Creating a RAS Terrain for 2D Modeling

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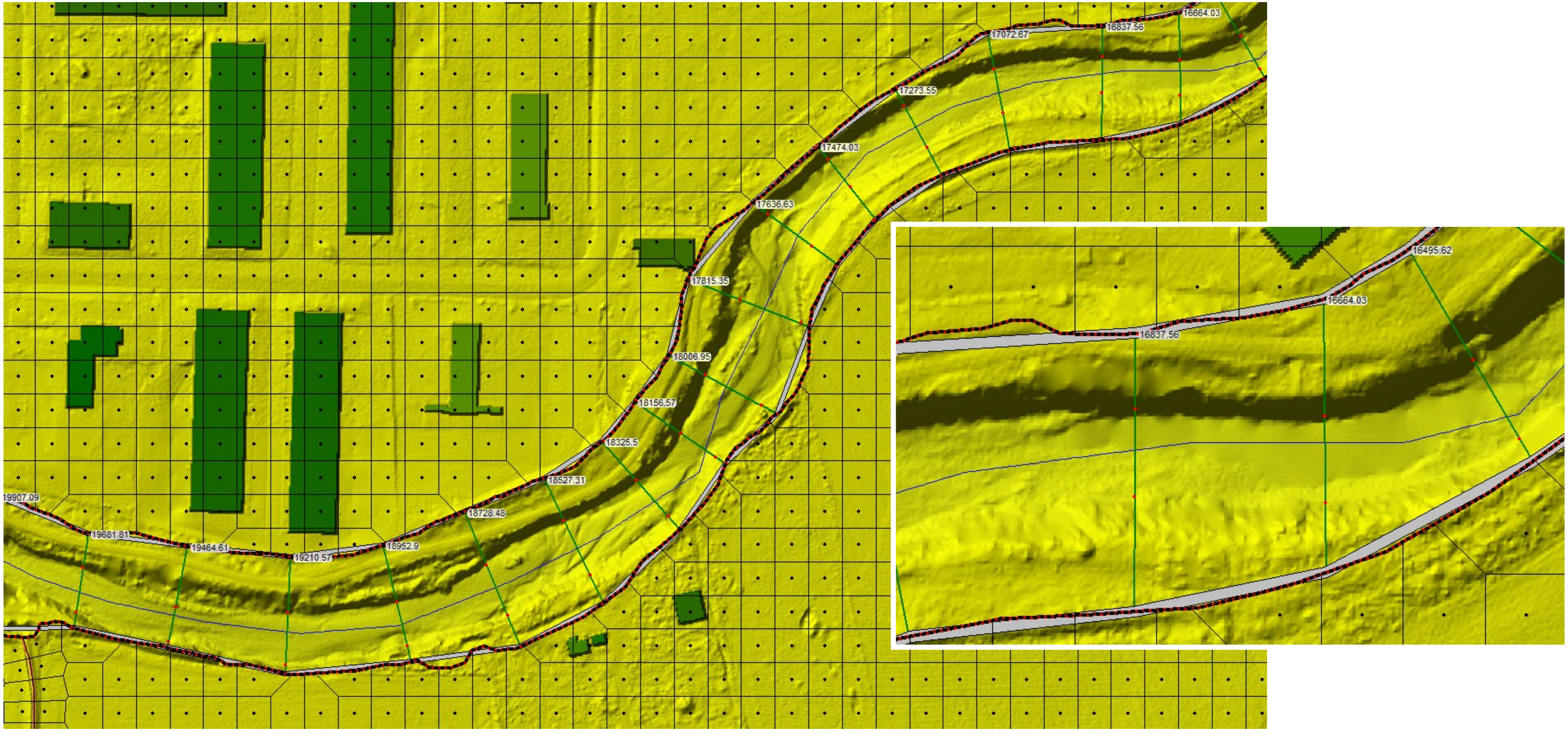
Overview

