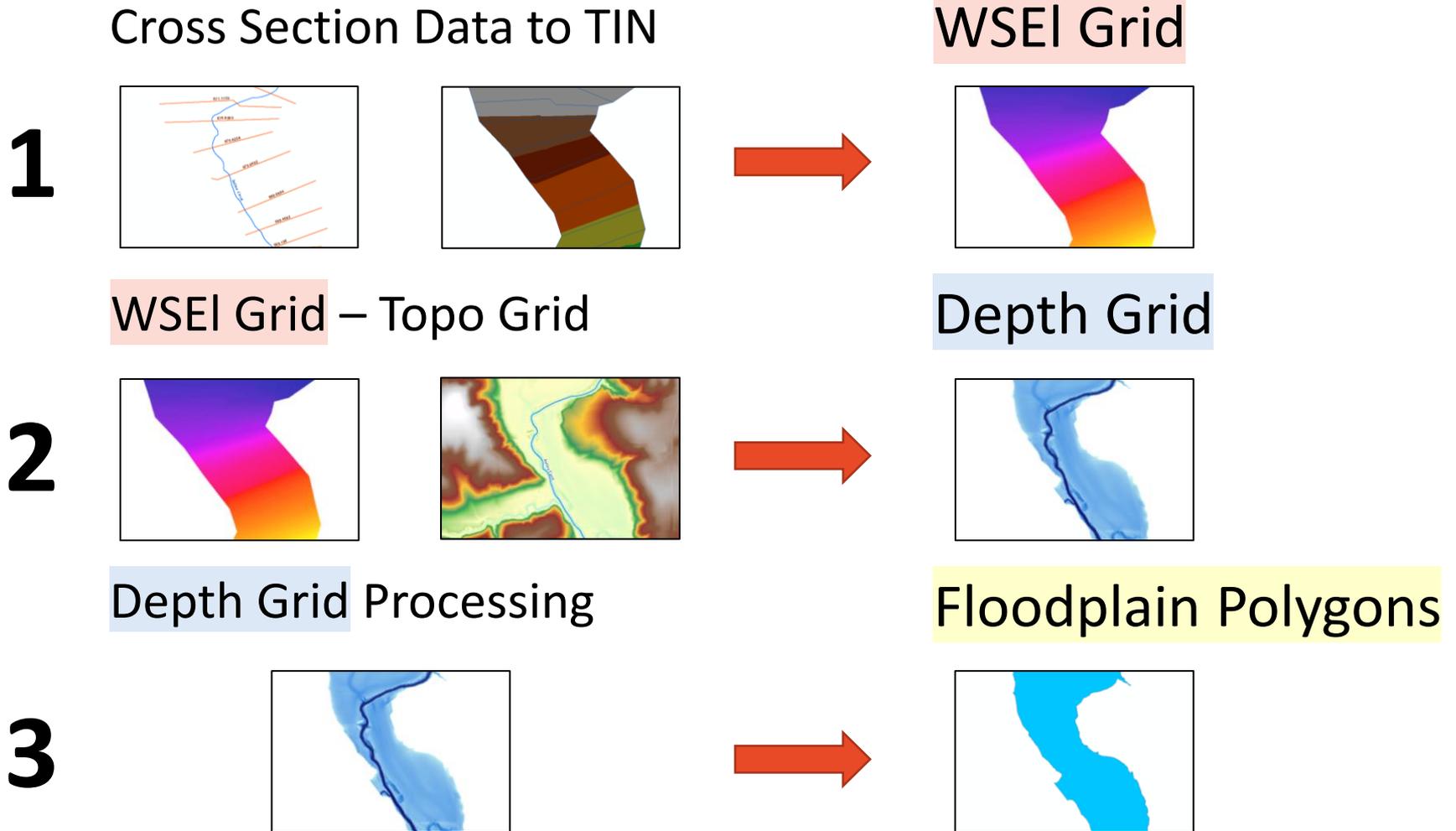
# Coming up with Consistent Workflow



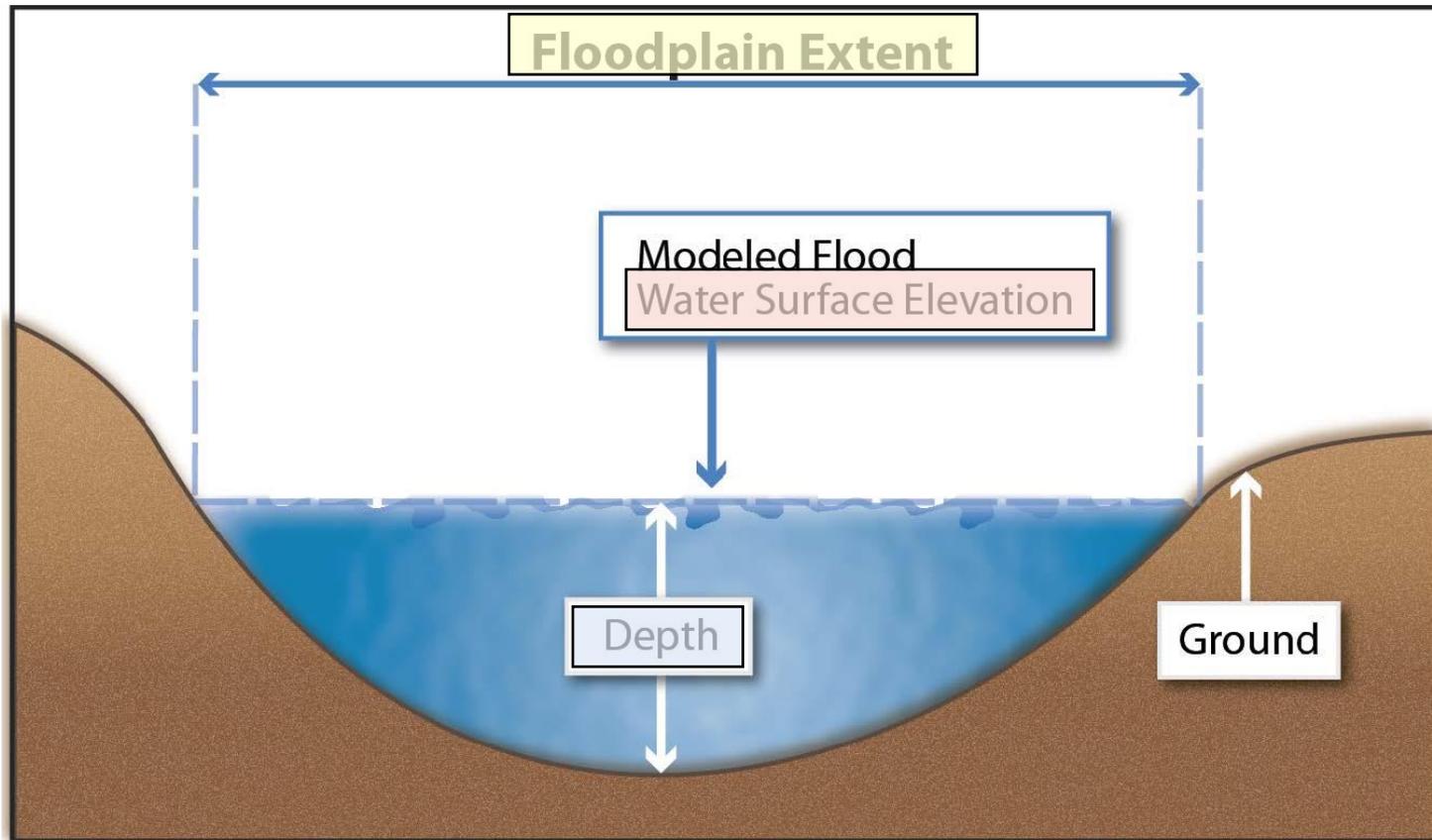
# Script Tool Inputs



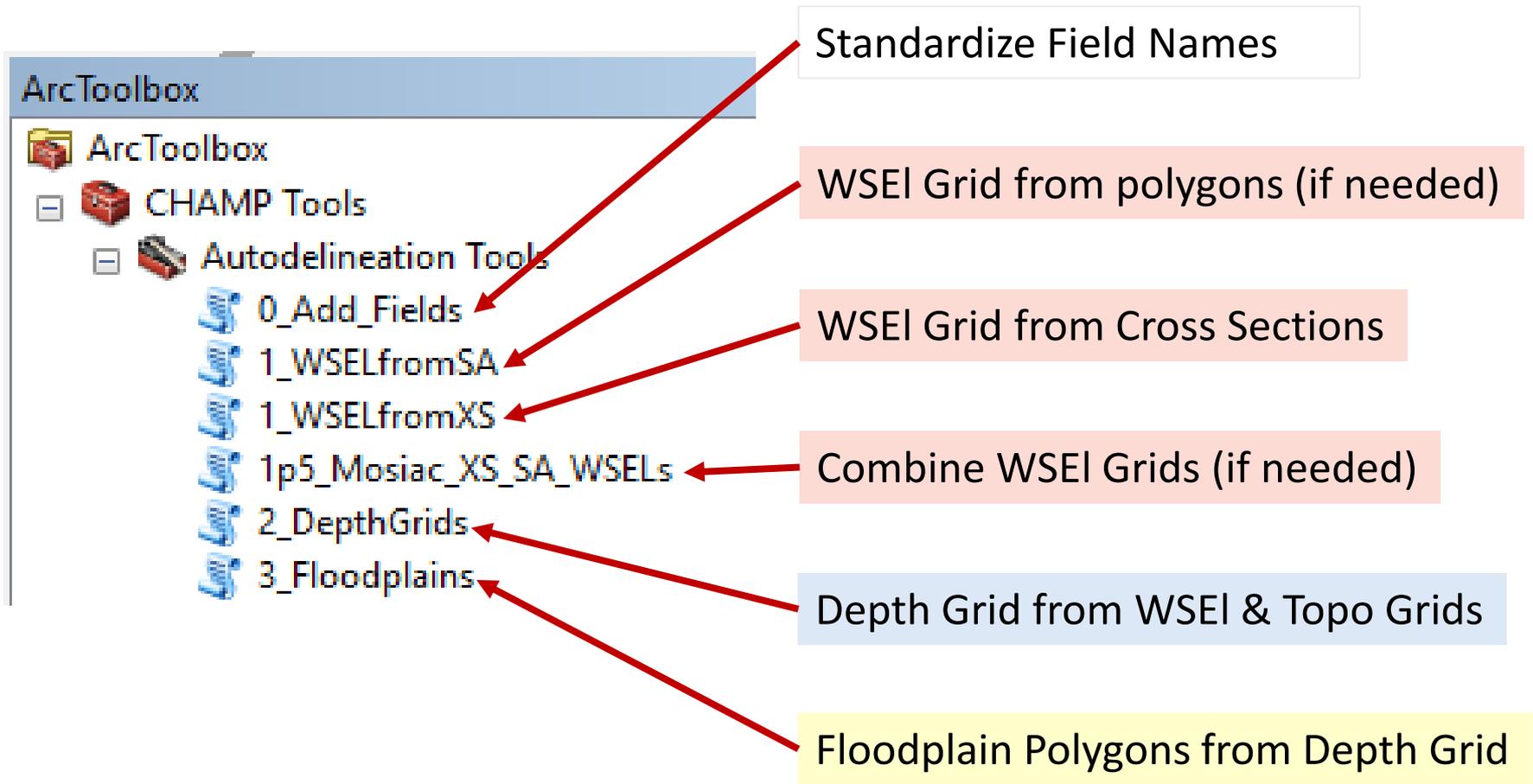
# Overall Delineation Process (3 steps)



