Recipes for using GSSHA and WMS as an EWN Watershed Design Tool

U.S. ARMY ERDC

Turning Conceptual Models to GSSHA Inputs

Multiple Grid Cells

- Change physical process descriptions in GSSHA
  - Land use changes
    - Roughness values
    - Interception
    - Retention
  - Wetlands
  - Detention basins

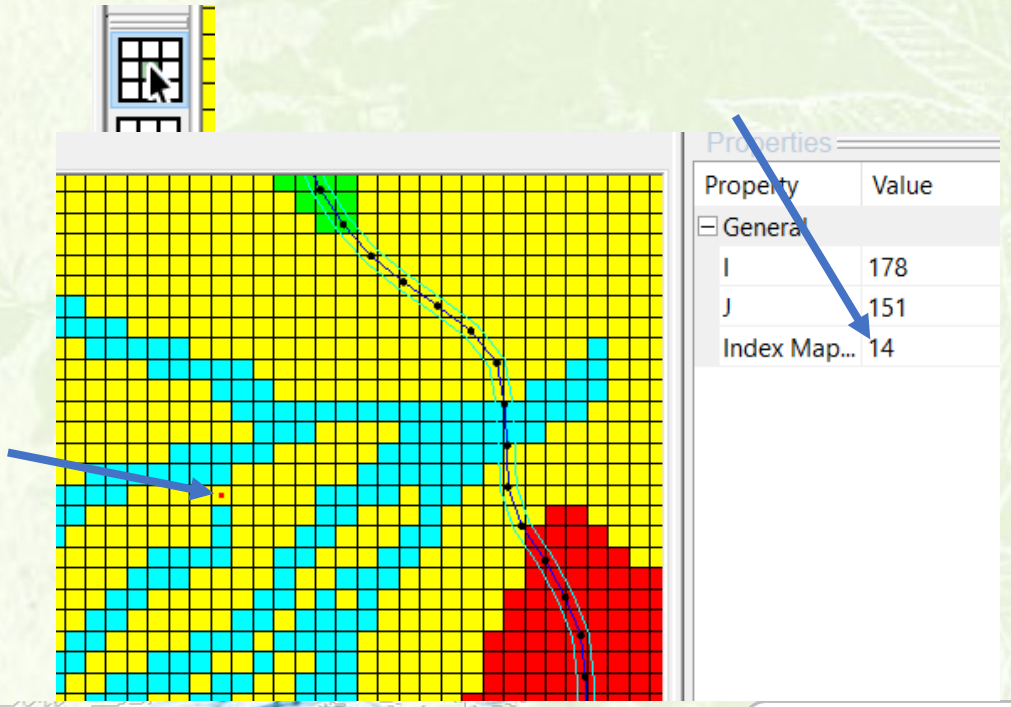
Less than Grid Cell Size

- Approximate effects with changes in
  - Retention Depth (retain water)
  - Changing Hydraulic Conductivity (infiltrate more water)
  - Roughness (slow the water down)

Land Use Change

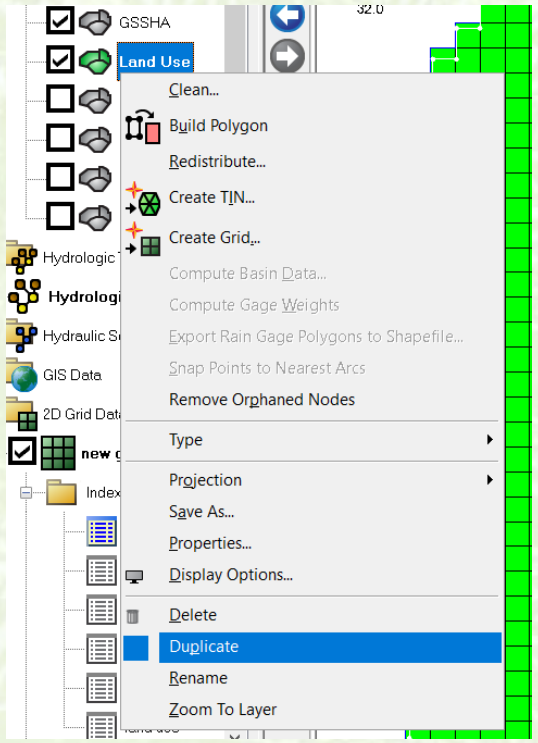
- Uses:
  - Changing Land Use for COAs
  - Buffer Strips
- How:
  - Externally, using a GIS
  - Using GIS capabilities in WMS
  - Manually adjusting index map cell values

Manual Mode: Use the “Select Grid Cell” tool, select the cell to change, and edit the index map number