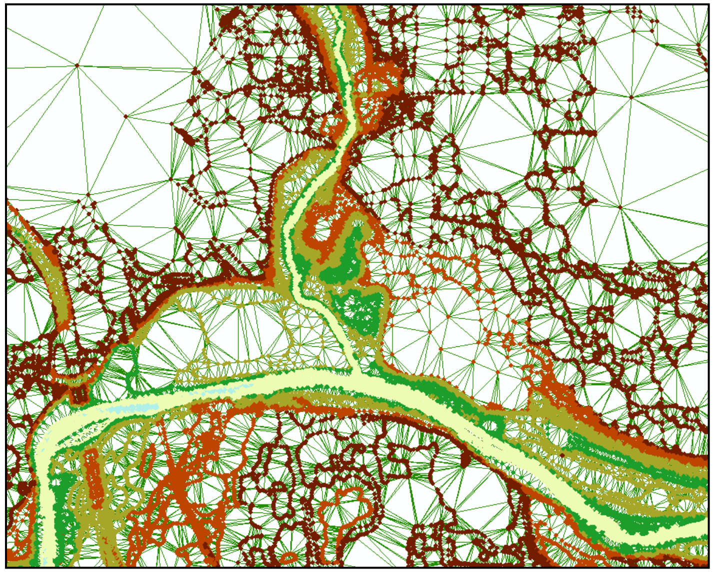
- Types of Terrain Models
- Building a Terrain Model
- Key Feature Considerations
- Cell Size Considerations
- Importing Terrain Information to RAS

A good model starts with **good** terrain …

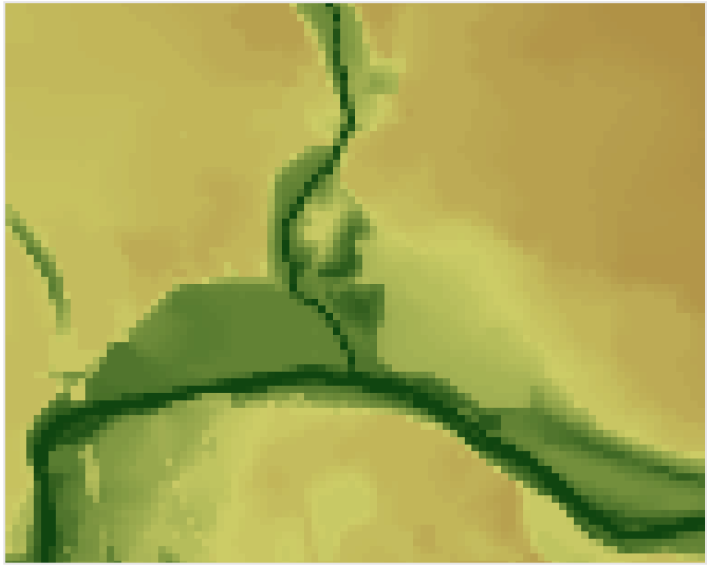


Terrain Model Types

- Triangulated Irregular Network (TIN)
- Triangulated points define surface allows for higher density in important areas.
- User-defined triangulation through points and break lines