# Overall Delineation Process (3 steps)

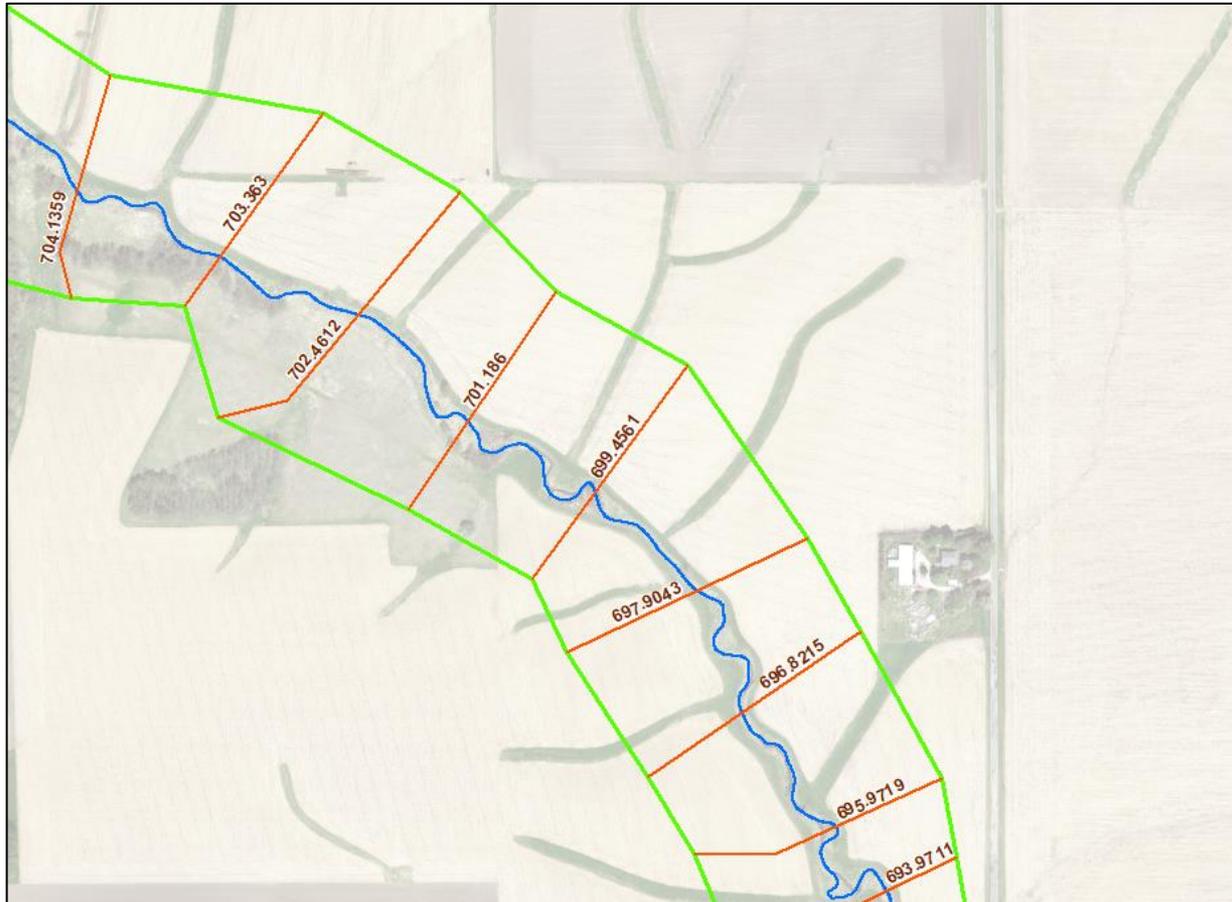


# The Script Tools



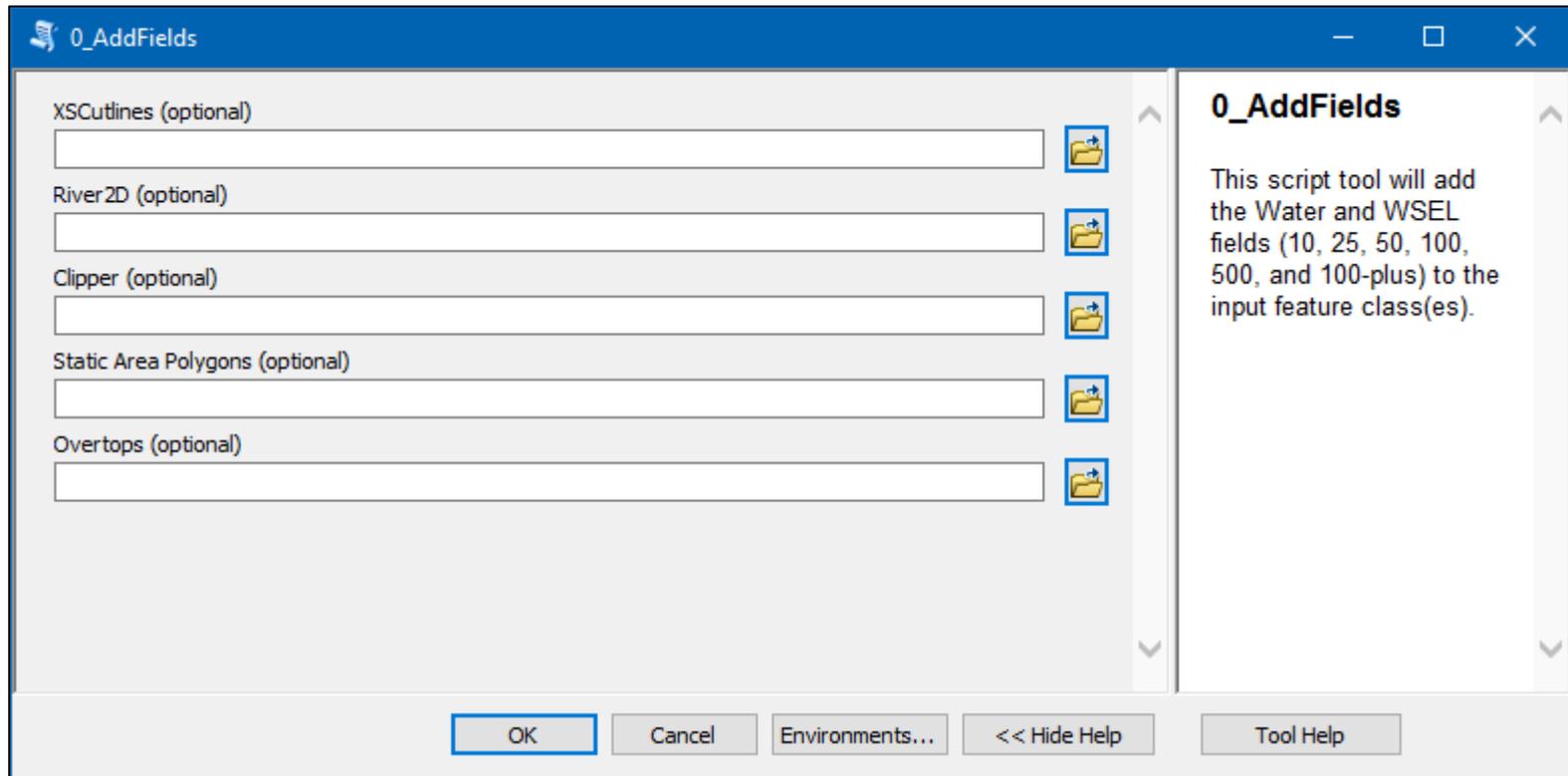
# Super Simple Stream

One stream, only cross sections



# Preparing Script Tool Inputs

## Run “0\_AddFields” tool



# Preparing Script Tool Inputs

## Attribute New Fields

### Cross Sections

	Water	WSEL_10	WSEL_25	WSEL_50	WSEL_100	WSEL_500	WSEL_100P	FakeXS_YN	S
▶	Indian Creek	662.5991	663.1017	663.4337	663.7402	664.379	665.4405	N	
	Indian Creek	663.2186	663.7464	664.0992	664.4274	665.1024	666.2255	N	
	Indian Creek	663.7519	664.3094	664.6804	665.0219	665.7212	666.8784	N	
	Indian Creek	663.8931	664.4655	664.8411	665.1901	665.9064	667.0874	N	
	Indian Creek	664.8934	665.2896	664.873	665.25	666.0033	667.2181	N	
	Indian Creek	664.8934	665.2896	665.5865	665.8933	666.5568	667.6808	N	
	Indian Creek	665.2488	665.6879	665.9979	666.3162	666.9951	668.1378	N	
	Indian Creek	665.7953	666.284	666.6132	666.9464	667.6556	668.8406	N	
	Indian Creek	666.2971	666.8391	667.1956	667.5441	668.2762	669.4804	N	
	Indian Creek	666.6469	667.1901	667.5439	667.8773	668.5851	669.7718	N	
	Indian Creek	667.0397	667.5888	667.945	668.2875	669.0106	670.223	N	

### Bounding Polygons

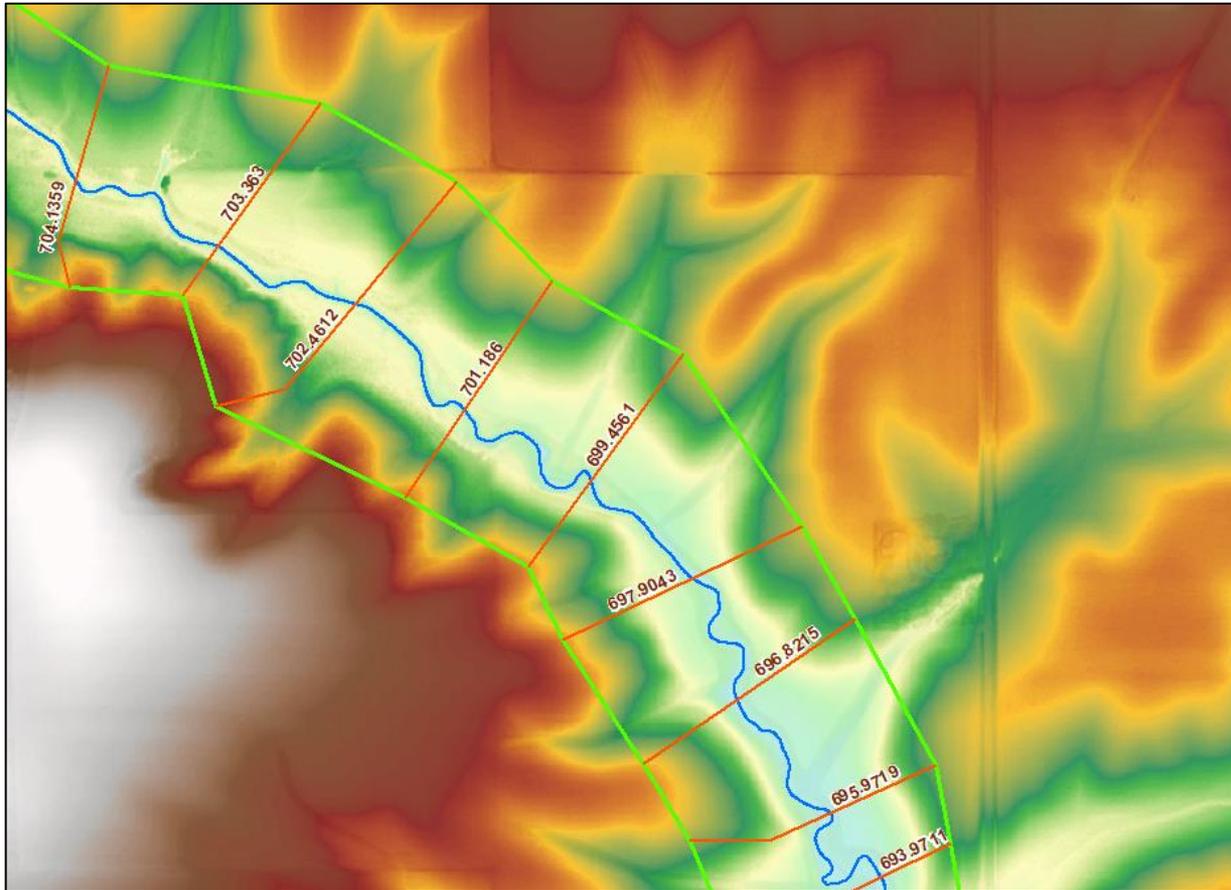
	object identifier *	Water	Shape *
▶	1	Indian Creek	Polygon