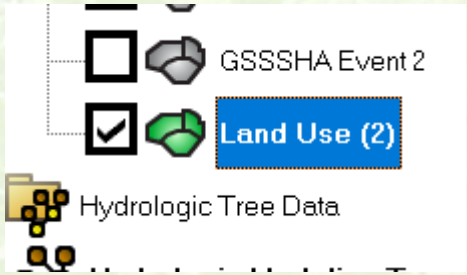


GIS Editing in WMS

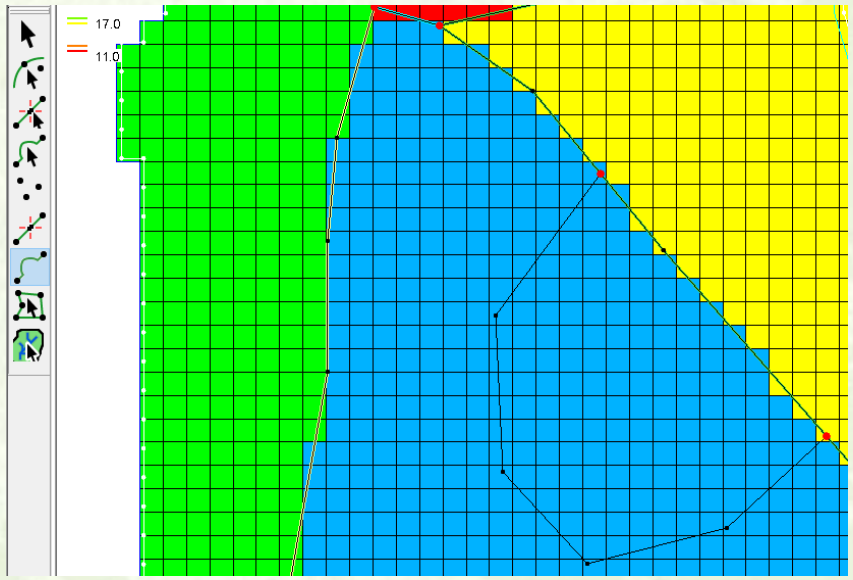
1. Duplicate the Map Data Coverage to change.