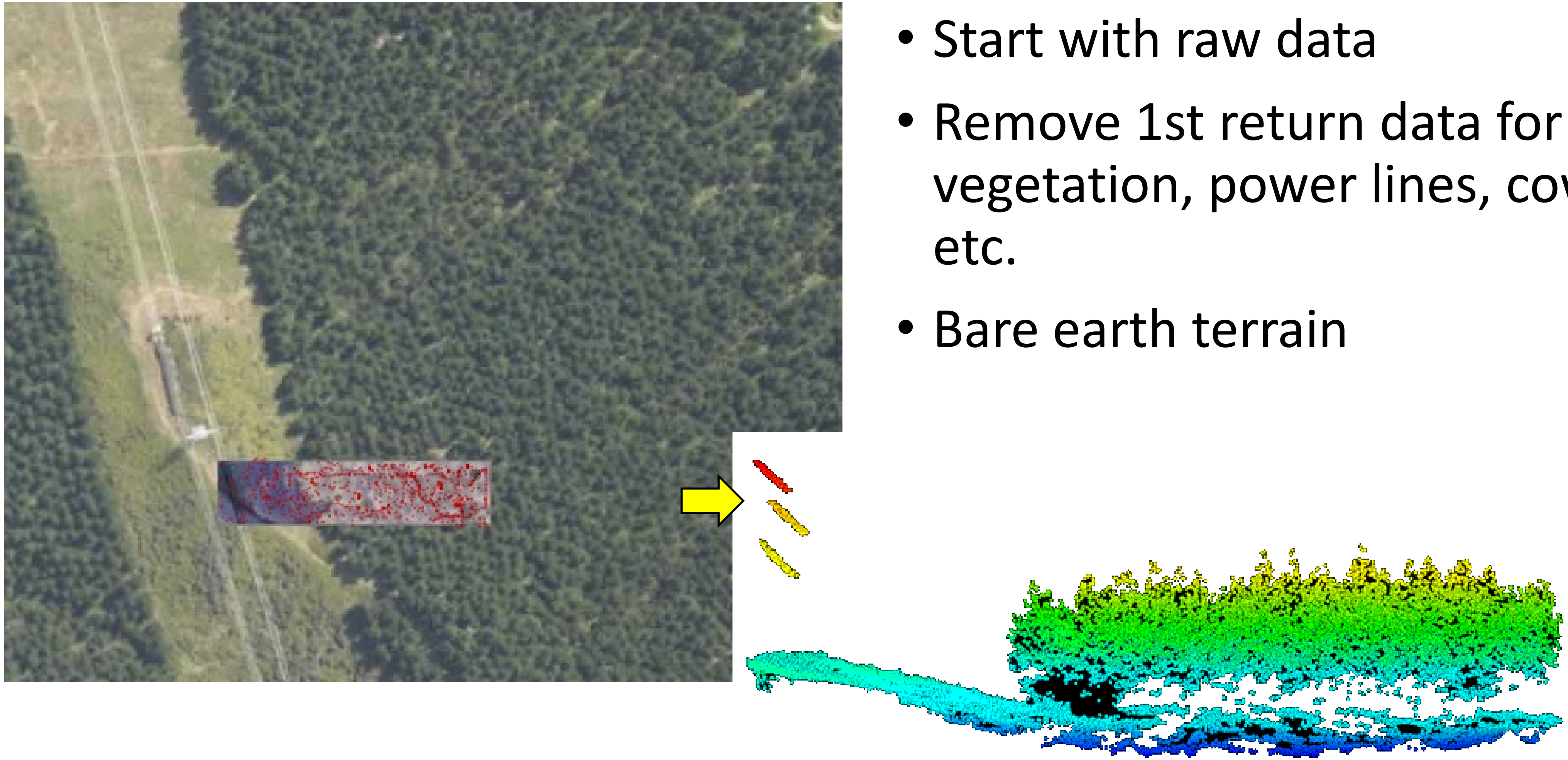
- Grid
- Single value at regular intervals. Cell size determines surface resolution.
- Fast mathematical computations



Building a Terrain Model

- Important to have imagery.