### Stream Lines

	object identifier *	Water	Shape *
▶	3	Indian Creek	Polyline

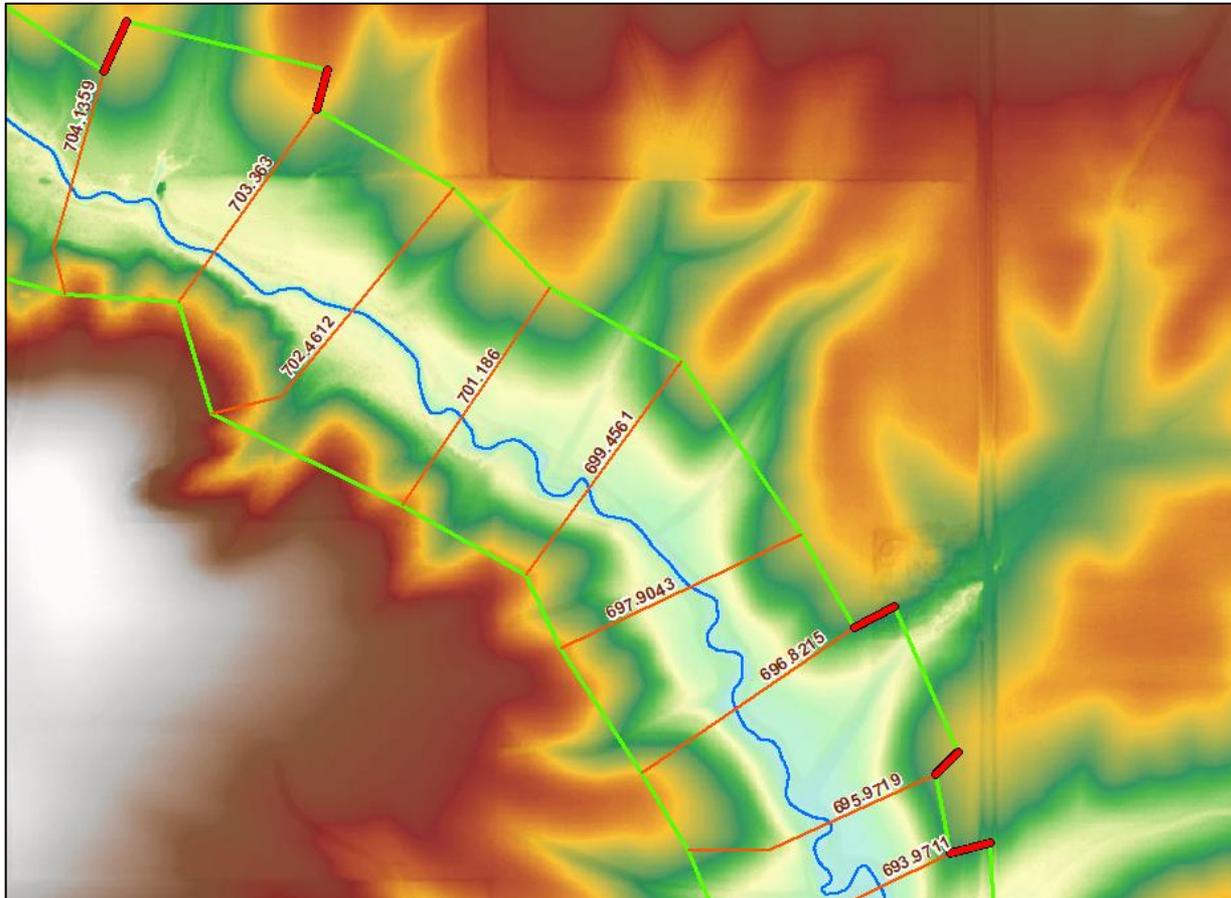
# Preparing Script Tool Inputs

Extend Cross Sections where needed

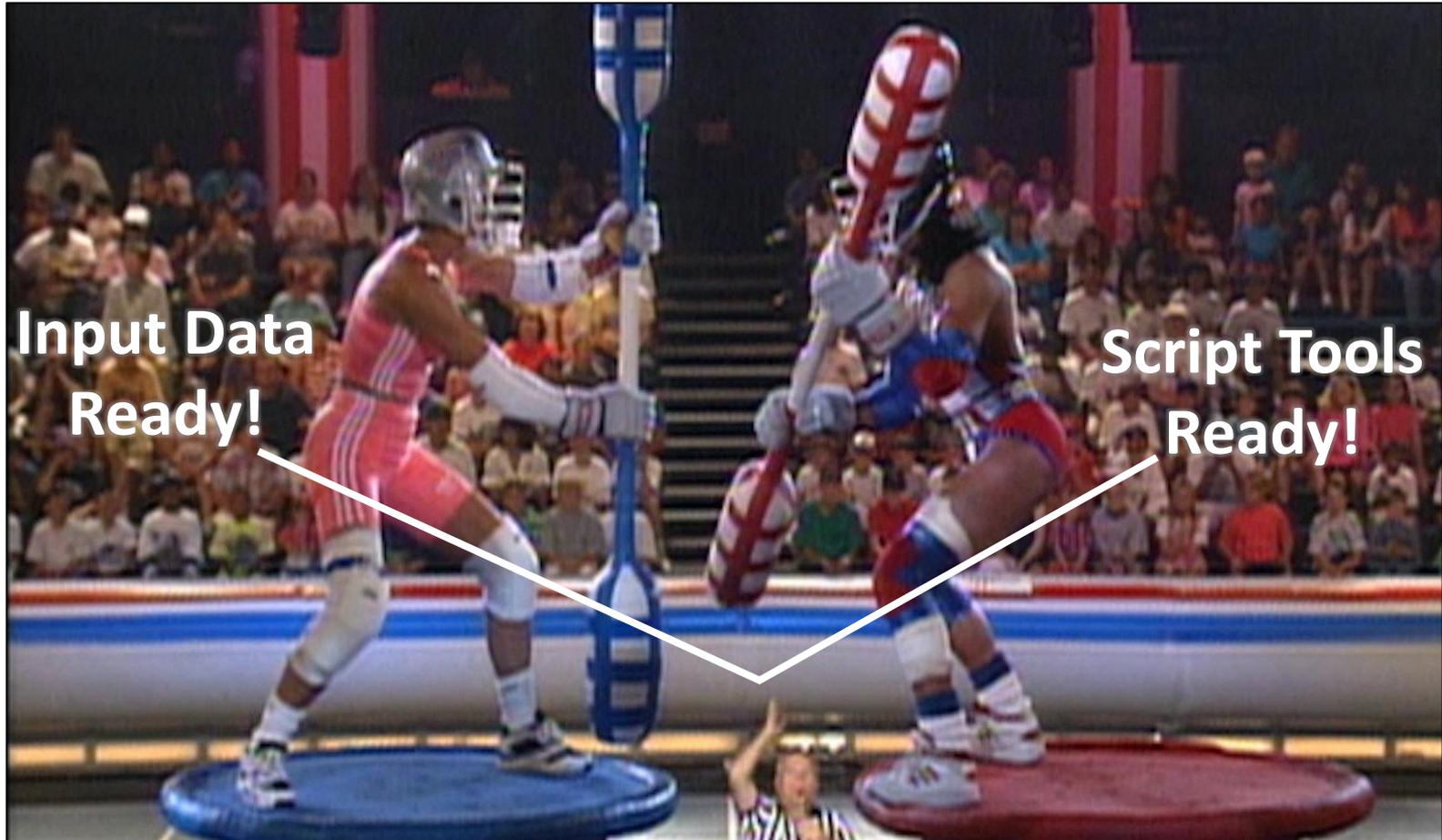


# Preparing Script Tool Inputs

Extend Cross Sections where needed

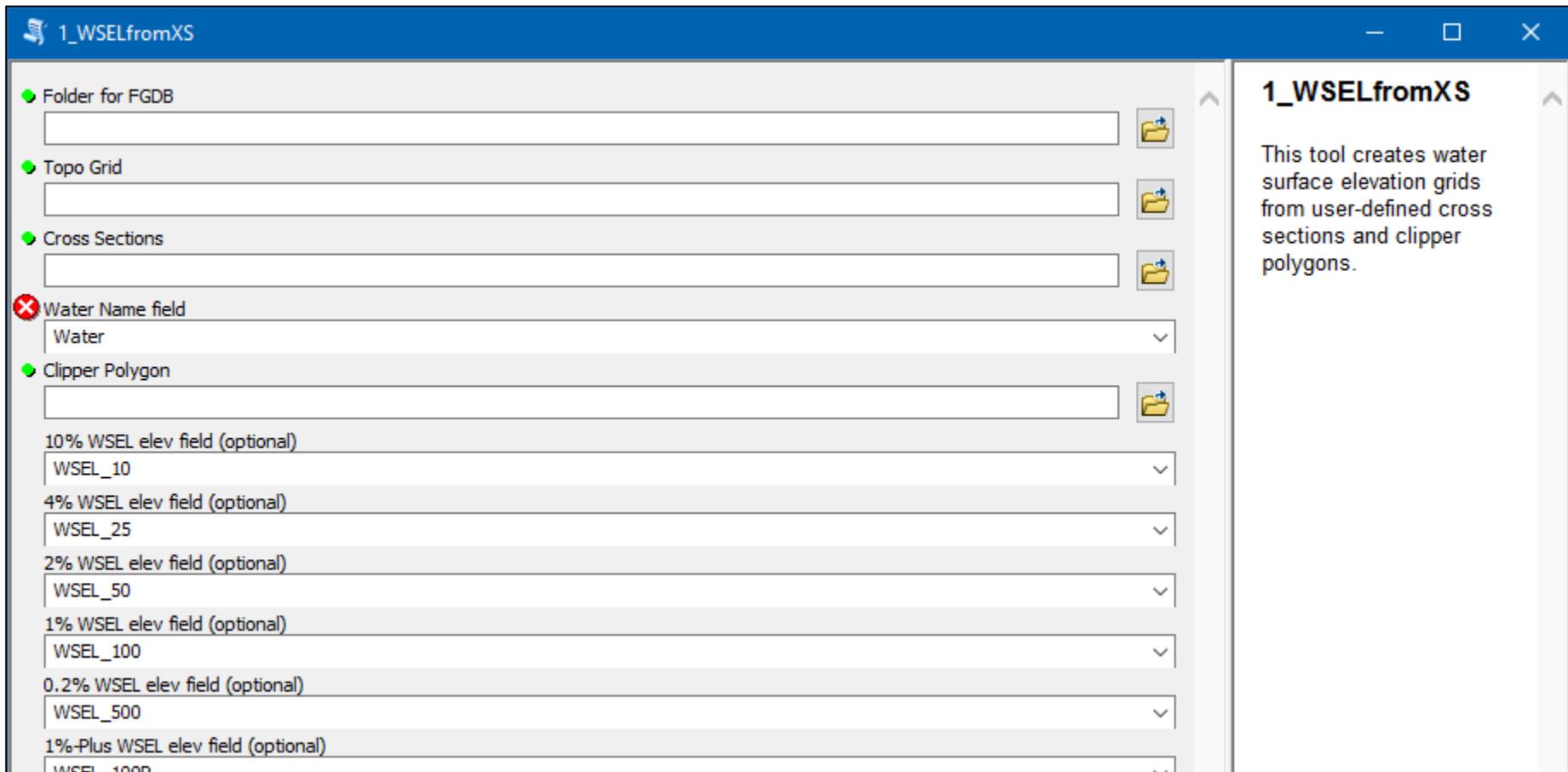


# Ready to Go!



# Making the WSEI Grid

## Dialog Box



# Making the WSEI Grid (1/3)

## Extract Stream's Cross Sections



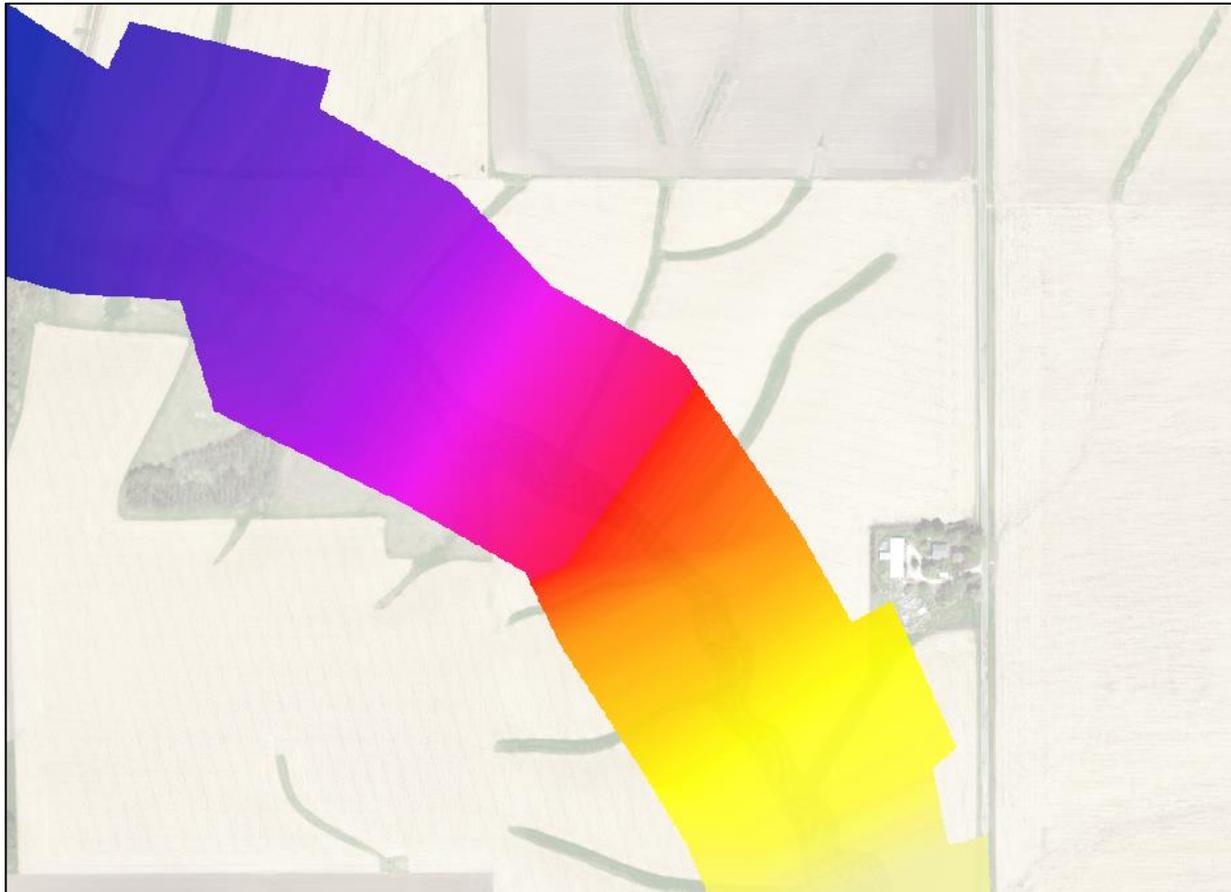
# Making the WSEI Grid (2/3)

## Create TIN



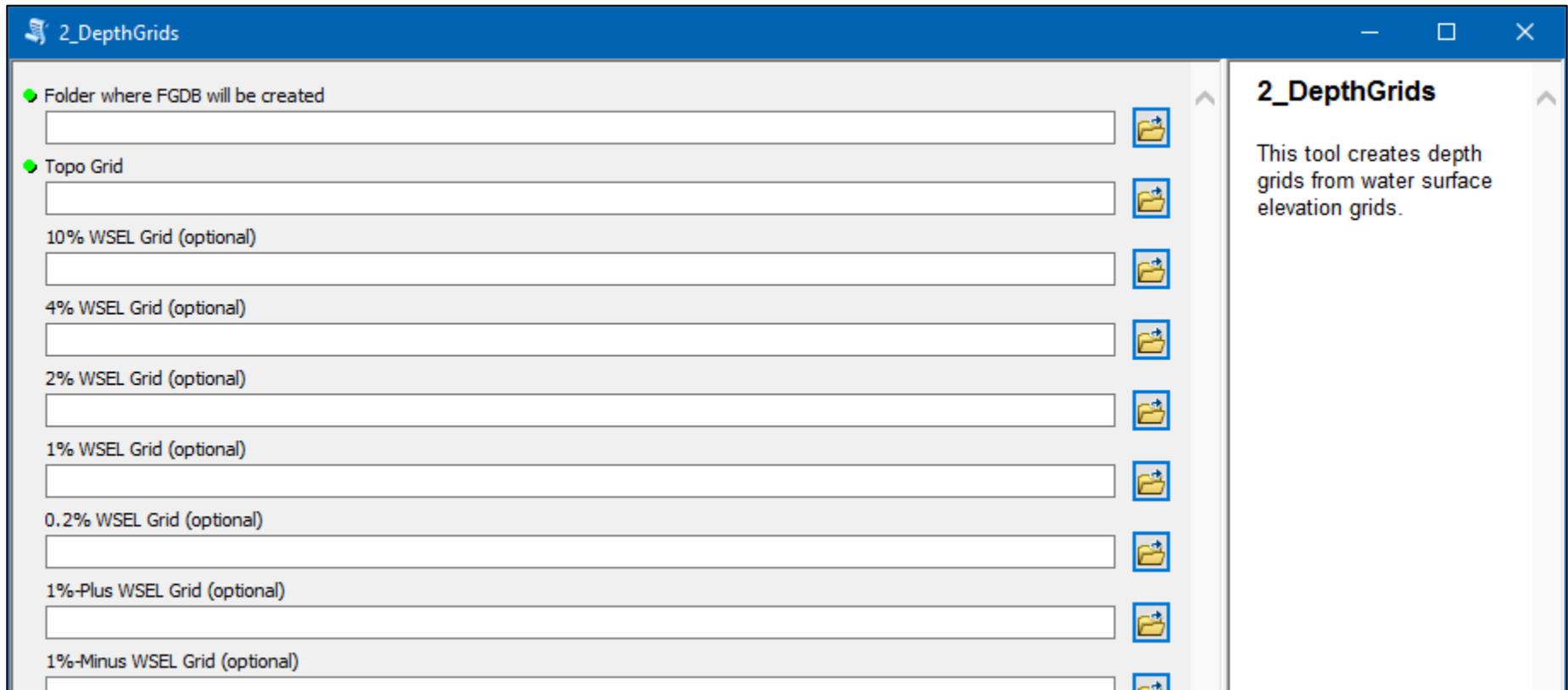
# Making the WSEI Grid (3/3)

## Convert TIN to Raster



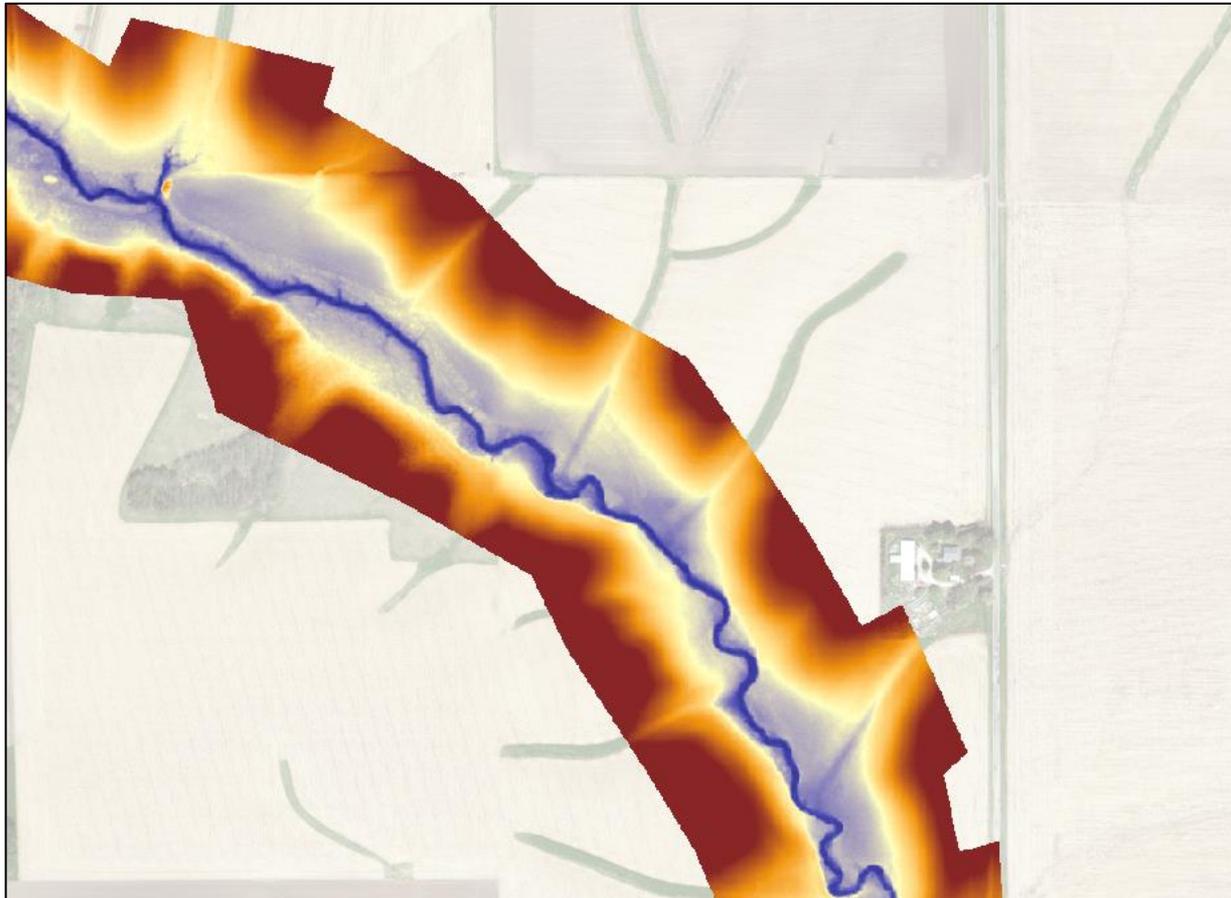
# Making the Depth Grid

## Dialog Box



# Making the **Depth Grid** (1/2)

Subtract Topo from WSEI



# Making the **Depth Grid** (2/2)

Set negative values to Null



# Making the Floodplains

## Dialog Box

3\_Floodplains

- Folder where GDB will be created
- Water Lines
- Overtopping Polygons (optional)
- 10% Depth "WithNeg" Grid (optional)
- 4% Depth "WithNeg" Grid (optional)
- 2% Depth "WithNeg" Grid (optional)
- 1% Depth "WithNeg" Grid (optional)
- 0.2% Depth "WithNeg" Grid (optional)
- 1%-Plus Depth "WithNeg" Grid (optional)
- 1%-Minus Depth "WithNeg" Grid (optional)
- Min Area (square feet) to keep Poly: 62500
- Min Depth (feet) to consider flooded

**3\_Floodplains**

This tool creates floodplain polygons from depth grids.