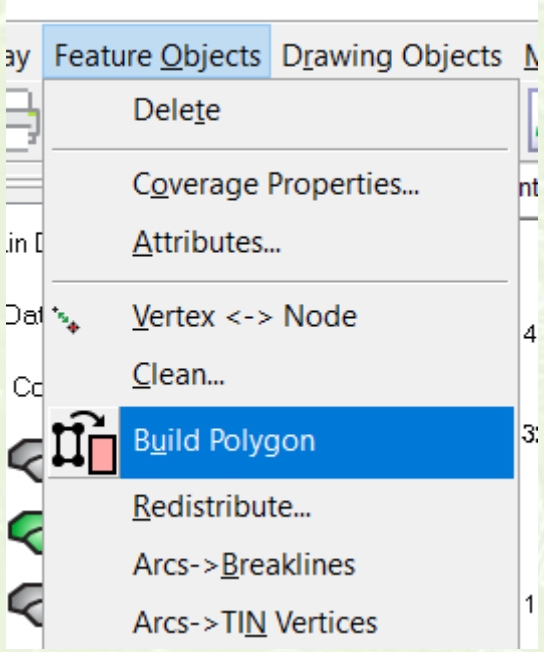
2. Select the new land use dataset



3. Using the Create Feature Arc tool, Create a feature arc for the changes.

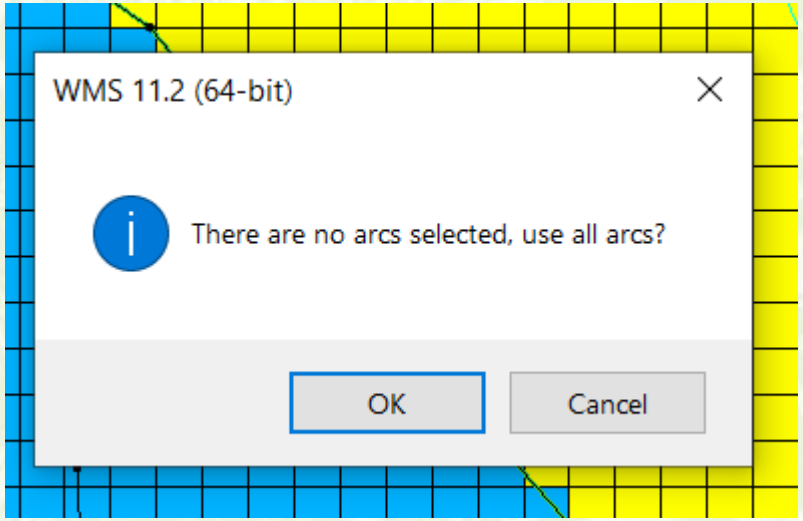


4. Select Feature Objects | Biuld Polygon

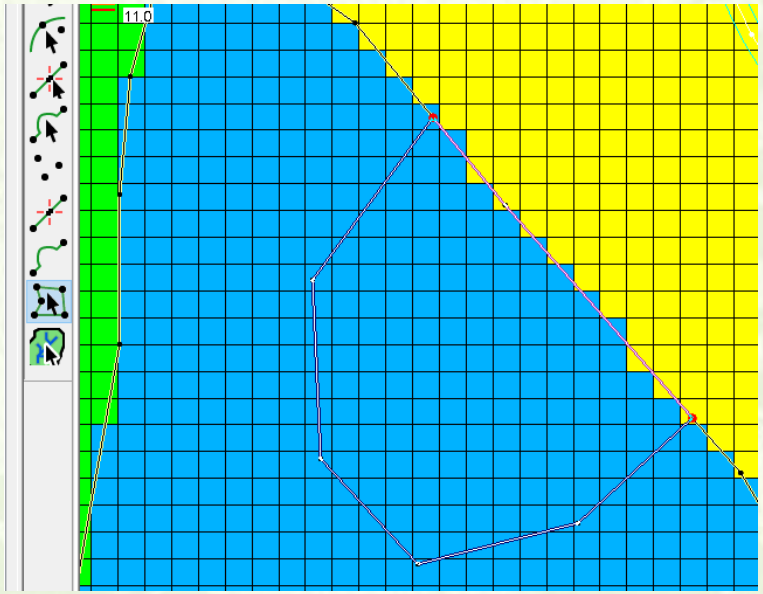


GIS Editing in WMS

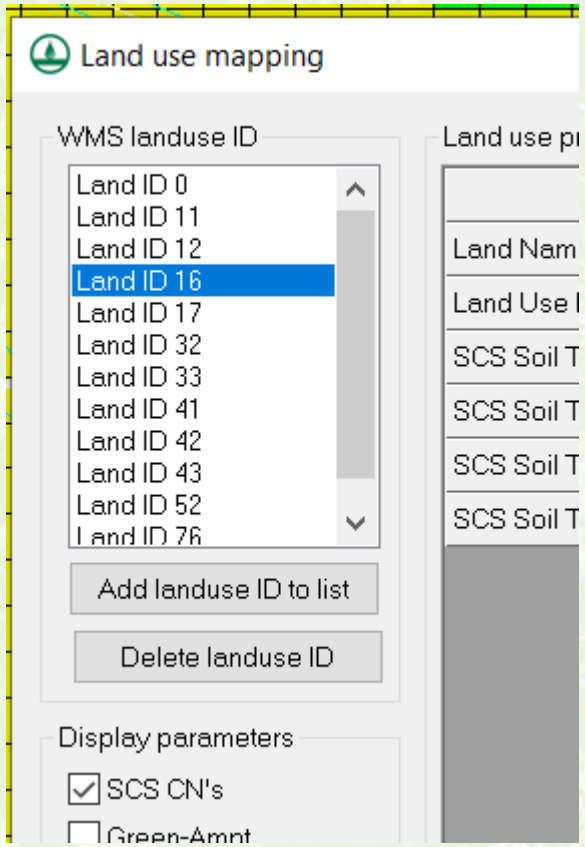
5. Select yes prompted to use all arcs



6. Double-click on the new polygon to bring up the attributes

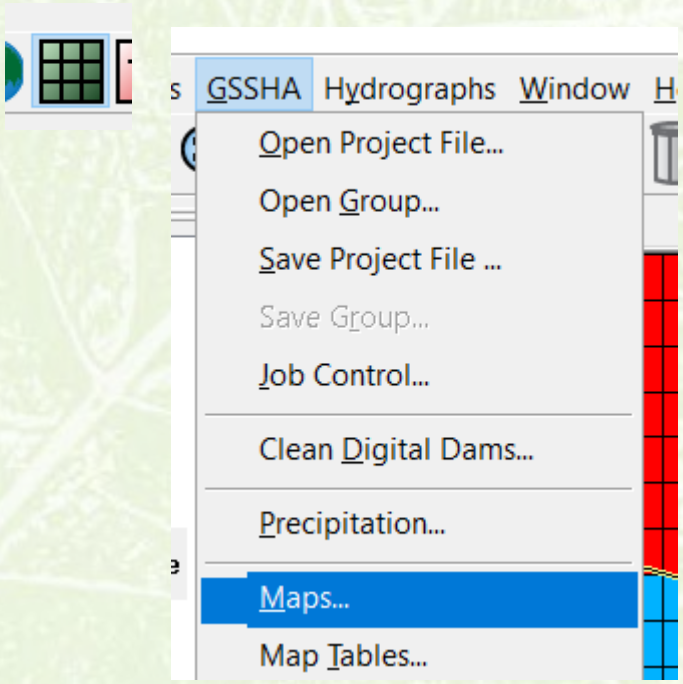


7. Change the land use / soil type.

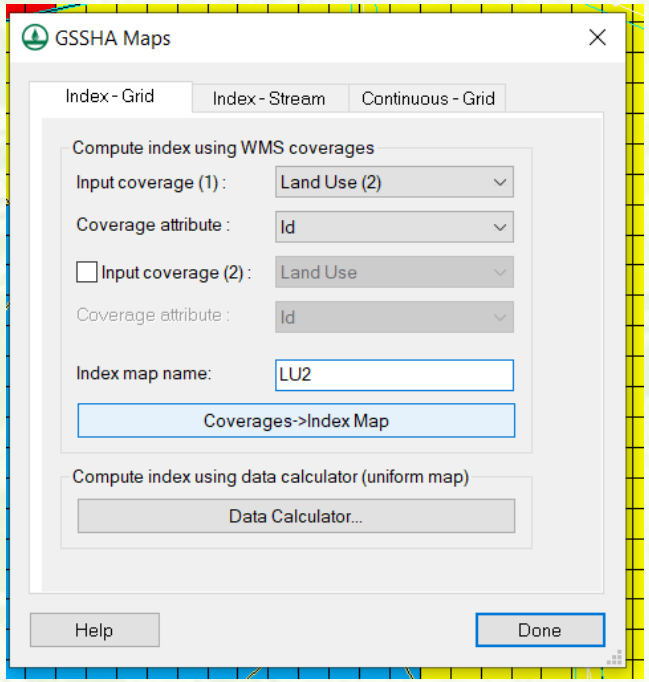


GIS Editing in WMS

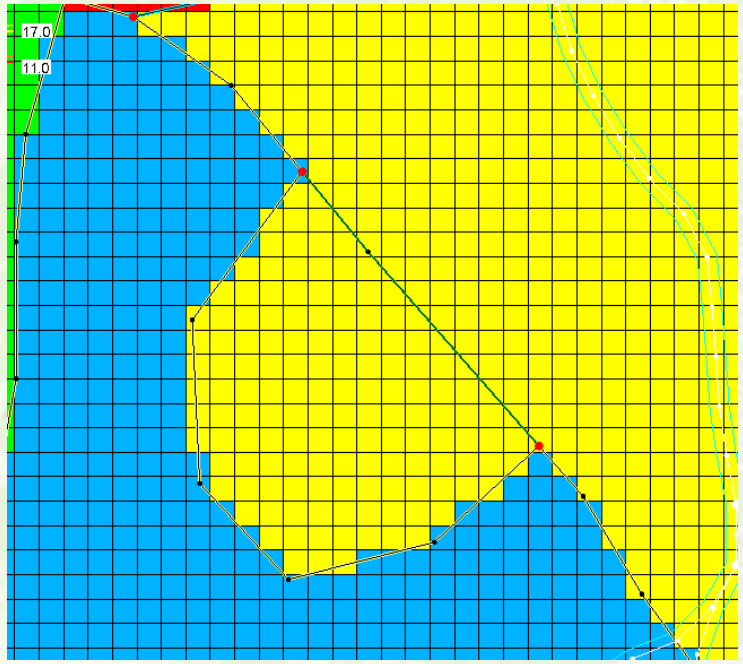
5. In the 2D Grid Module, select GSSHA | Maps