Building a Terrain Model
Verify and Process Points



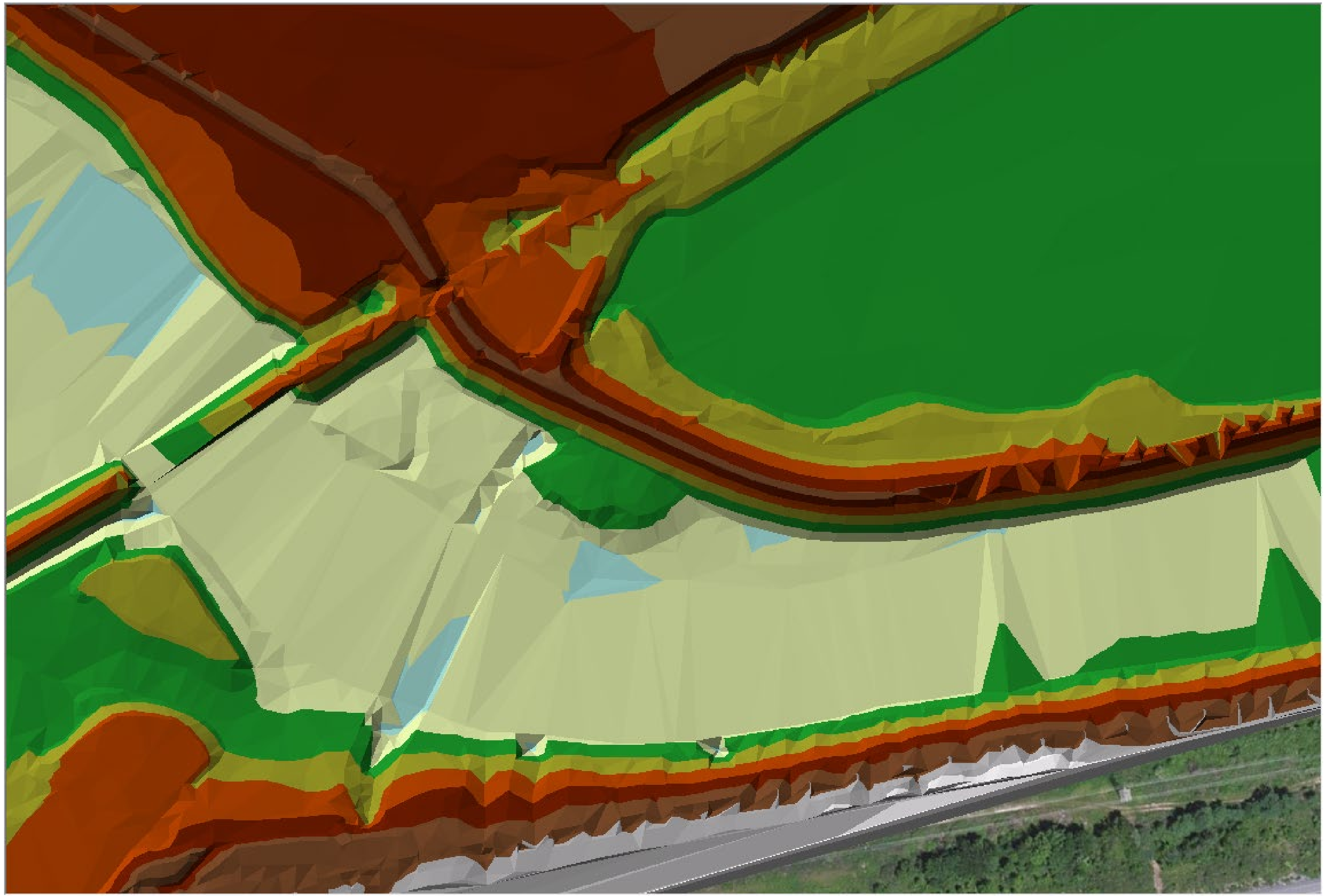
- Start with raw data
- Remove 1st return data for vegetation, power lines, cows, etc.
- Bare earth terrain

Building a Terrain Model
Verify and Process Points

- Remove of points that are not necessary/incorrect in representing the ground surface
  - Redundant points (more points = more processing)
  - Bridge deck elevations
- Make sure to add important features
  - Top of roads
  - Top of levees
  - Top of floodwalls
  - Bridge approaches
  - Hydraulic structures
- Replace over-water returns with bathymetric data