# Making the Floodplains (1/6)

Reclassify to binary (0 or 1)



# Making the Floodplains (2/6)

## Boundary Clean



# Making the Floodplains (3/6)

## Convert to Polygon



# Making the Floodplains (4/6)

## Eliminate Small Polygons



# Making the Floodplains (5/6)

Remove Polygons that don't intersect stream

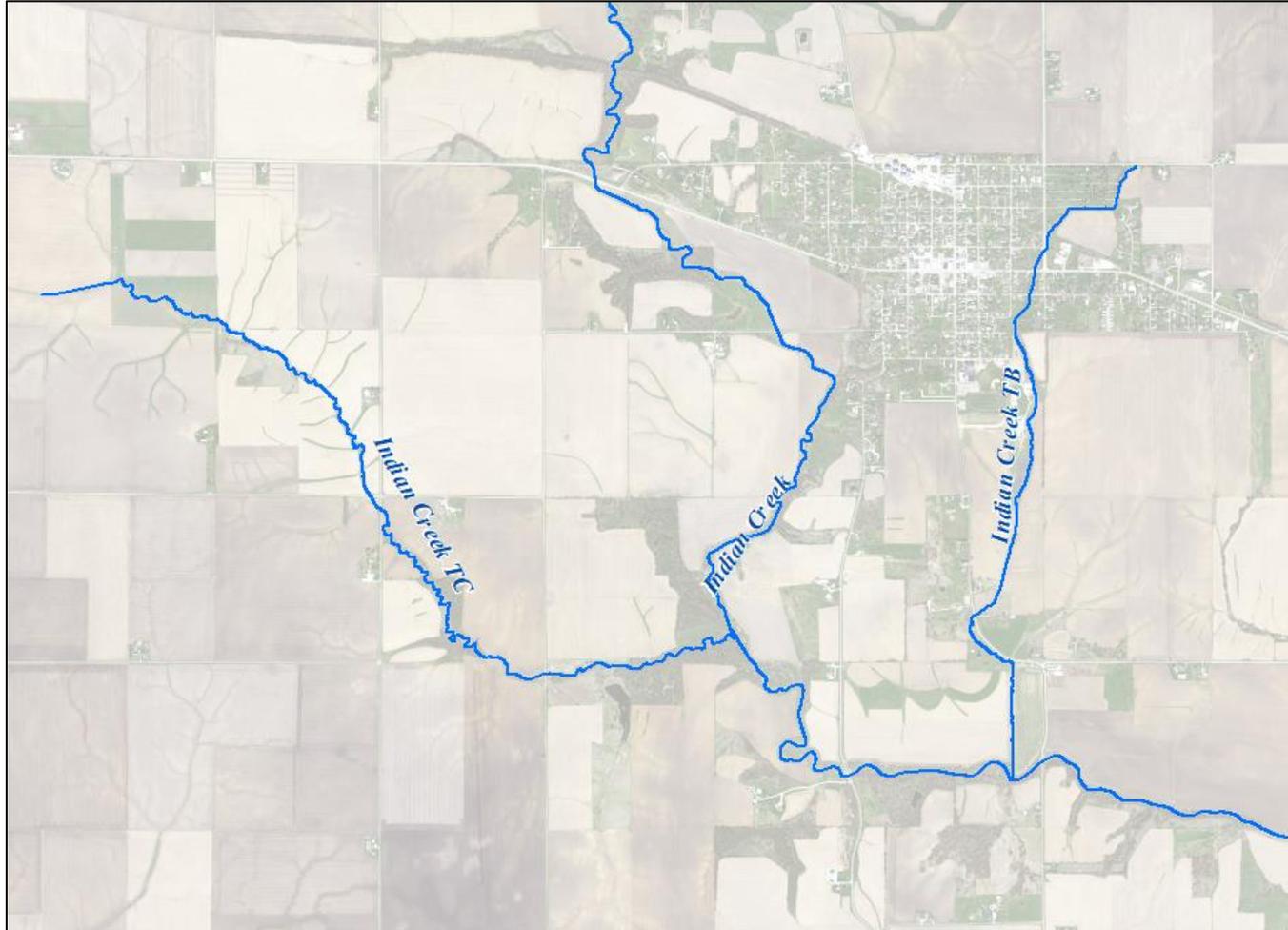


# Making the Floodplains (6/6)

Remove Polygons above WSEI

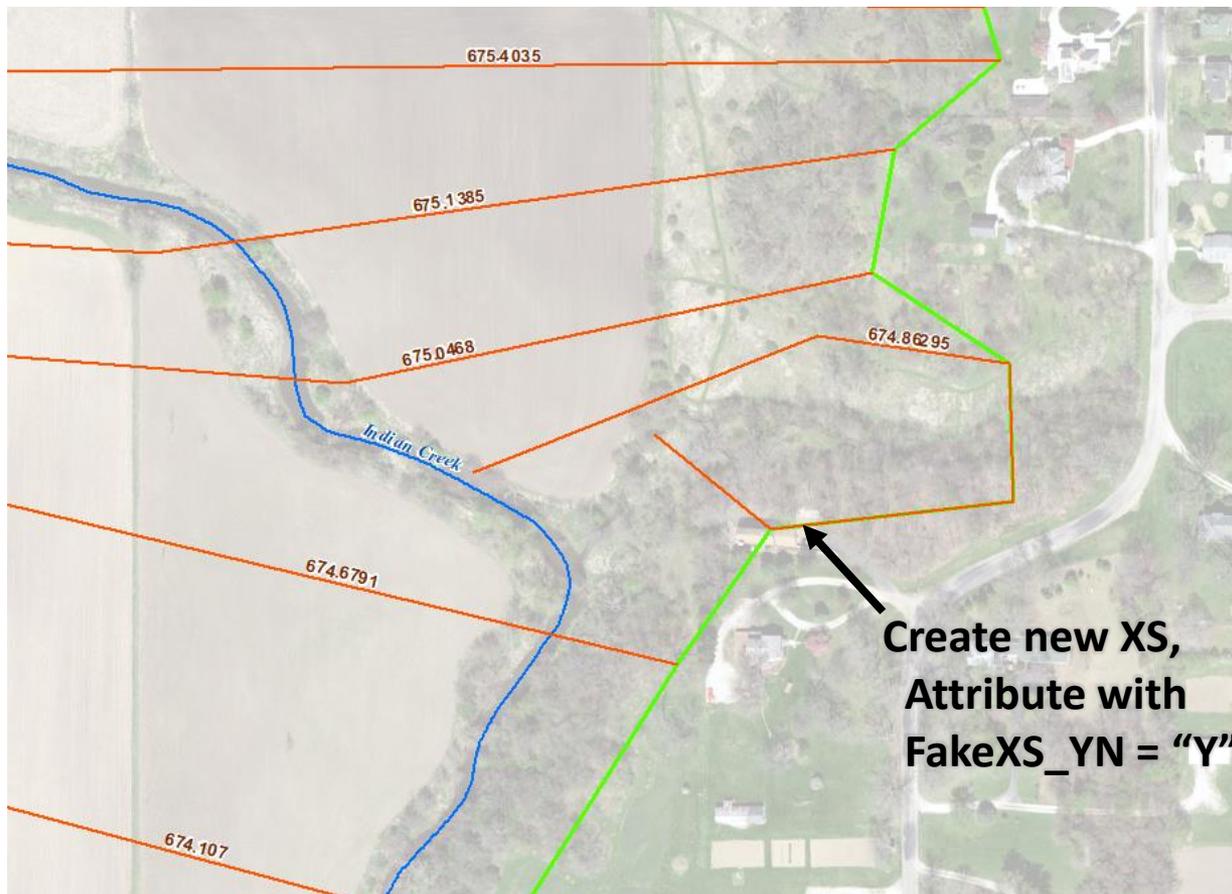


# But What About Tributaries?



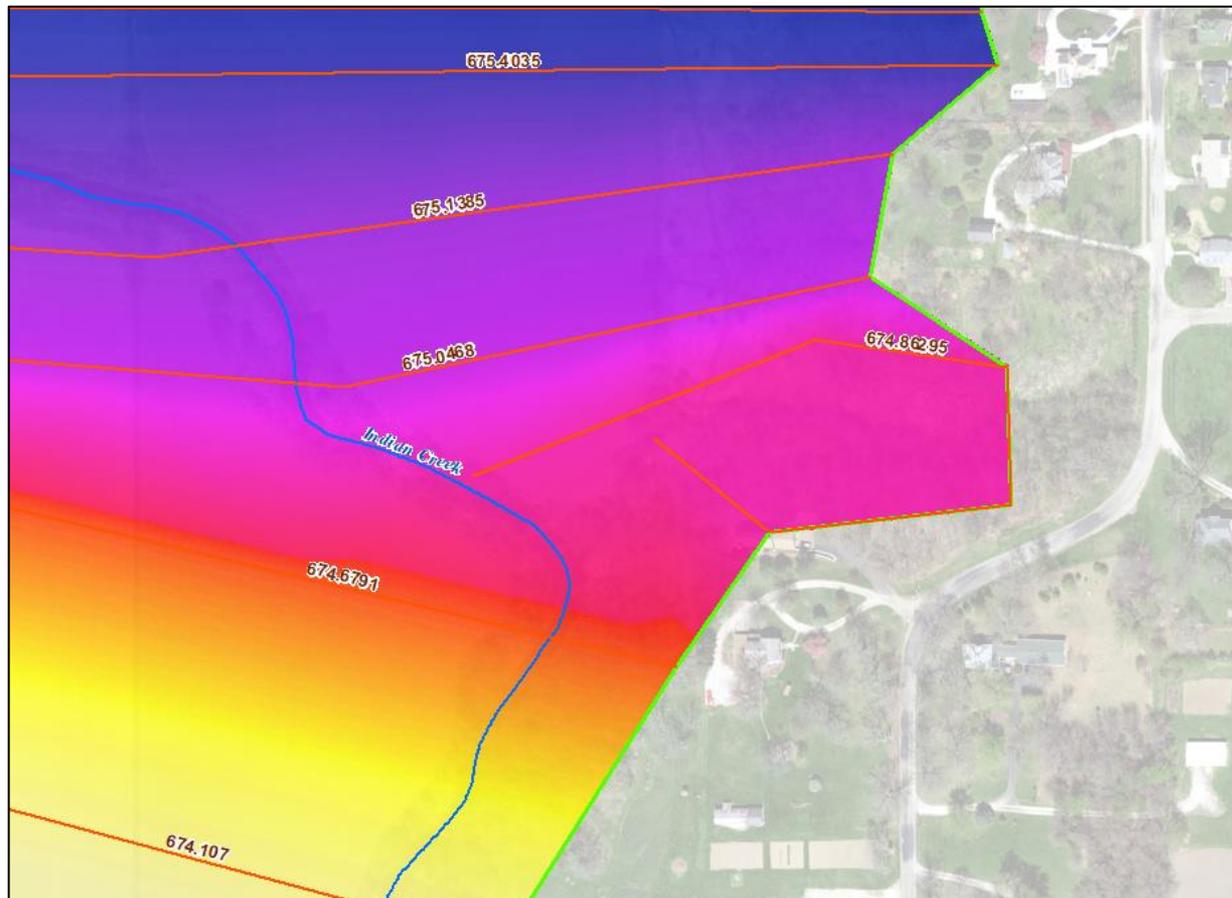
# Including Tributaries (1/3)

Not Studied – Lasso w/XS Method



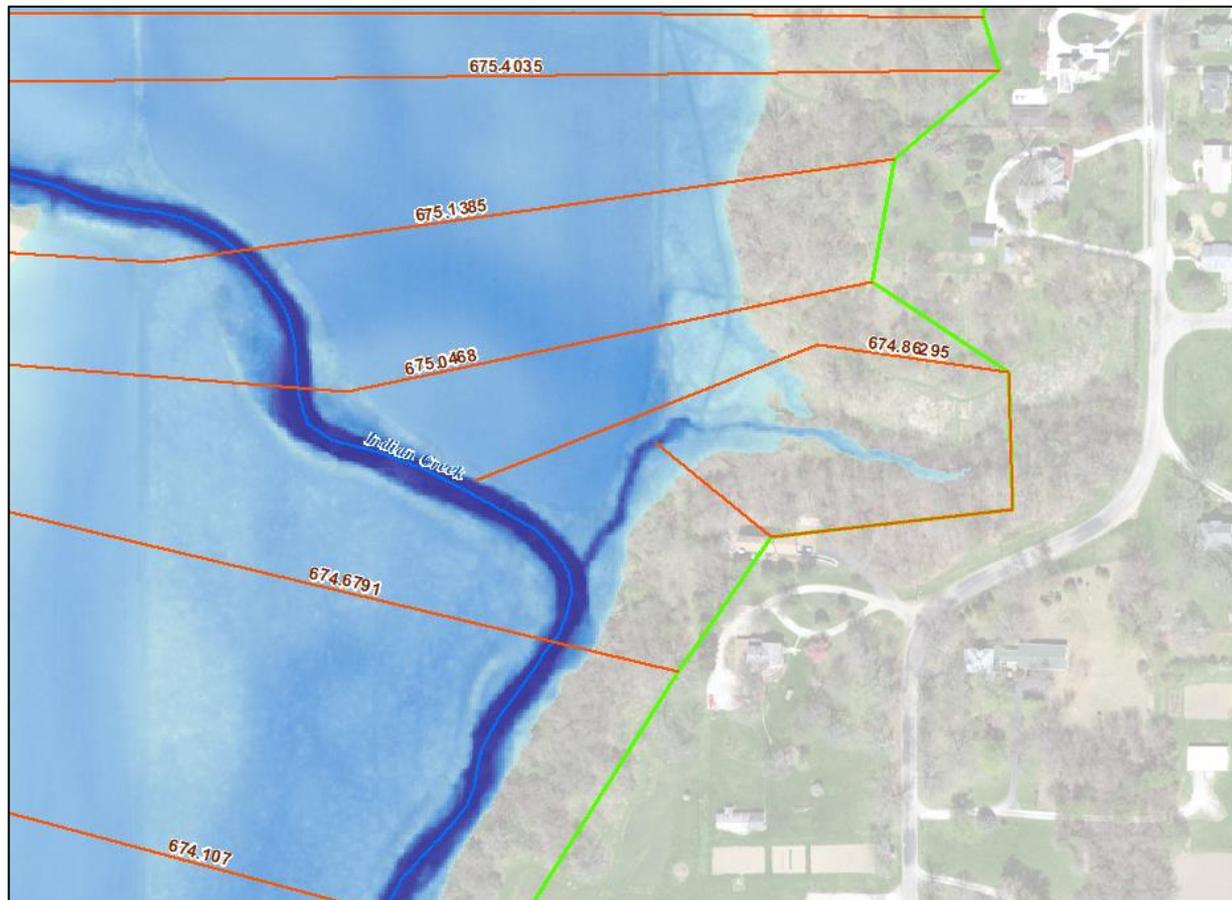
# Including Tributaries (1/3)

Not Studied – Lasso w/XS Method



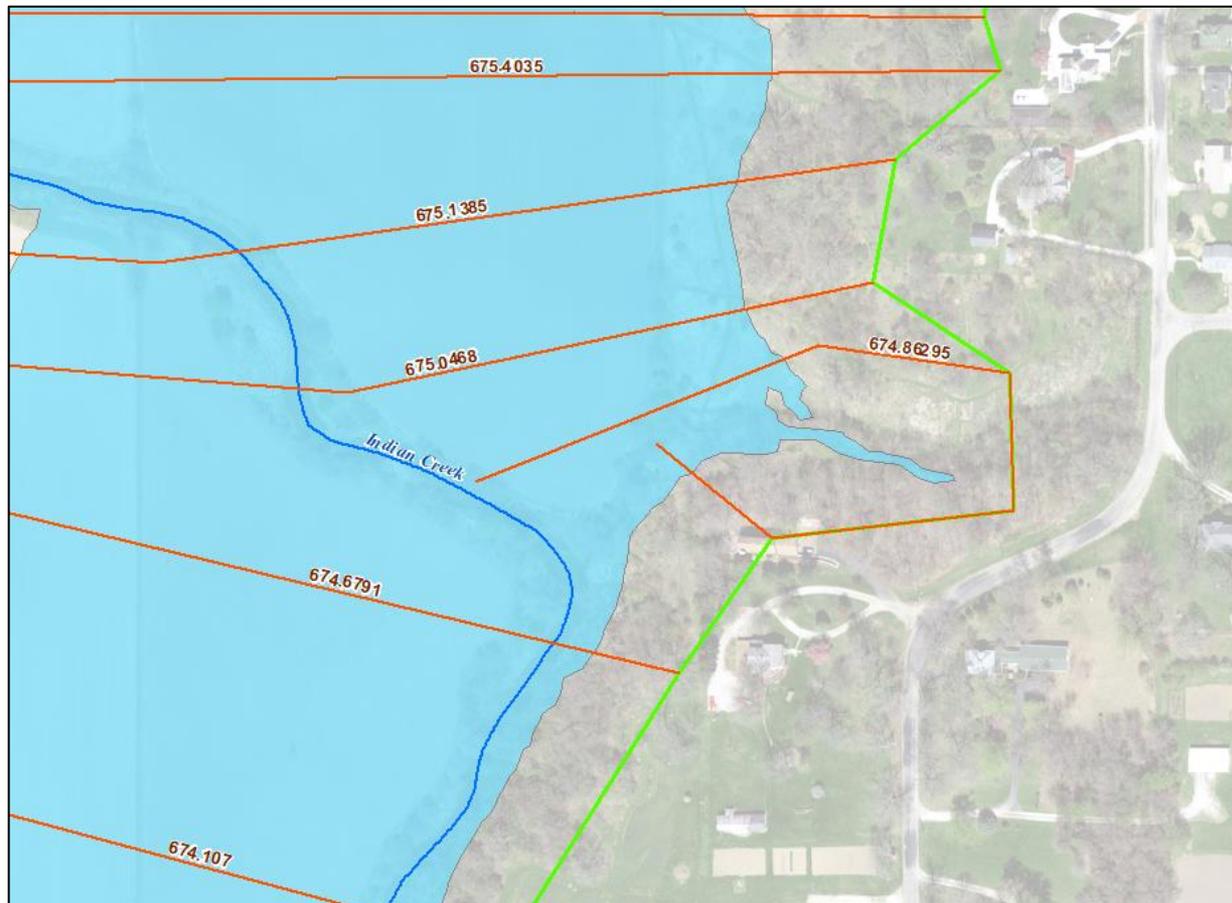
# Including Tributaries (1/3)