6. Create a new index maps from the input coverage.



7. Done. Edit mapping tables as needed.



Modeling Wetlands

Large Scale Wetlands

- Cover multiple grid cells
- -> Model with the wetland physics

Small Scale Wetlands

- Smaller than a grid cell
- -> Model as an increased retention depth, increased roughness

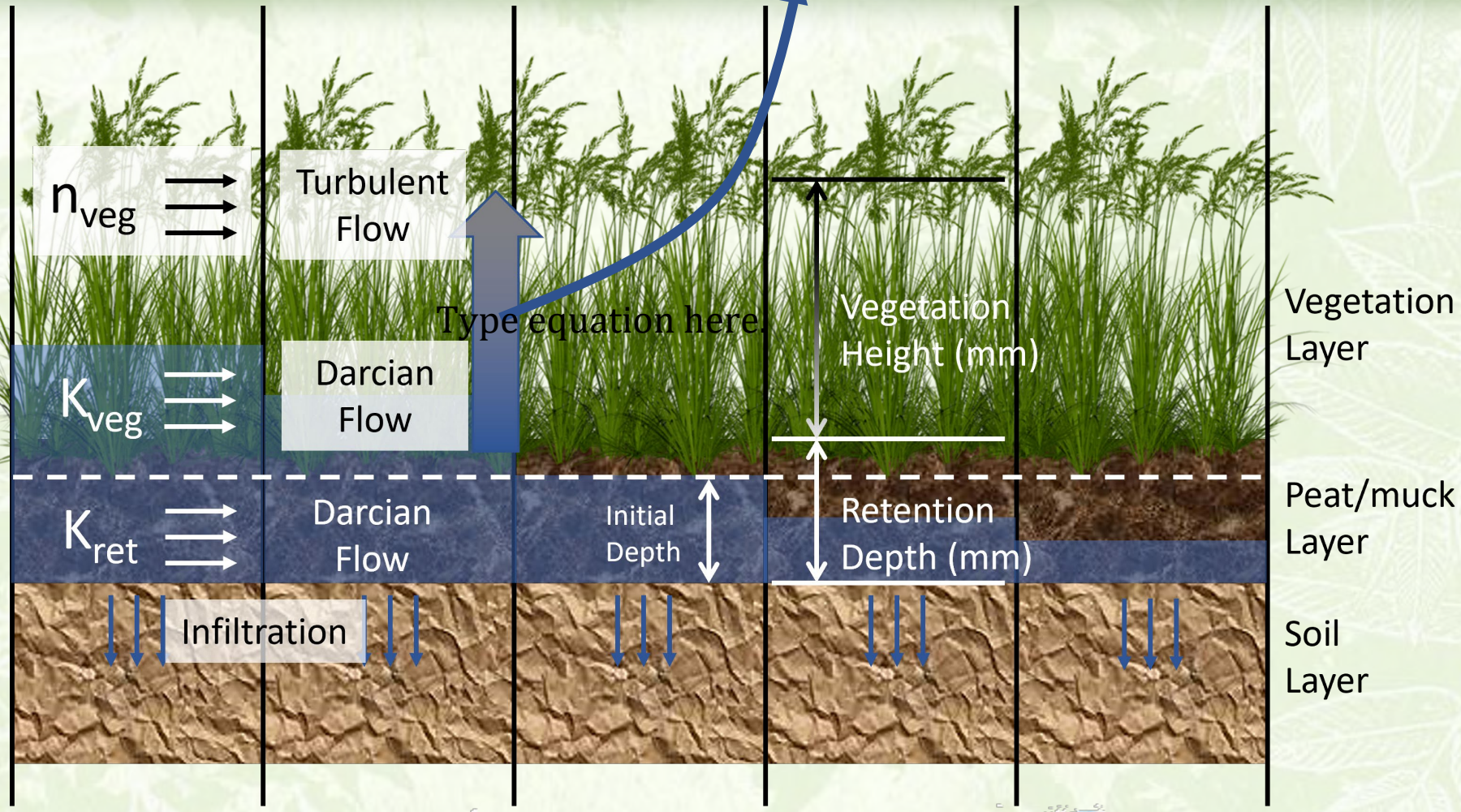
Large Scale Wetlands

https://gsshawiki.com/Wetlands:Wetlands

$$q_{x,veg} = \frac{h_{veg}}{d_{veg}} q_{x,darcian} + \frac{d_{veg} - h_{veg}}{d_{veg}} q_{x,turbulent}$$

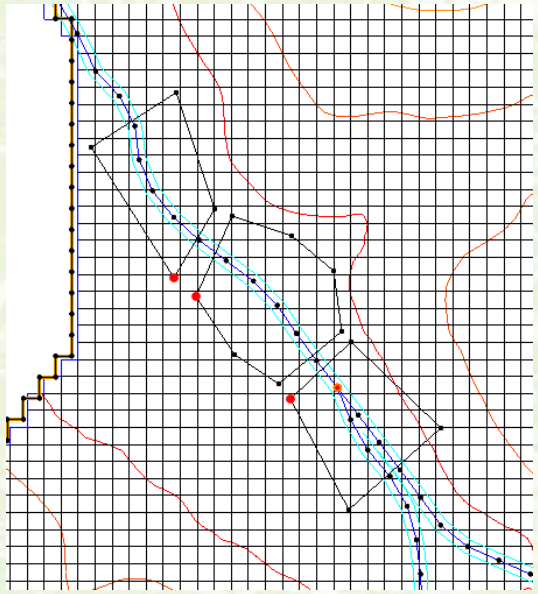
- Vegetation layer transitions from darcian flow (no water depth) to turbulent flow (vegetation height water depth) depending on water depth