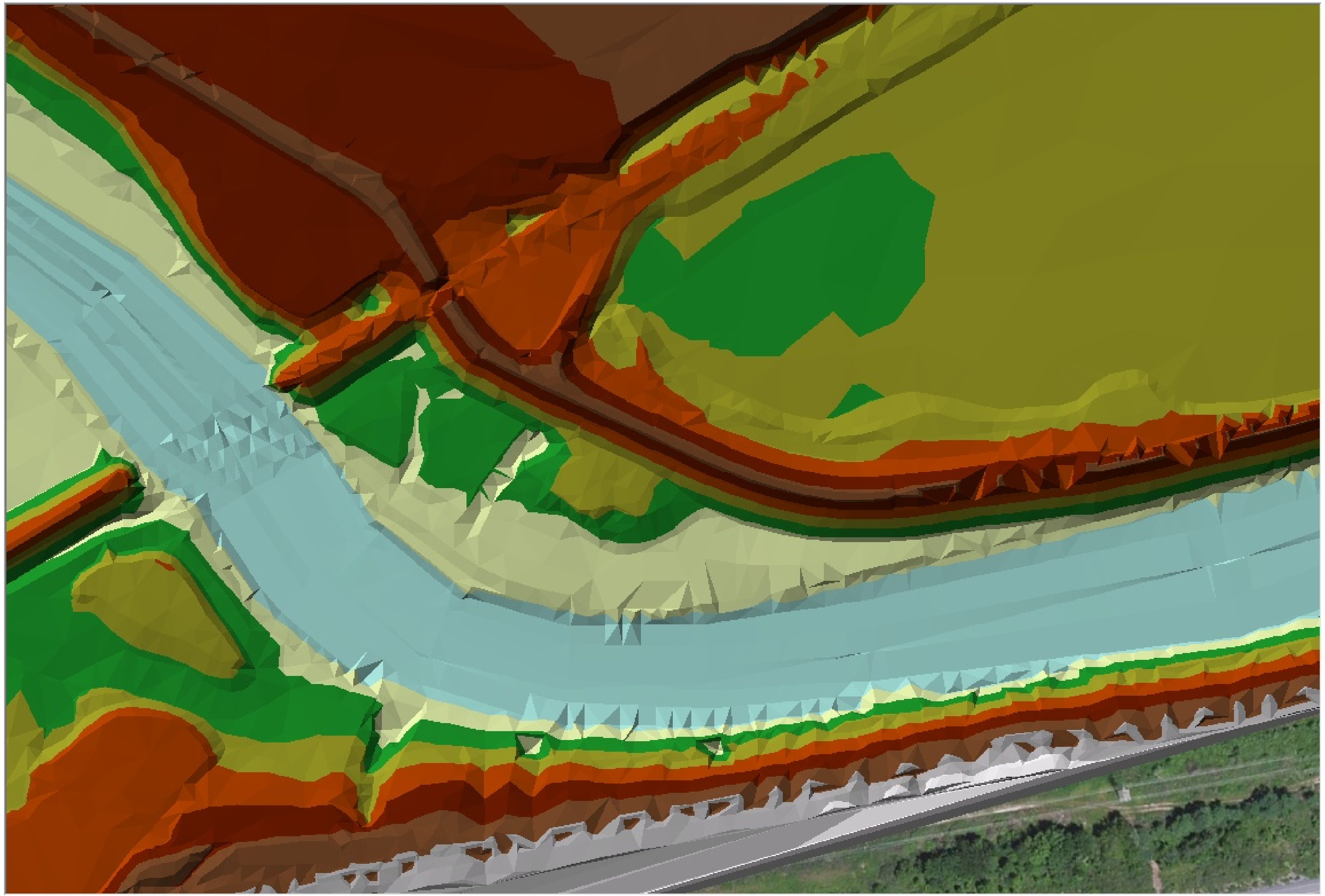
Building a Terrain Model
Bare Earth Points