Not Studied – Lasso w/XS Method



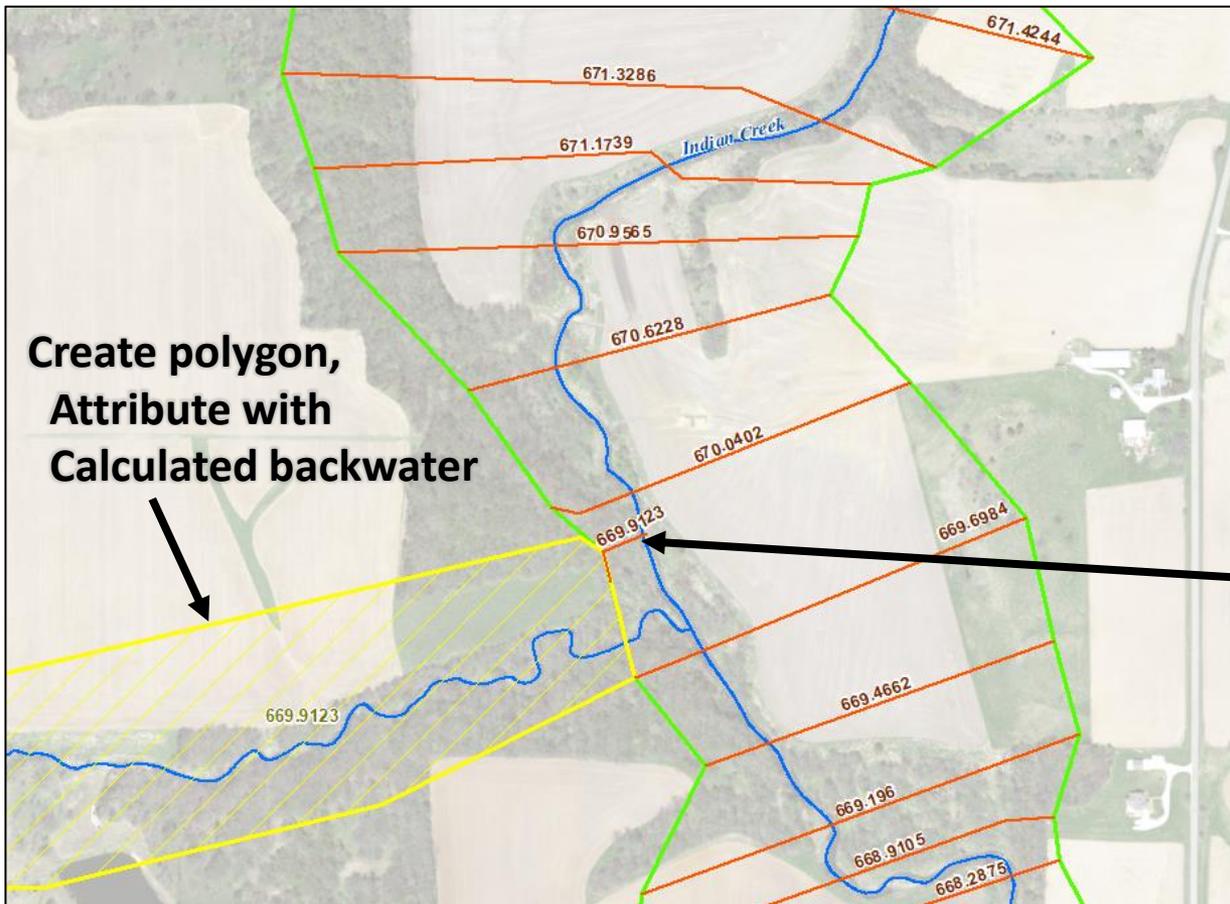
# Including Tributaries (1/3)

Not Studied – Lasso w/XS Method



# Including Tributaries (2/3)

Not Studied – Static Polygon Method

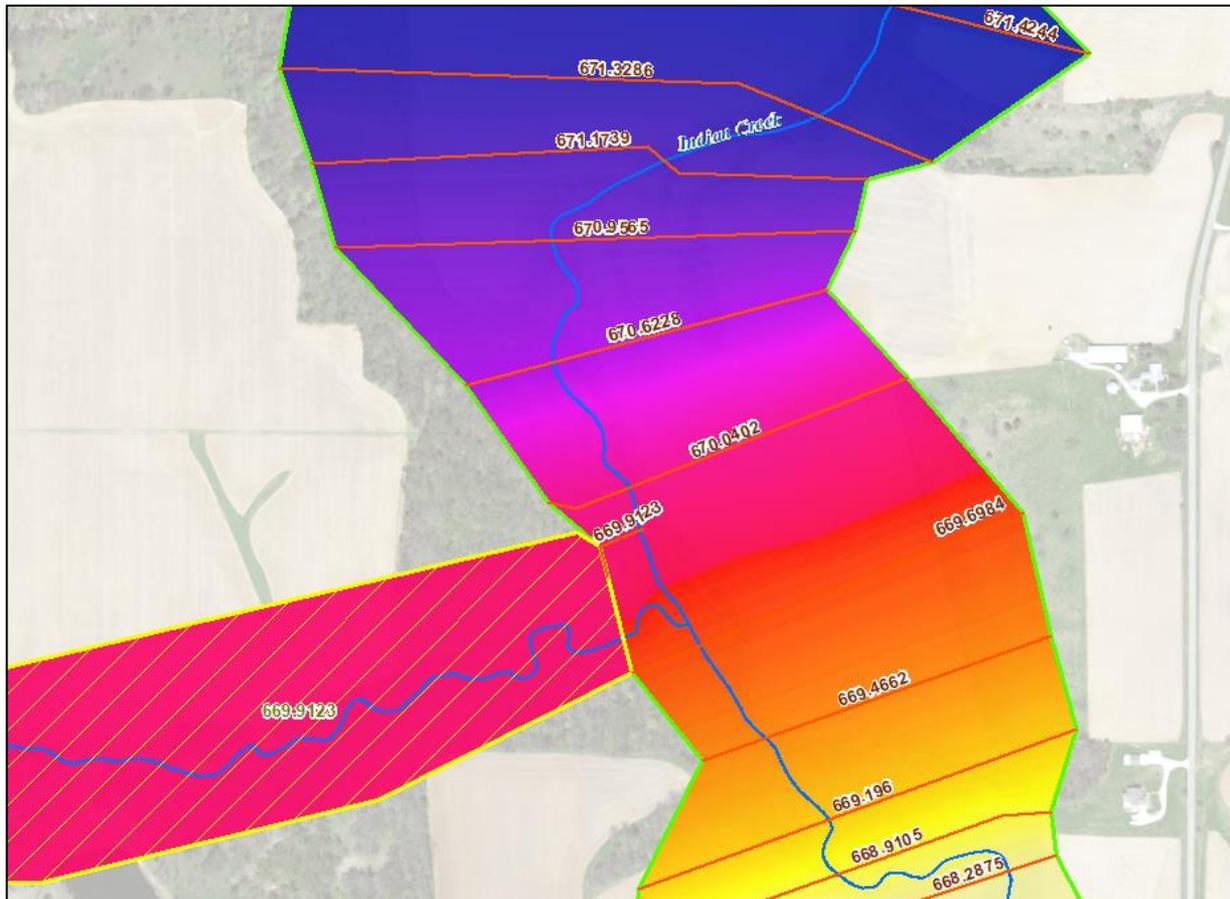


**Create polygon,  
Attribute with  
Calculated backwater**

**Create XS,  
Attribute with  
Calculated  
backwater**

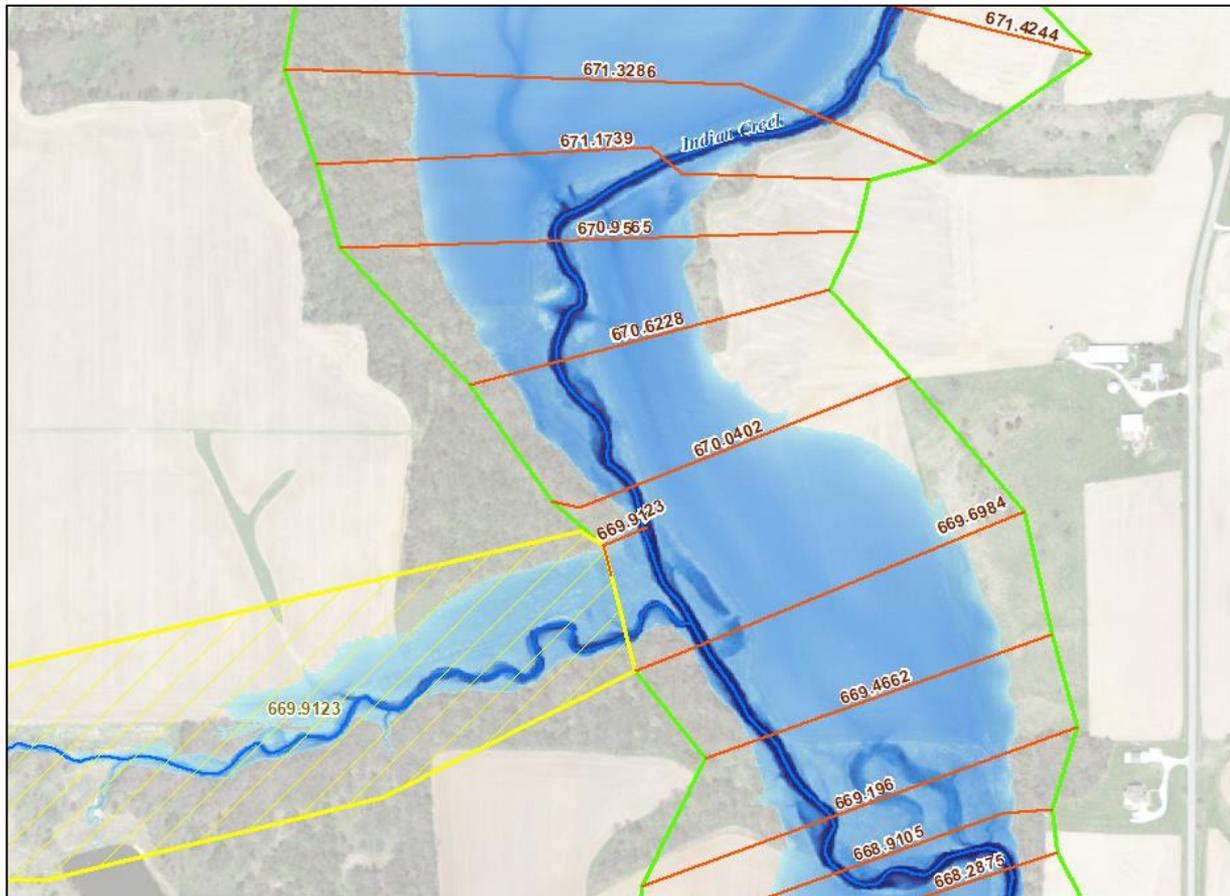
# Including Tributaries (2/3)

Not Studied – Static Polygon Method



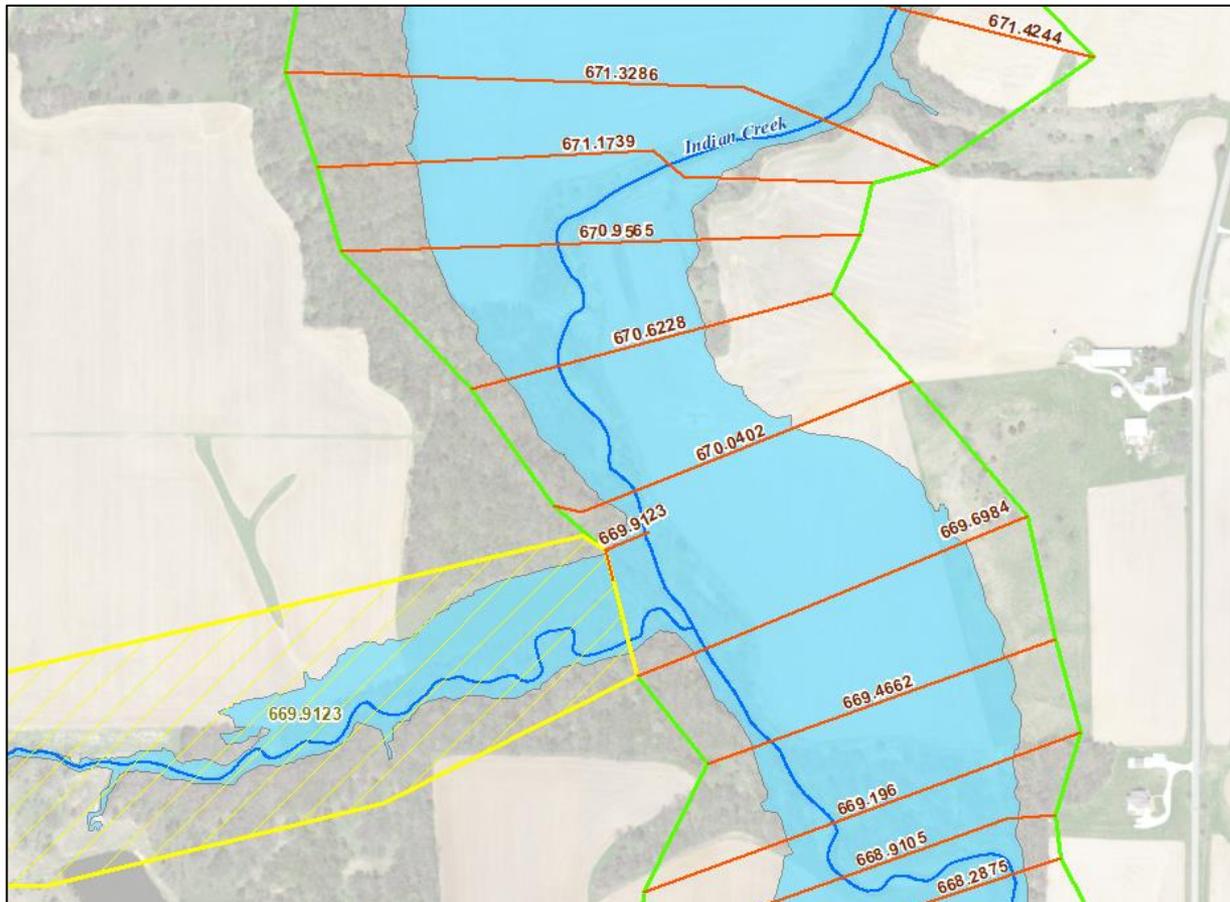
# Including Tributaries (2/3)

Not Studied – Static Polygon Method



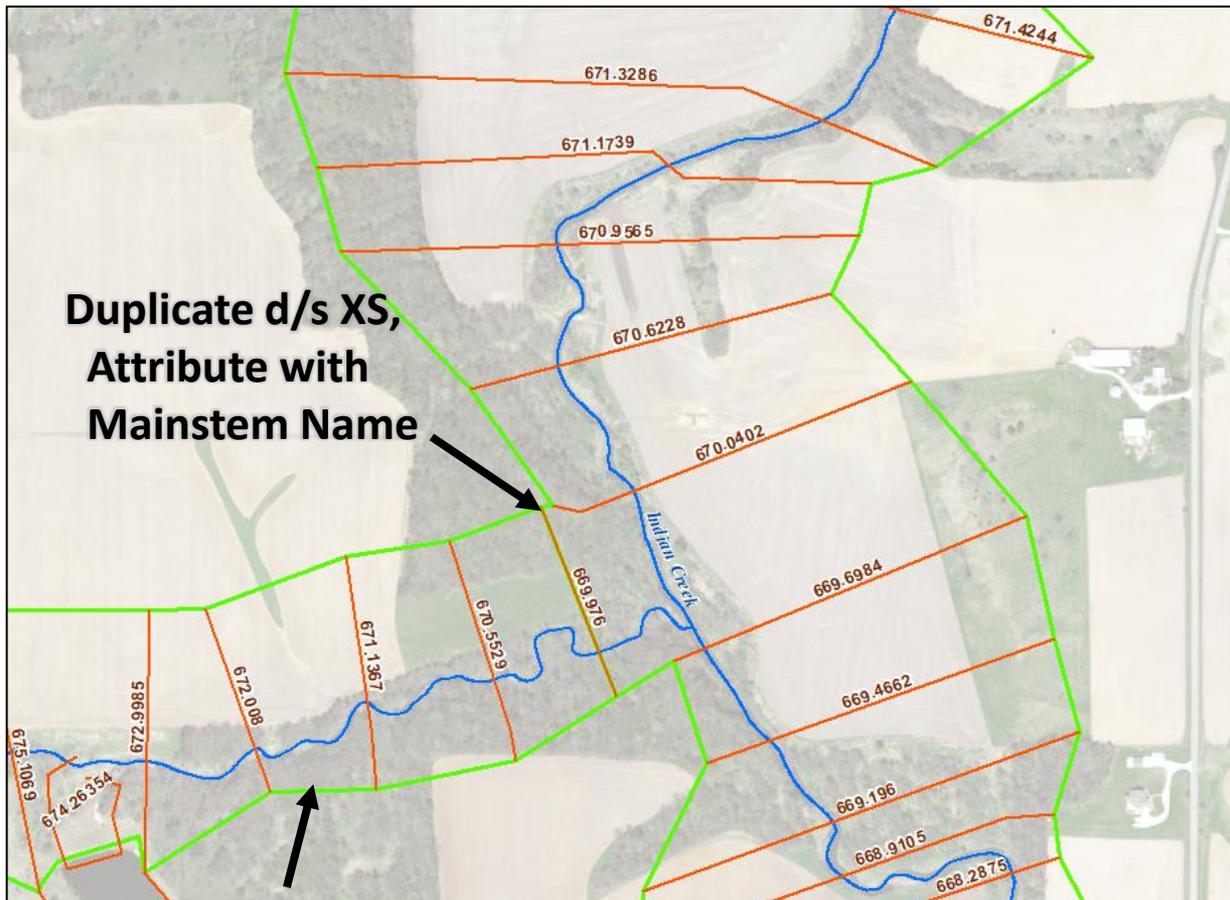
# Including Tributaries (2/3)