- Infiltration still happens according to soil properties

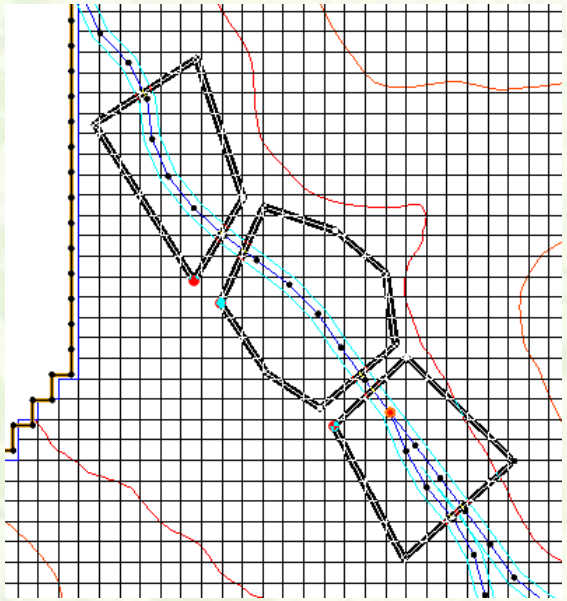


Building Wetlands in WMS

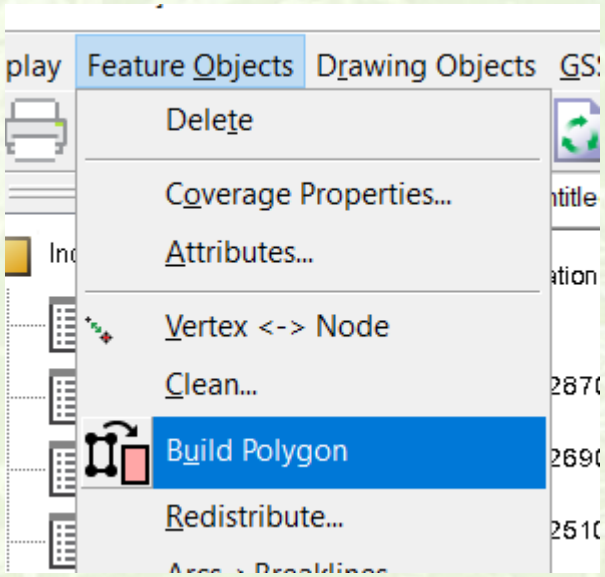
1. Use the “Create Feature Arc” to outline one or more wetland areas



2. Use the “Select Feature Arc” to select ALL of the wetland arcs

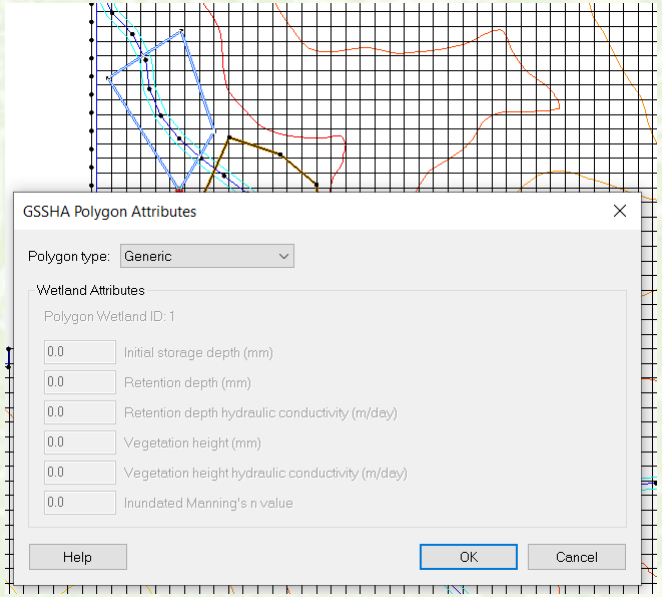


3. Select Feature Objects | Build Polygon

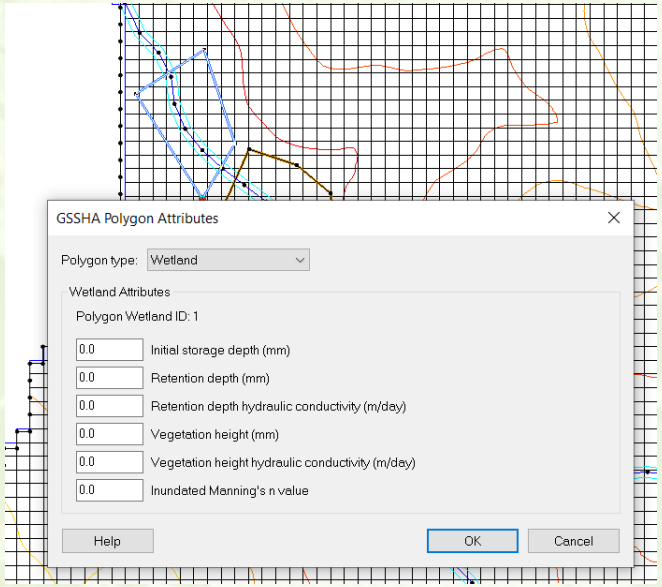


Building Wetlands in WMS

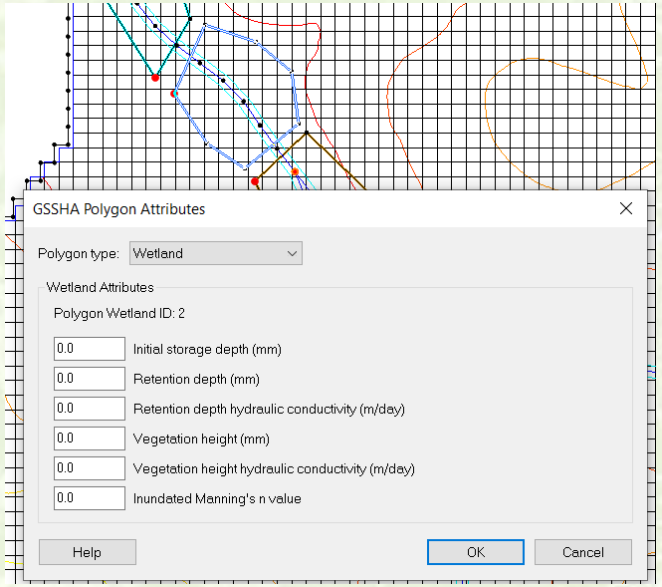
4. Use the “Select Feature Polygon” and double-click inside a wetland area to bring up the polygon attributes