Building a Terrain Model
Bare Earth Points

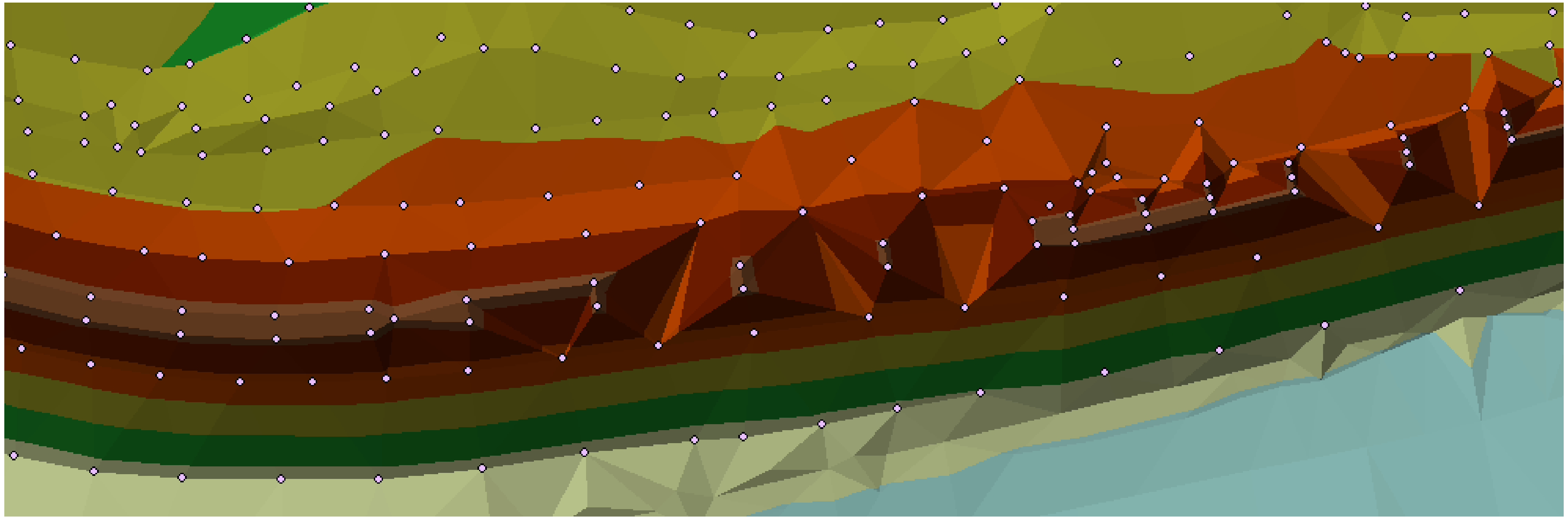


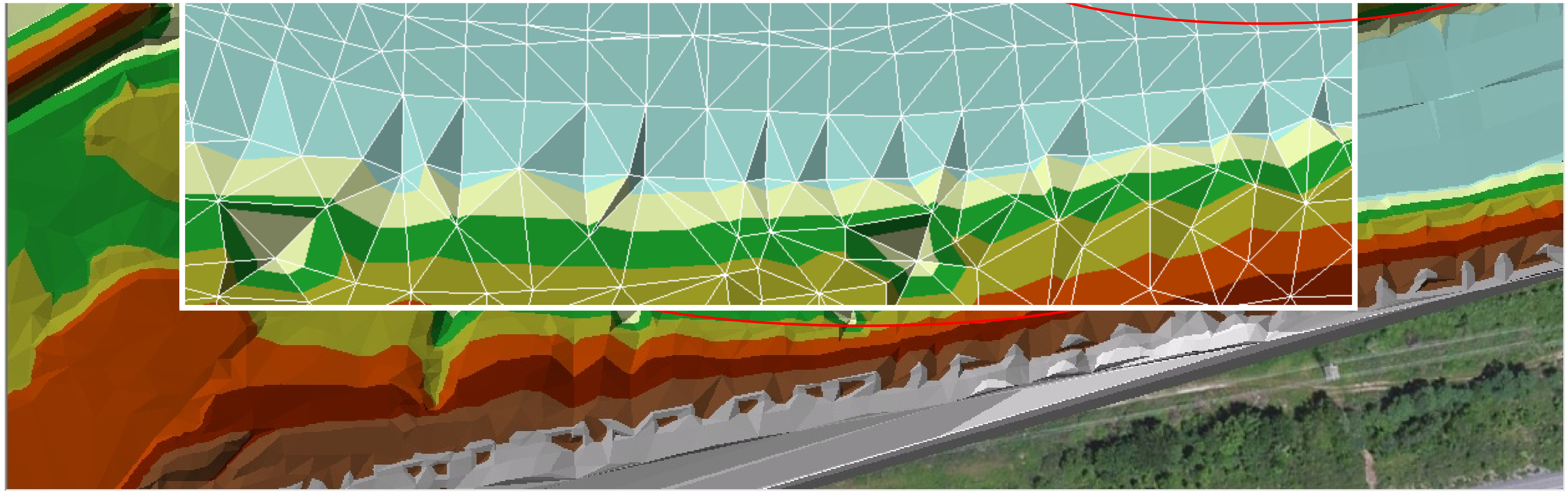
Building a Terrain Model
Bathymetry Points

Building a Terrain Model Bathymetric Data Added



Building a Terrain Model Problems?