Not Studied – Static Polygon Method



# Including Tributaries (3/3)

## Tributary modeled as well

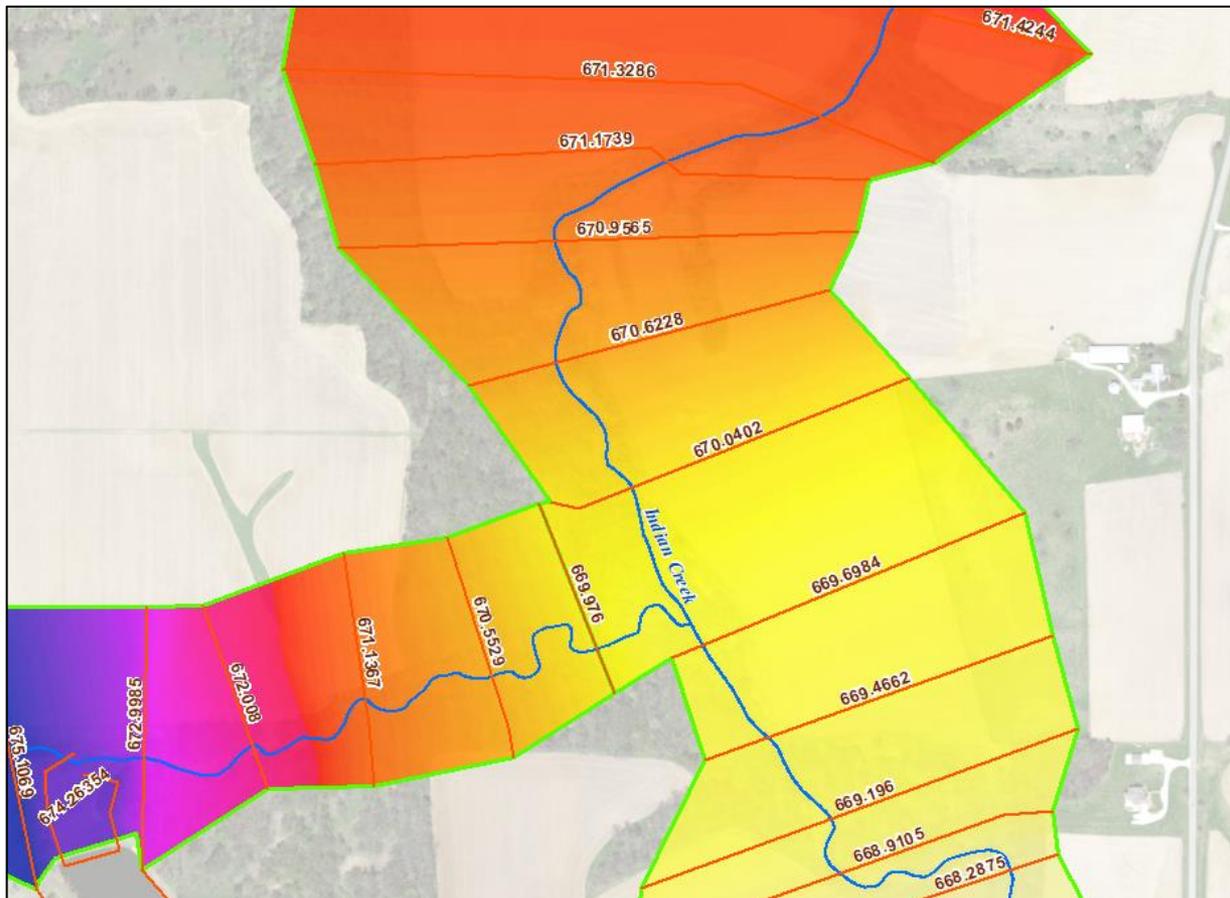


Duplicate d/s XS,  
Attribute with  
Mainstem Name

Separate Bounding Polygon

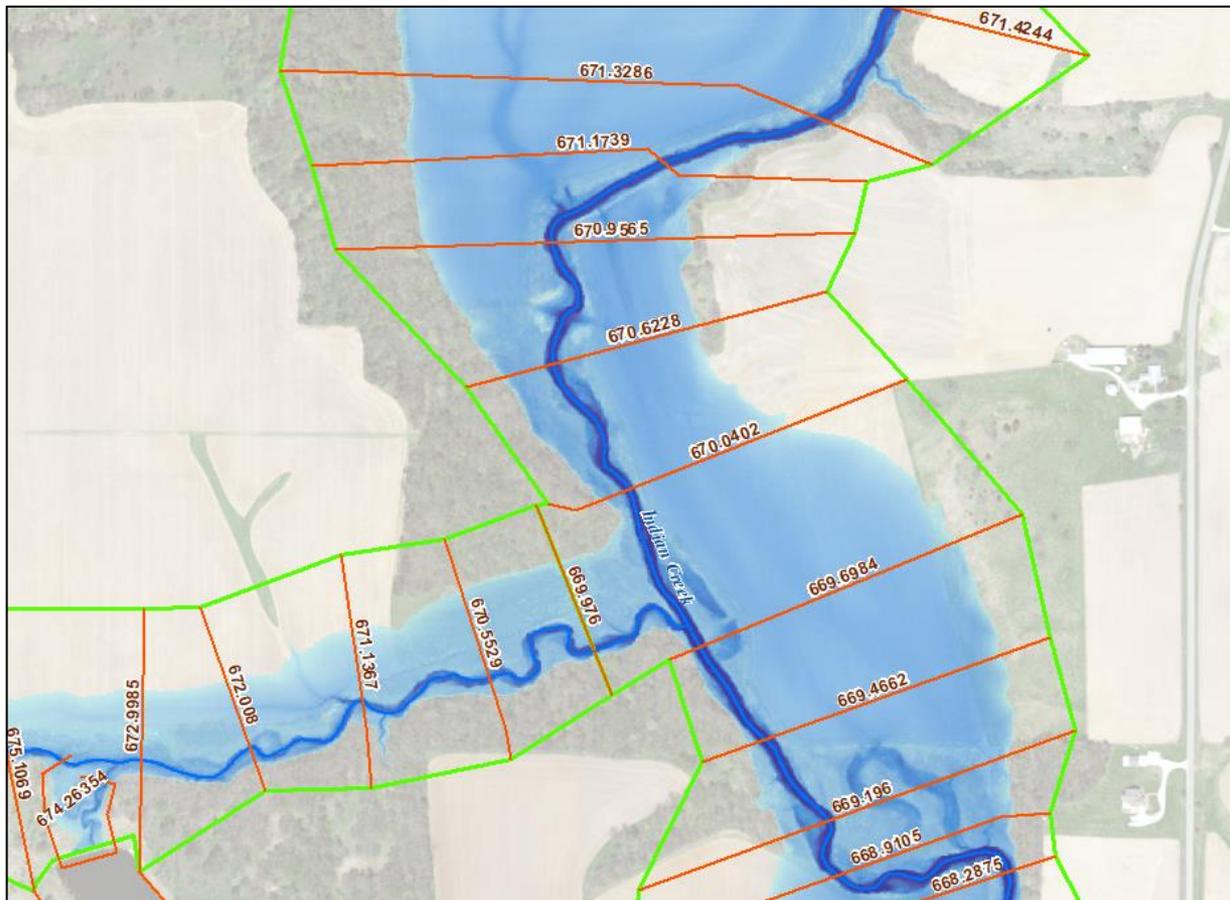
# Including Tributaries (3/3)

Tributary modeled as well



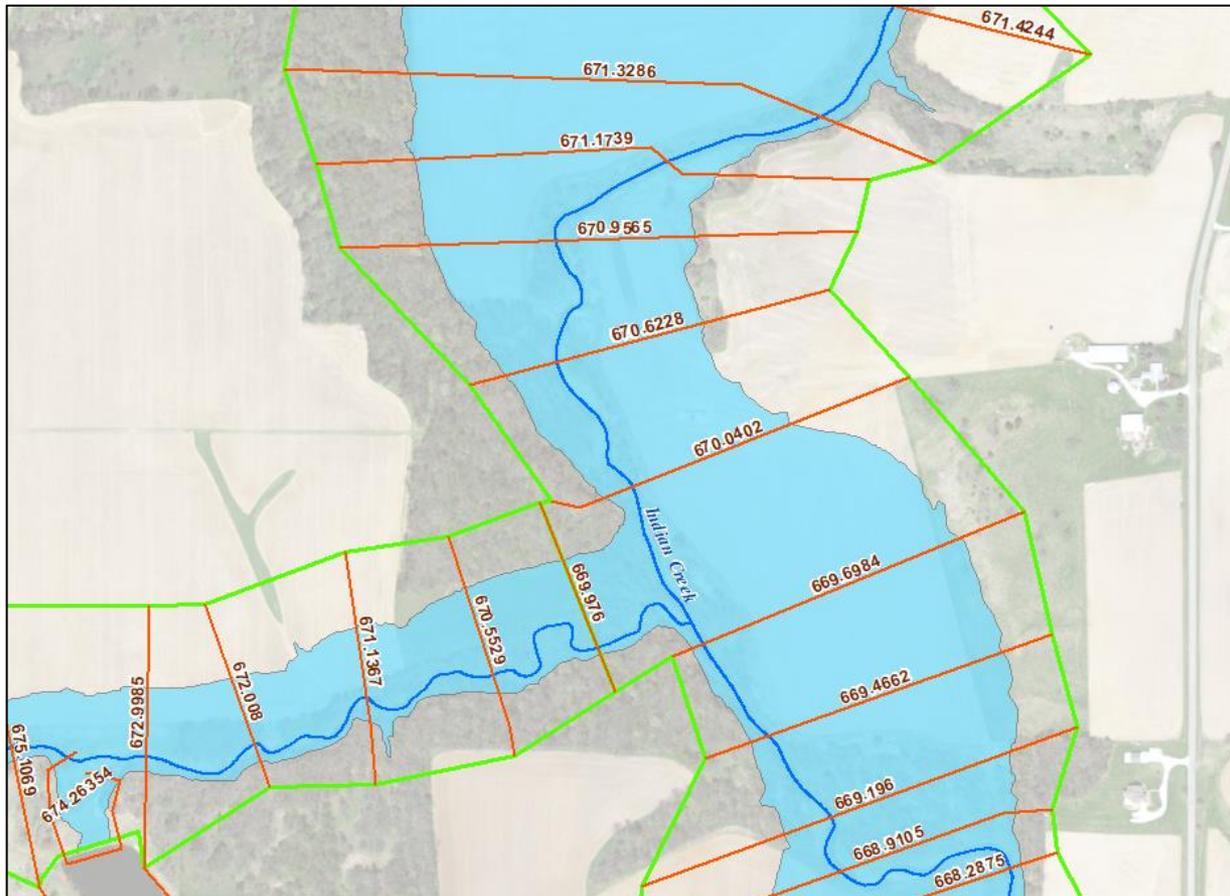
# Including Tributaries (3/3)