5. Change the polygon type to Wetland. Fill out the properties.



6. Repeat for the other wetlands.



Notes on Wetlands

- If the bottom of the wetland is an impervious layer, consider making the soil underneath the wetland a clay
- Constructed wetlands could involve berms and/or significant earthworks
- Large-scale constructed wetlands often involve different bays at different levels and with different wetland materials

Bonus Content: You can manually add a “burn in depth” in the mapping table file (.cmt) to the wetland field

Add a “Burn_in” Column (mm)

```
WETLAND_PROPERTIES "wetlands"
NUM_IDS 3
ID
    3
    2
    1
```

…

INIT_DEPTH	RET_DEPTH	RET_HYD_CON	VEG_HEIGHT	VEG_HYD_CON	OVR_VEG_N
75.0	120.0	20.0	1500.0	700.0	0.25
100.0	150.0	3.0	1000.0	500.0	0.3
120.0	170.0	2.5	1000.0	500.0	0.35

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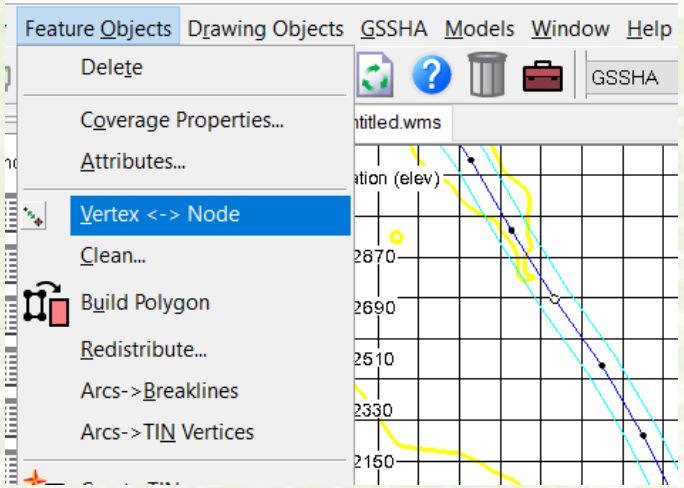
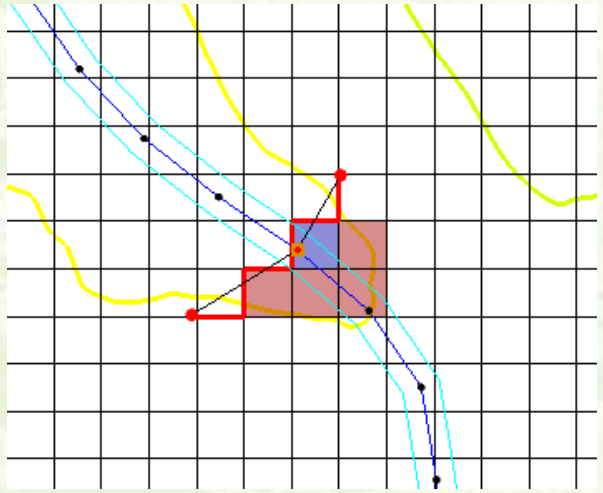
Beaver Dam Analogs

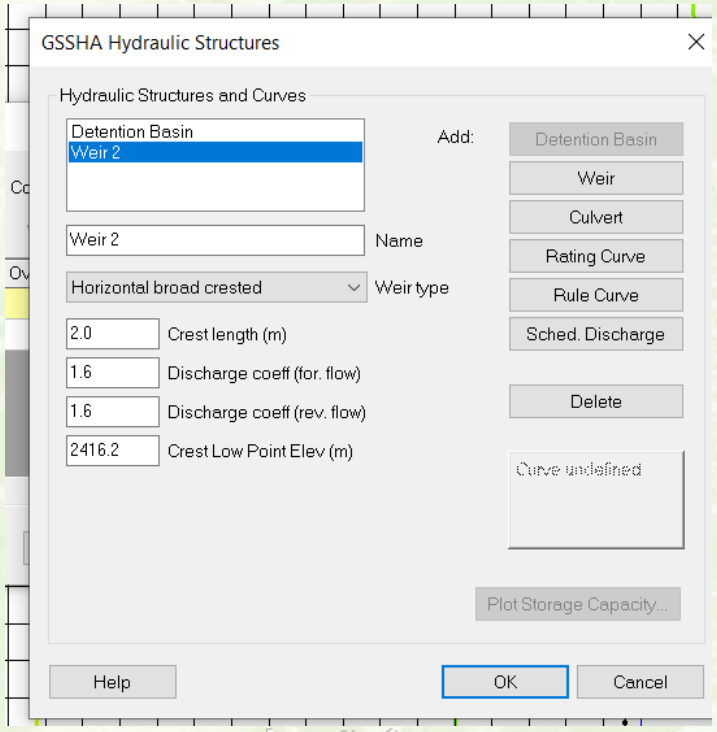
1. Find suitable vertex to turn into node