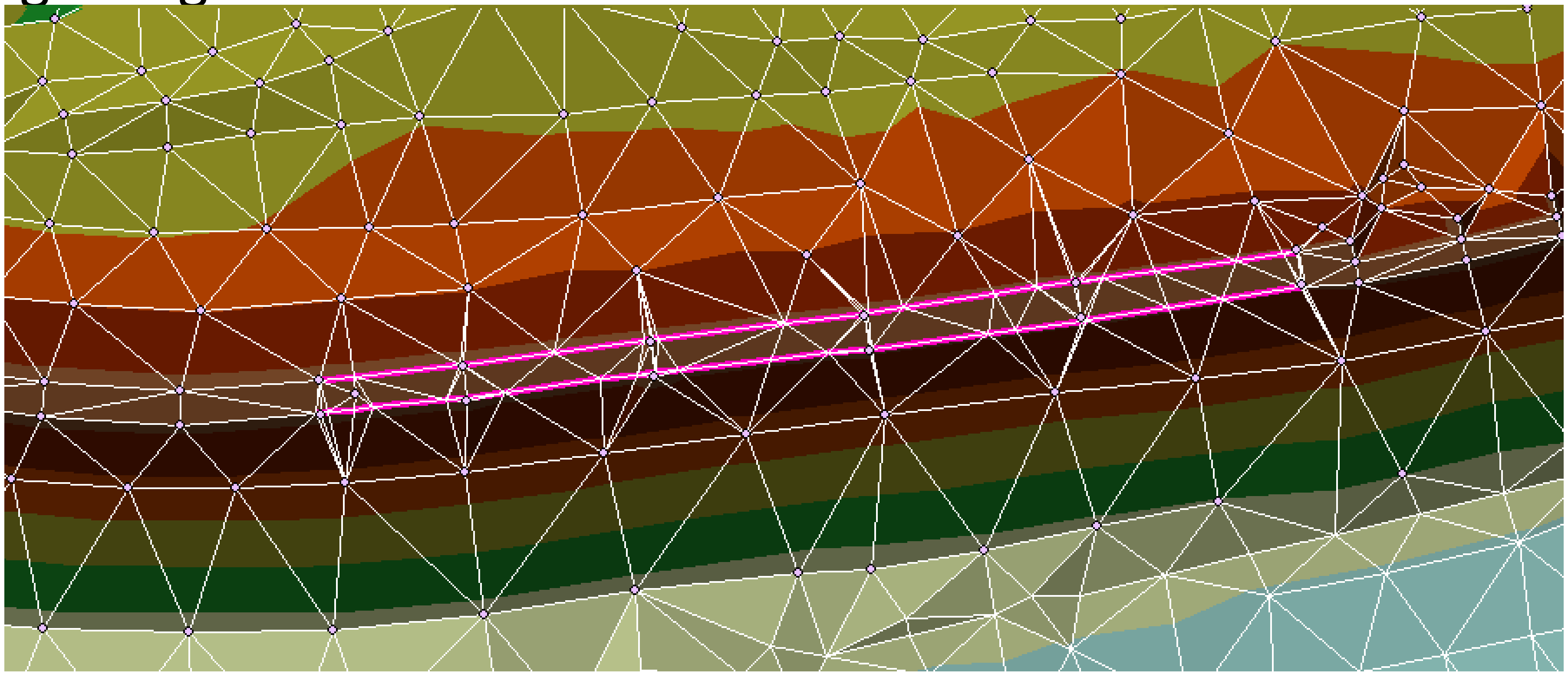


Building a Terrain Model Breaklines

- Breaklines are used to enforce triangle edges and elevations. They ensure that interpolation is done “correctly” along linear features.
  - Channel banks
  - Steep drops (drop structures, waterfalls)
  - Roadways
  - Levees
  - Bathymetry points