Tributary modeled as well



# Including Tributaries (3/3)

Tributary modeled as well

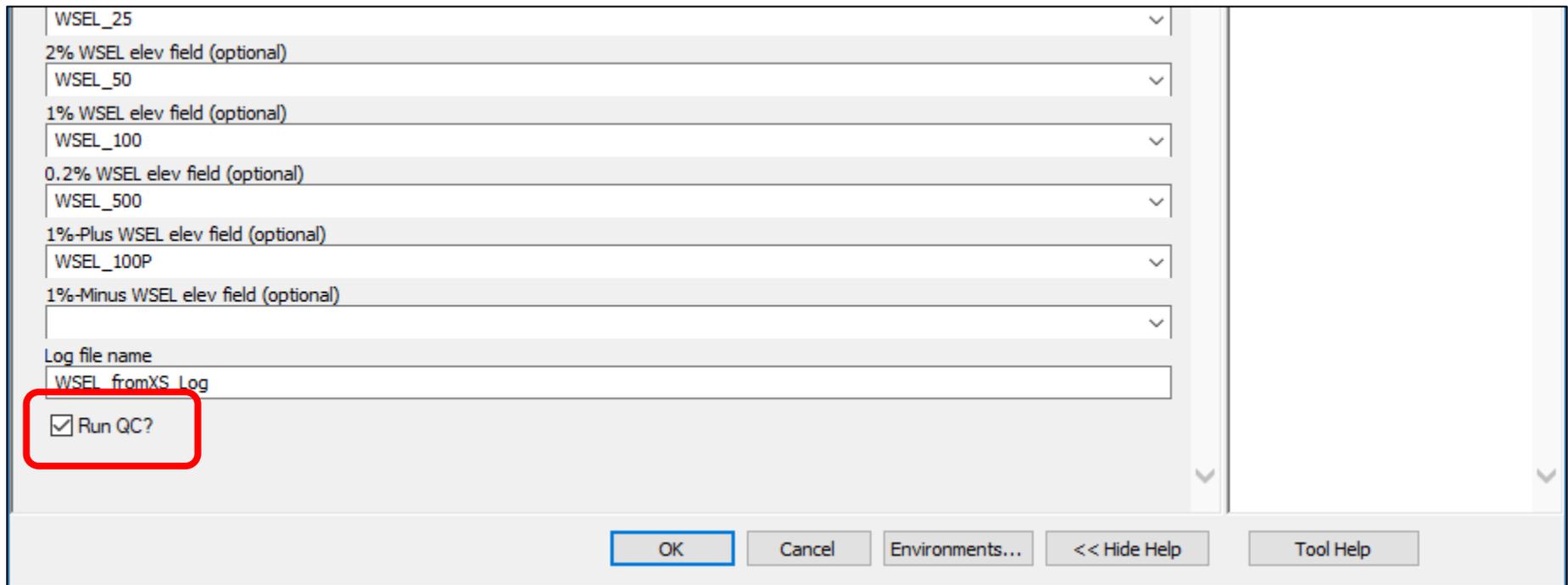


# Great Job! Let's make it better...



# Addition to WSEL Grid Tool

## Run QC option



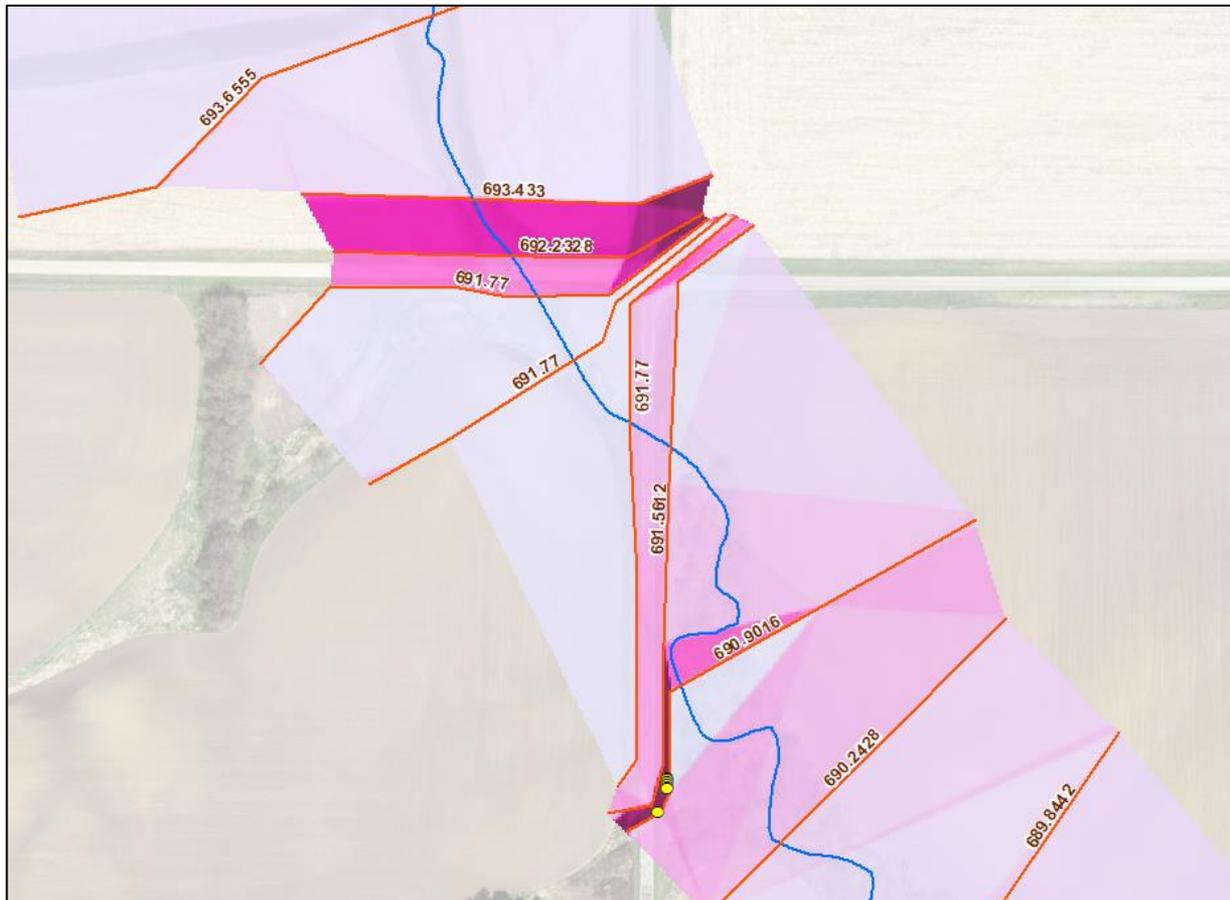
The screenshot shows a dialog box for the WSEL Grid Tool. It contains several dropdown menus for selecting WSEL elev field options, a text field for the log file name, and a checkbox for 'Run QC?'. The 'Run QC?' checkbox is checked and highlighted with a red box. The dialog box also has buttons for 'OK', 'Cancel', 'Environments...', '<< Hide Help', and 'Tool Help'.

WSEL_25	▼
2% WSEL elev field (optional)	
WSEL_50	▼
1% WSEL elev field (optional)	
WSEL_100	▼
0.2% WSEL elev field (optional)	
WSEL_500	▼
1%-Plus WSEL elev field (optional)	
WSEL_100P	▼
1%-Minus WSEL elev field (optional)	
	▼
Log file name	
WSEL_fromXS_Log	
<input checked="" type="checkbox"/> Run QC?	

OK Cancel Environments... << Hide Help Tool Help

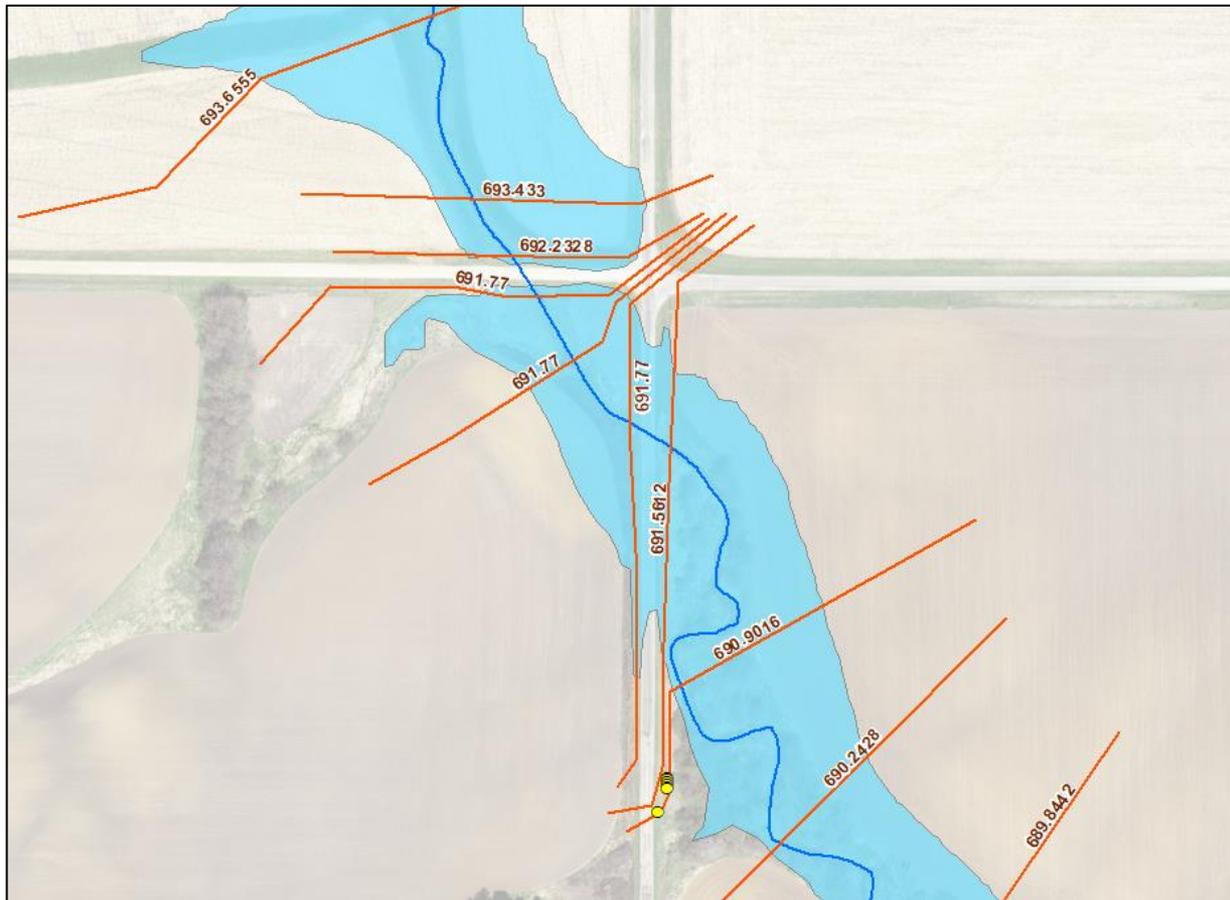
# Addition to **WSEI Grid Tool**

Run QC option – Slope output



# Addition to **WSEI Grid Tool**

Run QC option – Mismatch Points output



# Additions to Floodplains Tool

## Minimum Depth option

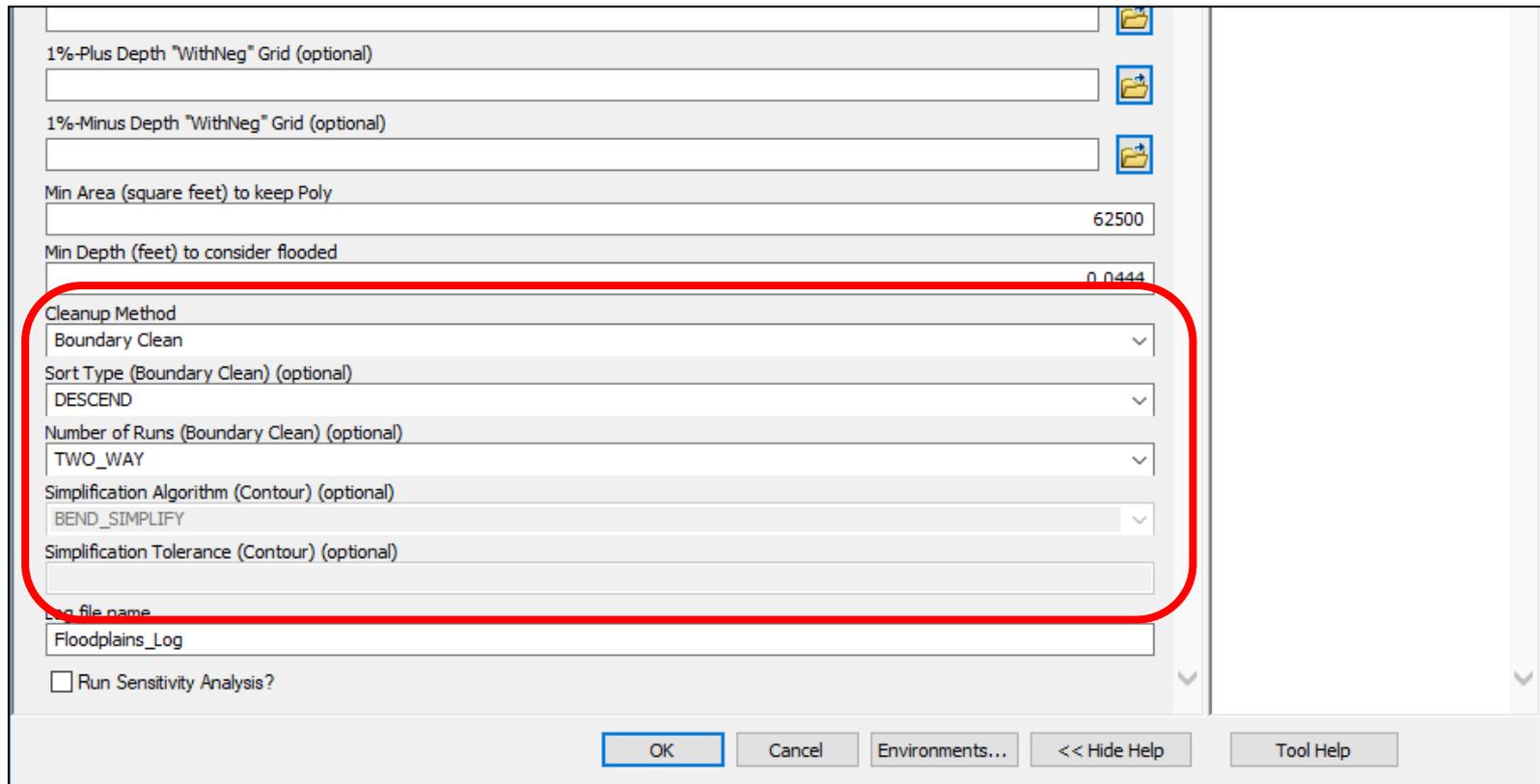
The screenshot shows the Floodplains Tool dialog box with the following fields and options:

- 1%-Plus Depth "WithNeg" Grid (optional)
- 1%-Minus Depth "WithNeg" Grid (optional)
- Min Area (square feet) to keep Poly: 62500
- Min Depth (feet) to consider flooded: 0.0444** (highlighted with a red box)
- Cleaning Method: Boundary Clean
- Sort Type (Boundary Clean) (optional): DESCEND
- Number of Runs (Boundary Clean) (optional): TWO\_WAY
- Simplification Algorithm (Contour) (optional): BEND\_SIMPLIFY
- Simplification Tolerance (Contour) (optional)
- Log file name: Floodplains\_Log
- Run Sensitivity Analysis?

Buttons at the bottom: OK, Cancel, Environments..., << Hide Help, Tool Help

# Additions to Floodplains Tool

## Cleanup Method options



The screenshot displays the Floodplains Tool dialog box with several input fields and a red circle highlighting the Cleanup Method options. The options include Boundary Clean, Sort Type (Boundary Clean) (optional) set to DESCEND, Number of Runs (Boundary Clean) (optional) set to TWO\_WAY, Simplification Algorithm (Contour) (optional) set to BEND\_SIMPLIFY, and Simplification Tolerance (Contour) (optional). The Run Sensitivity Analysis? checkbox is unchecked. The dialog box has buttons for OK, Cancel, Environments..., << Hide Help, and Tool Help.

1%-Plus Depth "WithNeg" Grid (optional)	
1%-Minus Depth "WithNeg" Grid (optional)	
Min Area (square feet) to keep Poly	62500
Min Depth (feet) to consider flooded	0.0444
Cleanup Method	Boundary Clean
Sort Type (Boundary Clean) (optional)	DESCEND
Number of Runs (Boundary Clean) (optional)	TWO_WAY
Simplification Algorithm (Contour) (optional)	BEND_SIMPLIFY
Simplification Tolerance (Contour) (optional)	
Log file name	Floodplains_Log
<input type="checkbox"/> Run Sensitivity Analysis?	

# Additions to Floodplains Tool

## Cleanup Method options

**Boundary Clean: Descending, Two-Way**



**Boundary Clean: Descending, One-Way**



# Additions to Floodplains Tool

## Run Sensitivity Analysis option

The screenshot shows the Floodplains Tool dialog box with the following settings:

- 1%-Plus Depth "WithNeg" Grid (optional): [Empty]
- 1%-Minus Depth "WithNeg" Grid (optional): [Empty]
- Min Area (square feet) to keep Poly: 62500
- Min Depth (feet) to consider flooded: 0.0444
- Cleanup Method: Boundary Clean
- Sort Type (Boundary Clean) (optional): DESCEND
- Number of Runs (Boundary Clean) (optional): TWO\_WAY
- Simplification Algorithm (Contour) (optional): BEND\_SIMPLIFY
- Simplification Tolerance (Contour) (optional): [Empty]
- Log file name: Floodplains\_log
- Run Sensitivity Analysis?

On the right side of the dialog, there is a warning message:

area is less sensitive to the cleanup method / settings than areas with median values.

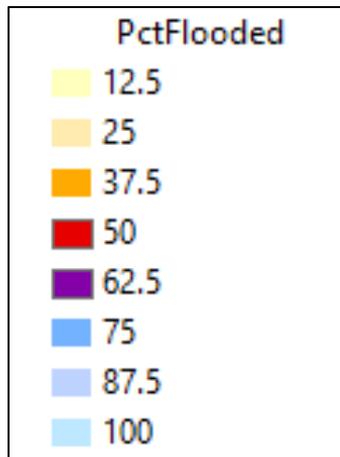
Check this box if you're unsure of which Cleanup method/settings to use.

**WARNING:** This option will greatly increase geoprocessing time. Consider only using on smaller areas.

At the bottom of the dialog, there are buttons for OK, Cancel, Environments..., << Hide Help, and Tool Help.