2. Add embankment arcs to the sides of the channel



3. Add two hydraulic structures: a detention basin and a weir



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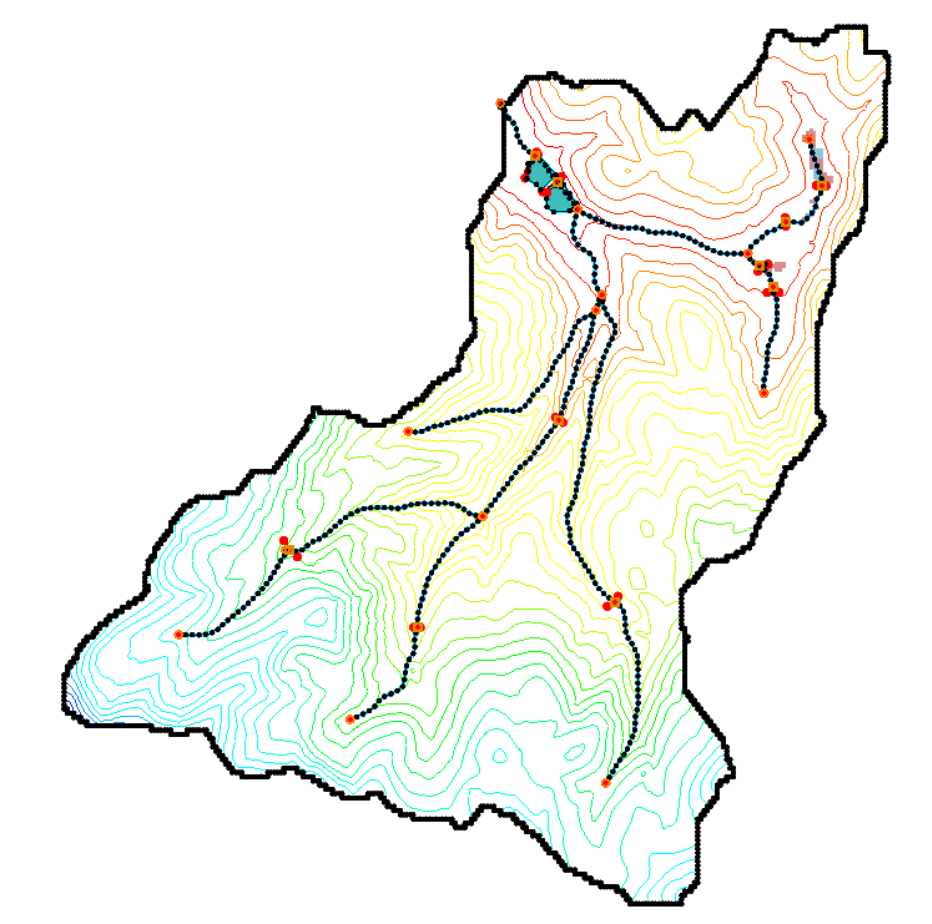
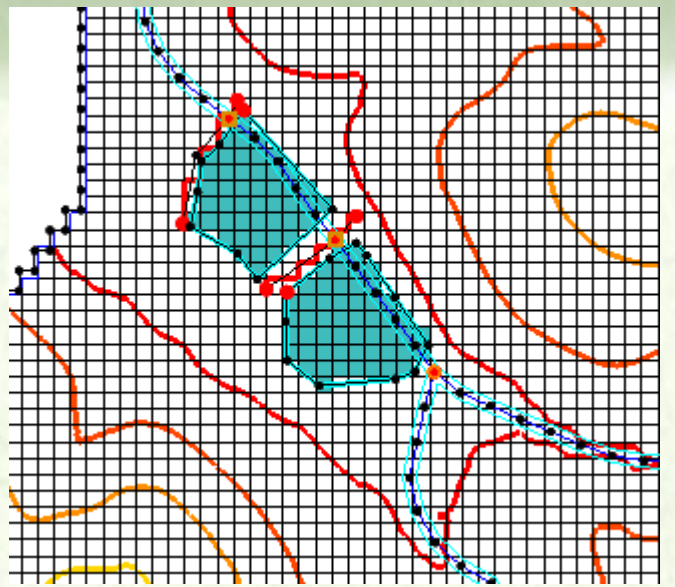
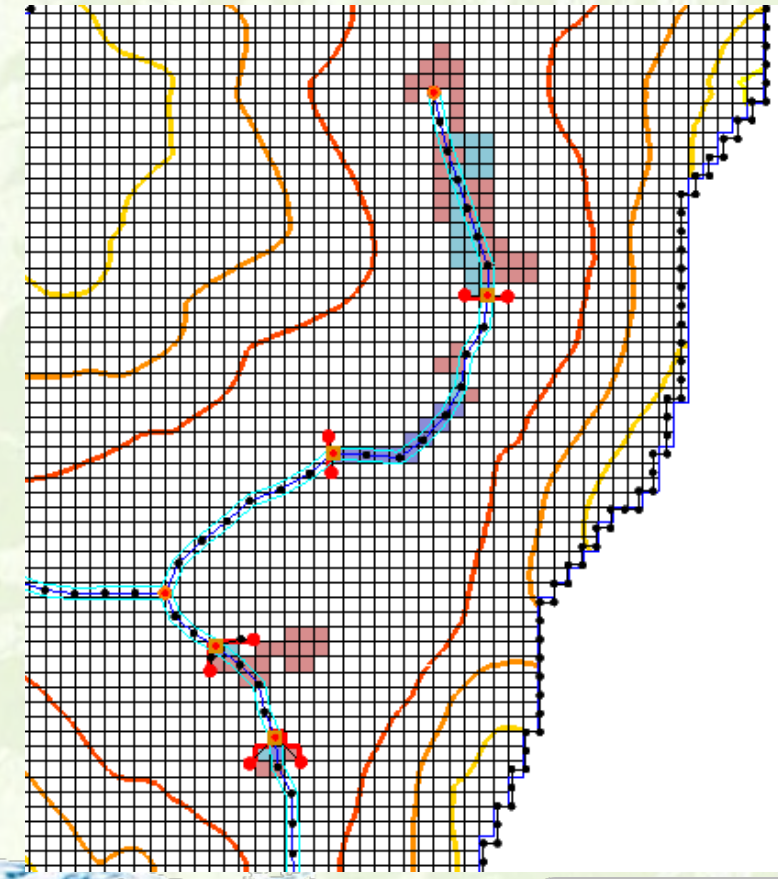
Example BDA + Constructed Wetlands





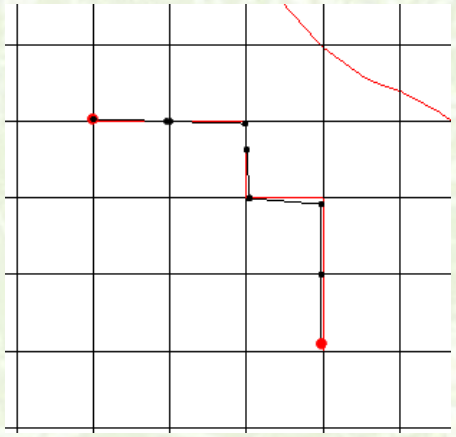
- Channels have weirs to force out-of-bank flow
- Embankments force water to pond and spread out
- Wetland cells give the hydraulics

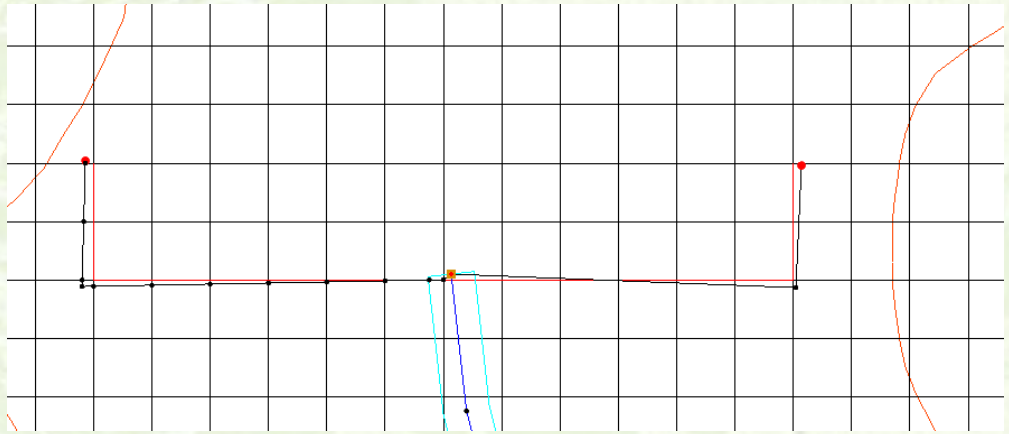
- Multiple small detention basins simulate beaver dams

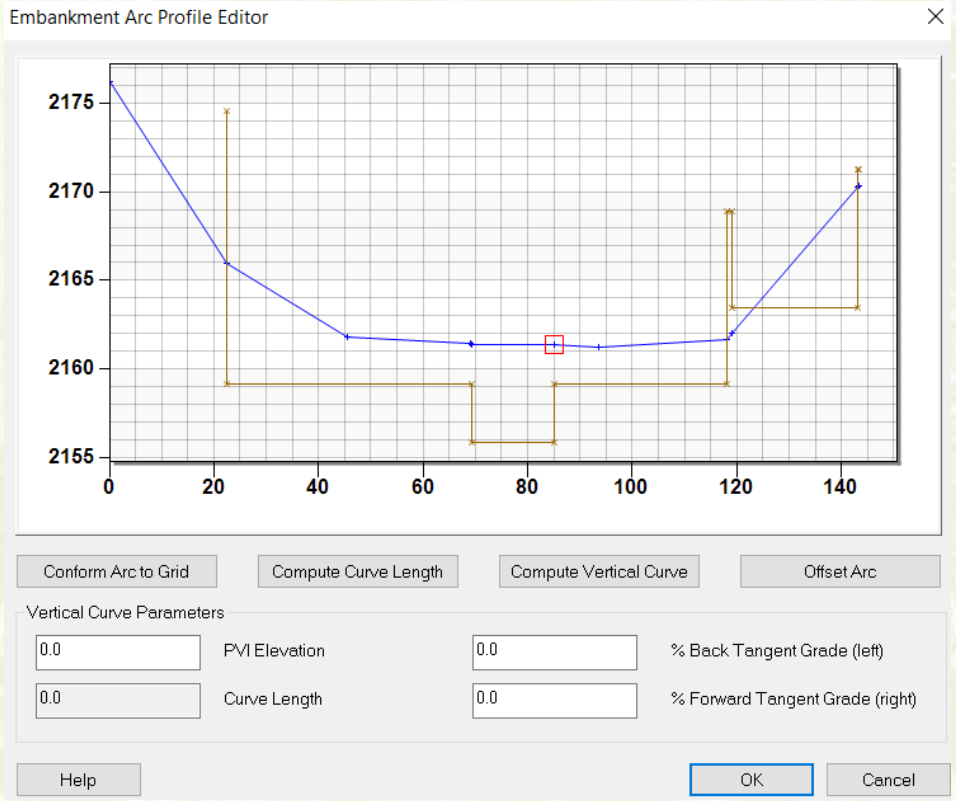


Infiltration Basins

- Can be stand-alone or connected to stream network
- Use embankments with or without detention basins







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Multi-Scale Models

- https://gsshawiki.com/Alternate_Run_Modes:Inset_Models

- GSSHA can read boundary conditions from a larger ("upstream") GSSHA model
- GSSHA project files need to refer to the other model
- GSSHA will deduce where the intersection is between the two models and write out the needed input data

- Useful for looking at "regional" scale models and driving more "local" process-level models