# Additions to Floodplains Tool

## Run Sensitivity Analysis option



# Additions to Floodplains Tool

## Overtopping Polygons (New Input)

The screenshot shows the '3\_Floodplains' tool interface. The main panel on the left contains a list of input fields, each with a folder icon to its right. The fields are:

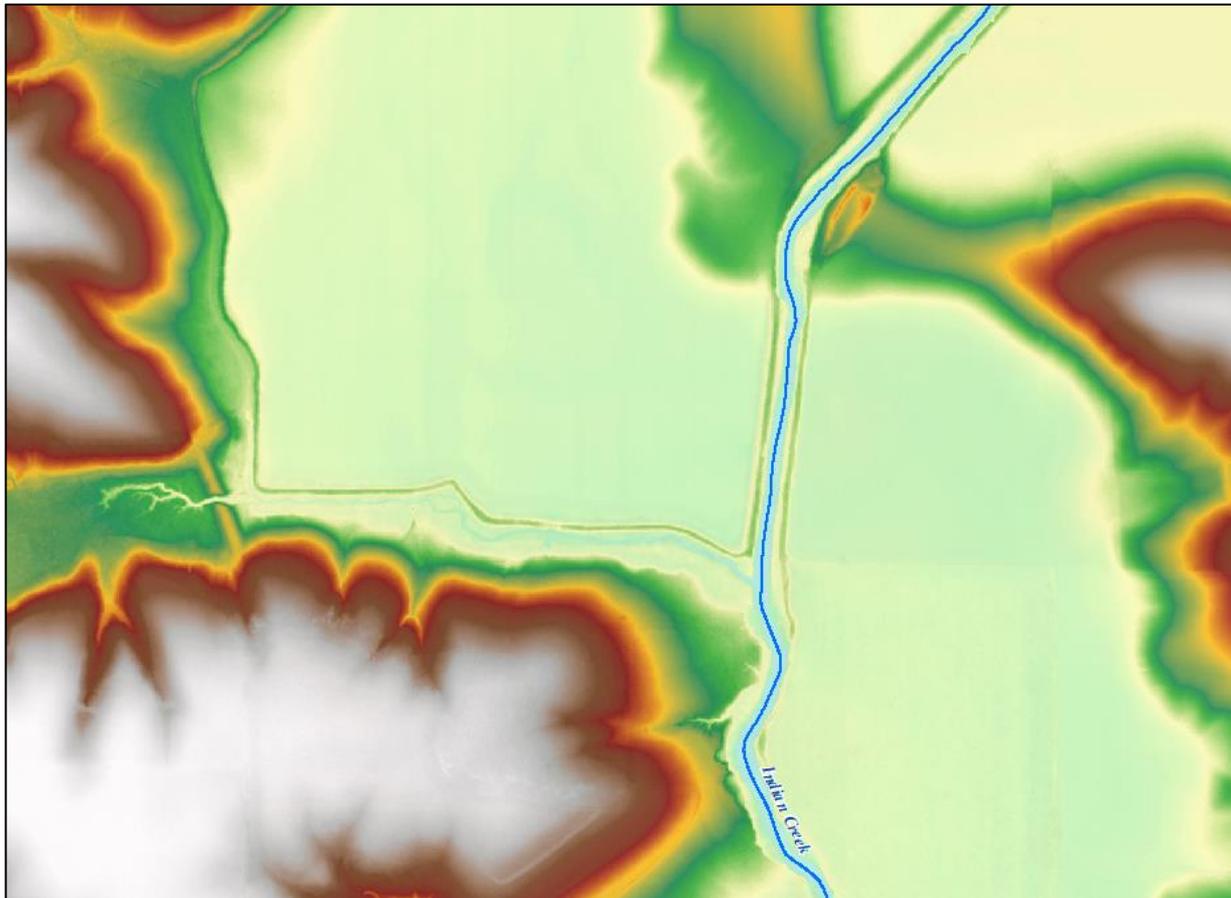
- Folder where GDB will be created
- Water Lines
- Overtopping Polygons (optional)** (highlighted with a red rectangle)
- 10% Depth "WithNeg" Grid (optional)
- 4% Depth "WithNeg" Grid (optional)
- 2% Depth "WithNeg" Grid (optional)
- 1% Depth "WithNeg" Grid (optional)
- 0.2% Depth "WithNeg" Grid (optional)
- 1%-Plus Depth "WithNeg" Grid (optional)
- 1%-Minus Depth "WithNeg" Grid (optional)

The right-hand panel, titled '3\_Floodplains', contains the following text:

This tool creates floodplain polygons from depth grids.

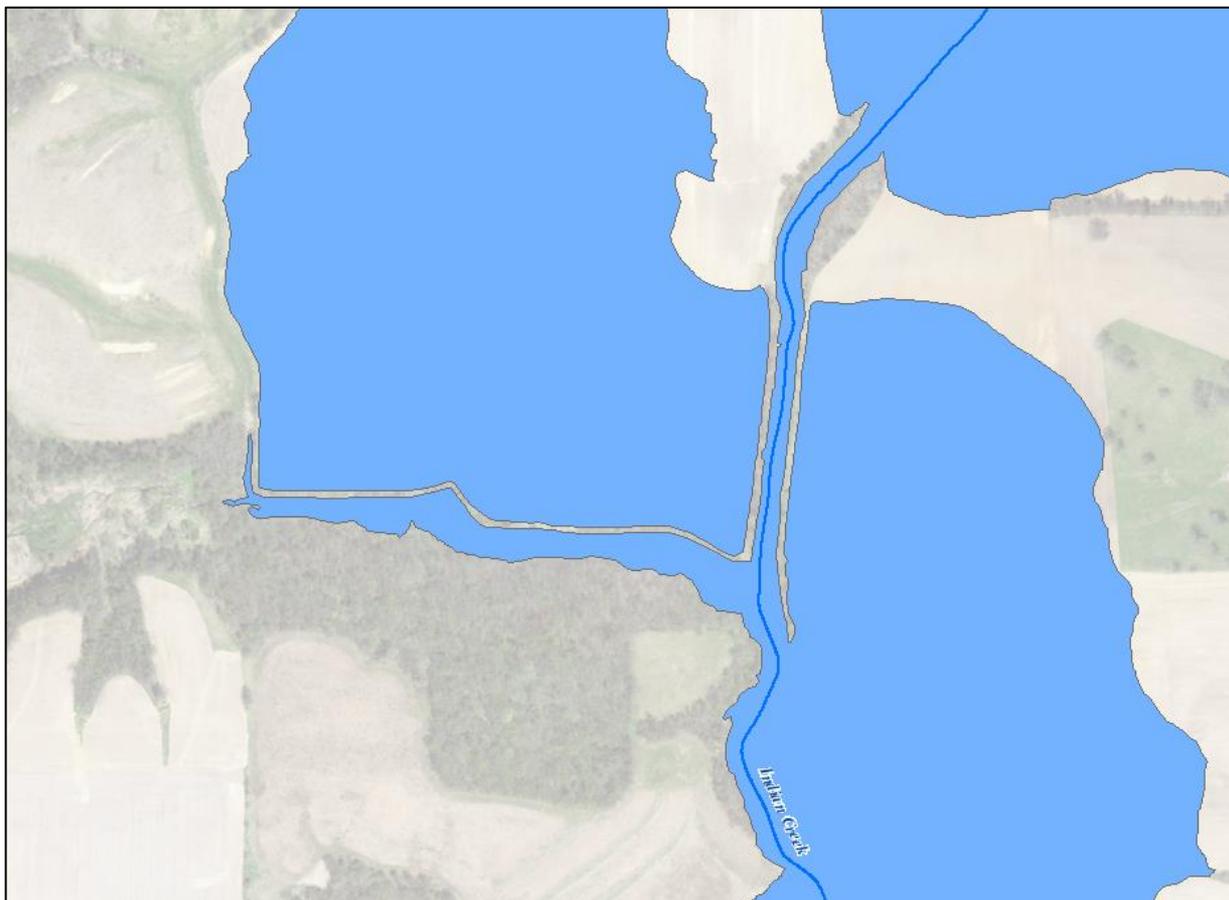
# Additions to Floodplains Tool

## Overtopping Polygons (New Input)



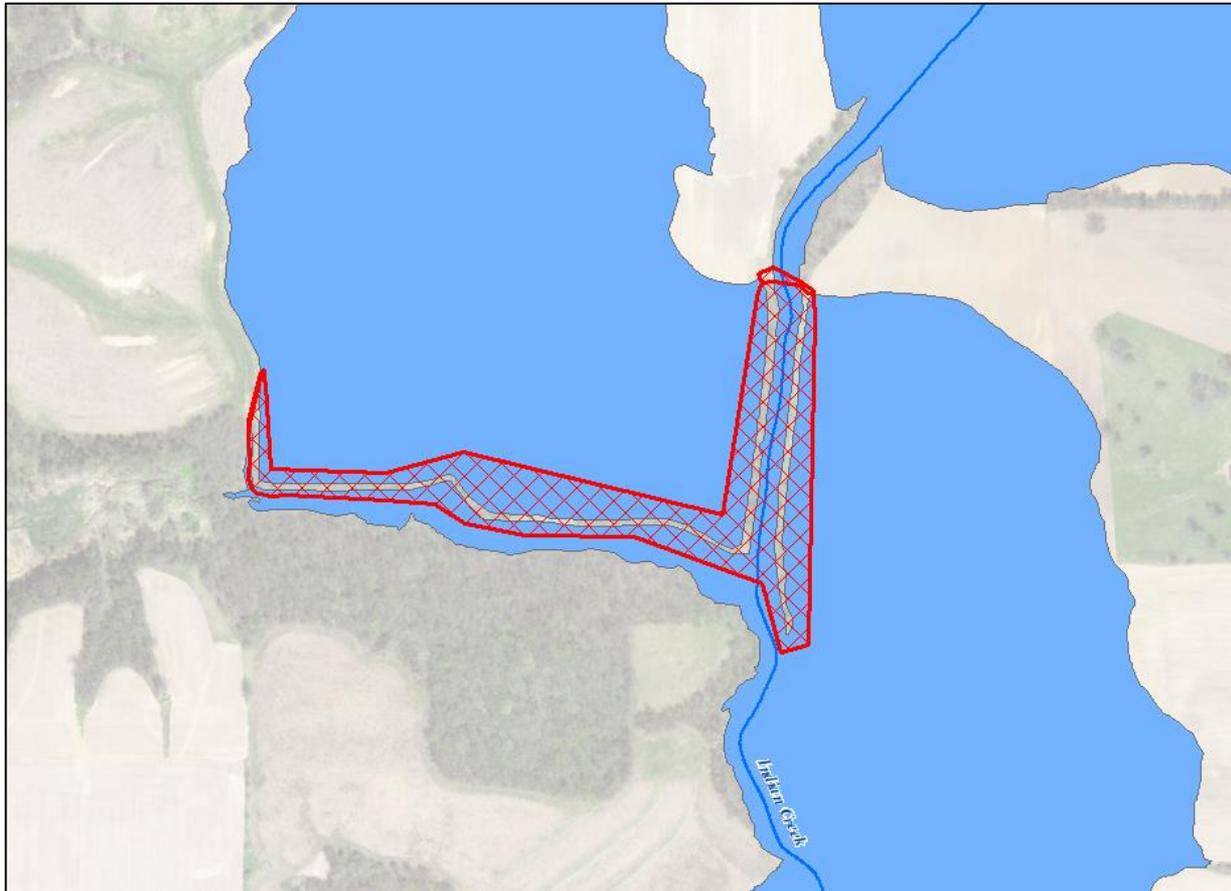
# Additions to Floodplains Tool

## Overtopping Polygons (New Input)



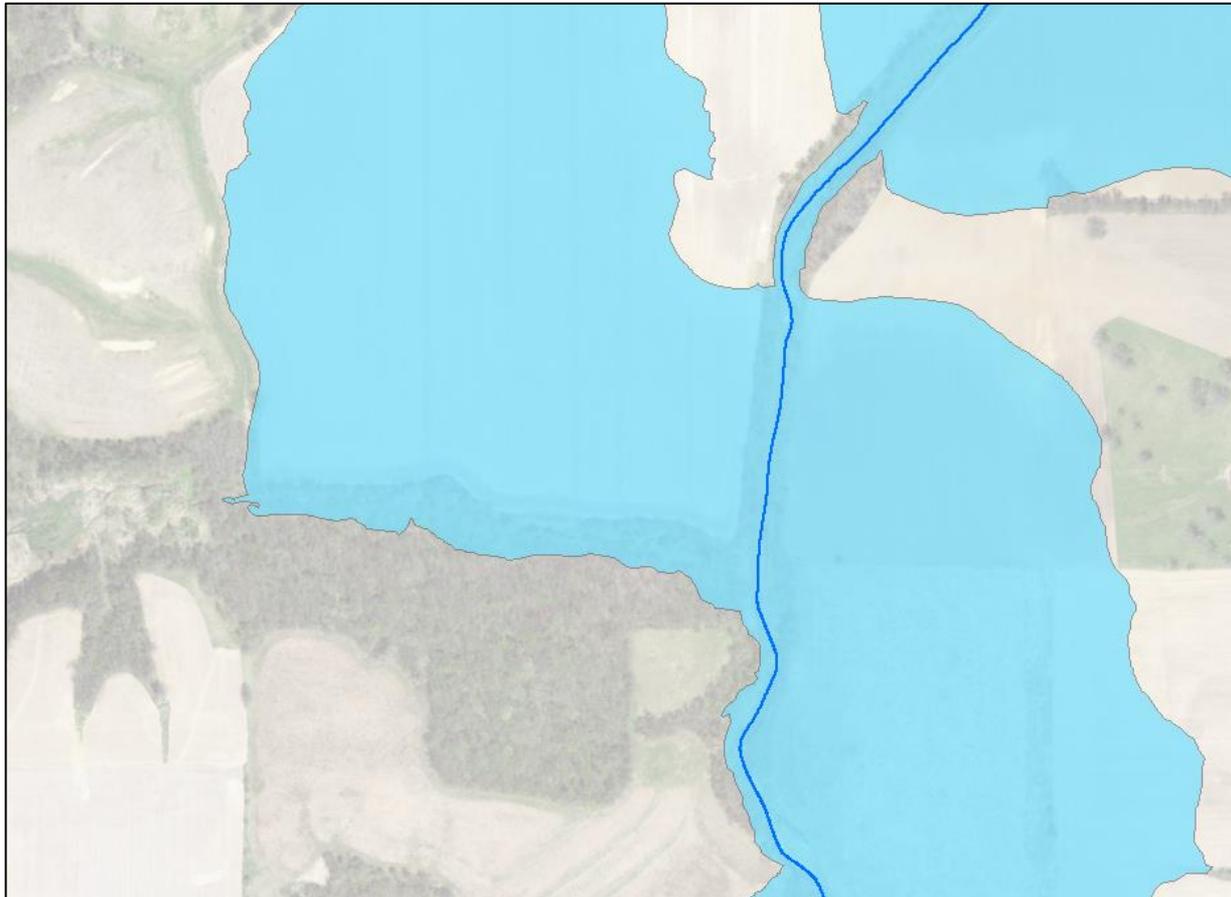
# Additions to Floodplains Tool

## Overtopping Polygons (New Input)



# Additions to Floodplains Tool

## Overtopping Polygons (New Input)



# Looking to the Future...



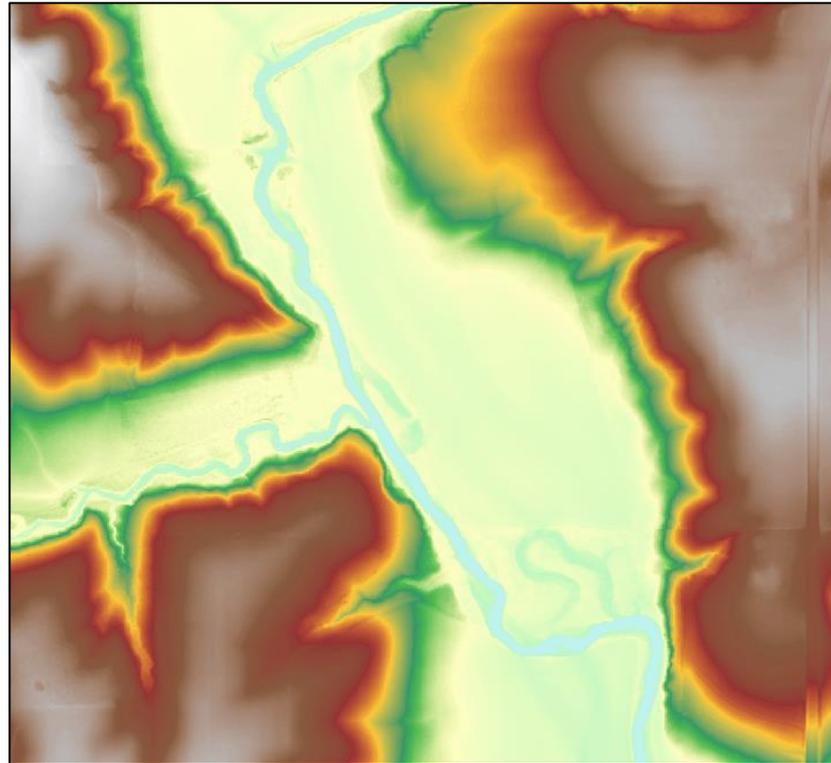
# Future Plans (1/3)

Floodplain Tool: Keep all floodplain polygons touching stream lines, regardless of area size



# Future Plans (2/3)

2-D Maybe?



# Future Plans (3/3)

Migrate to ArcGIS Pro and Python 3 😊



**ArcGIS Pro**



**Python 3**

# Questions?

Zoe Zaloudek, GISP, CFM  
[zaloudek@Illinois.edu](mailto:zaloudek@Illinois.edu)

<https://www.illinoisfloodmaps.org>