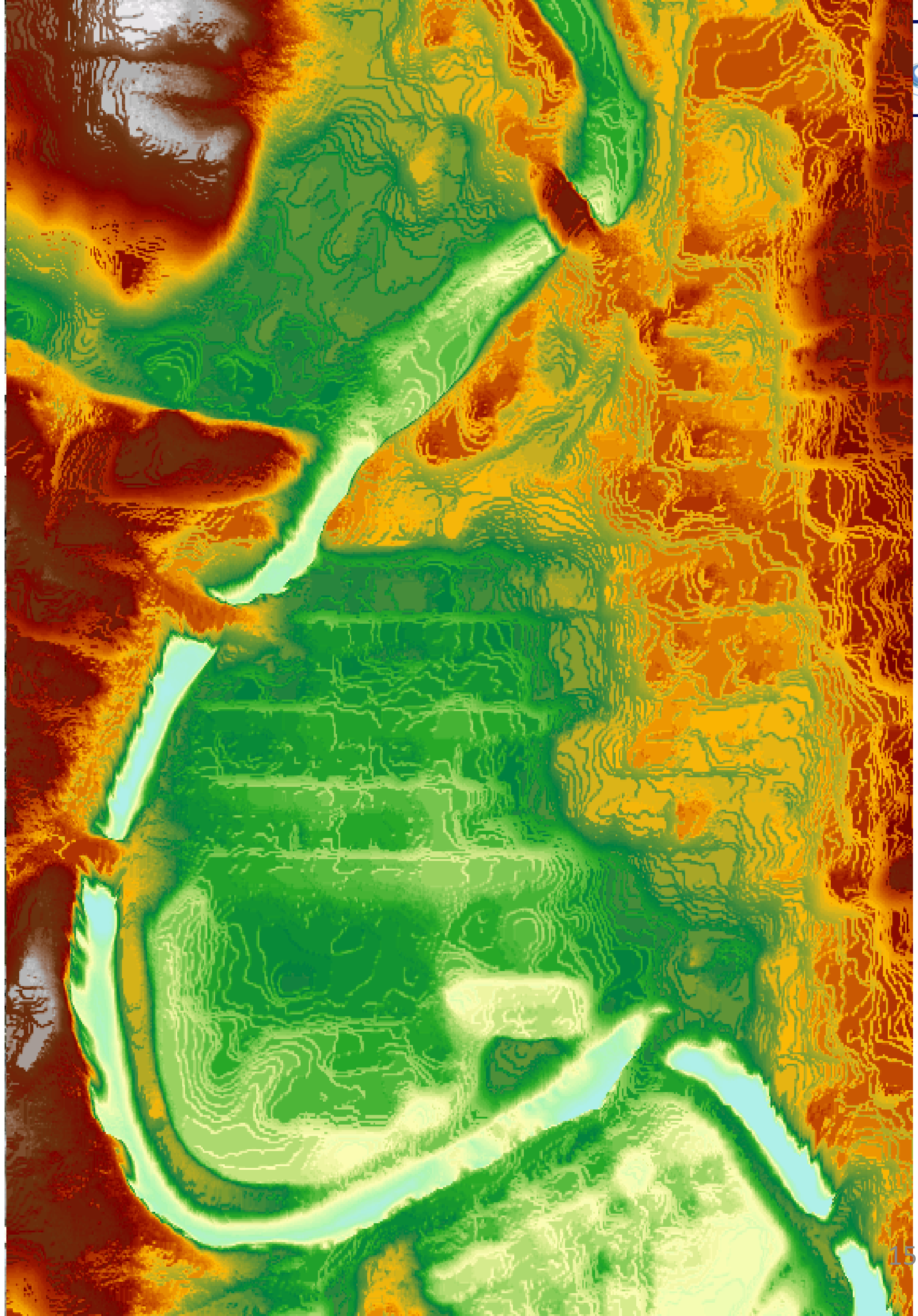
Building a Terrain Model
Breaklines

- Breaklines with elevations insert points to enforce elevations and triangle edges



Bridges

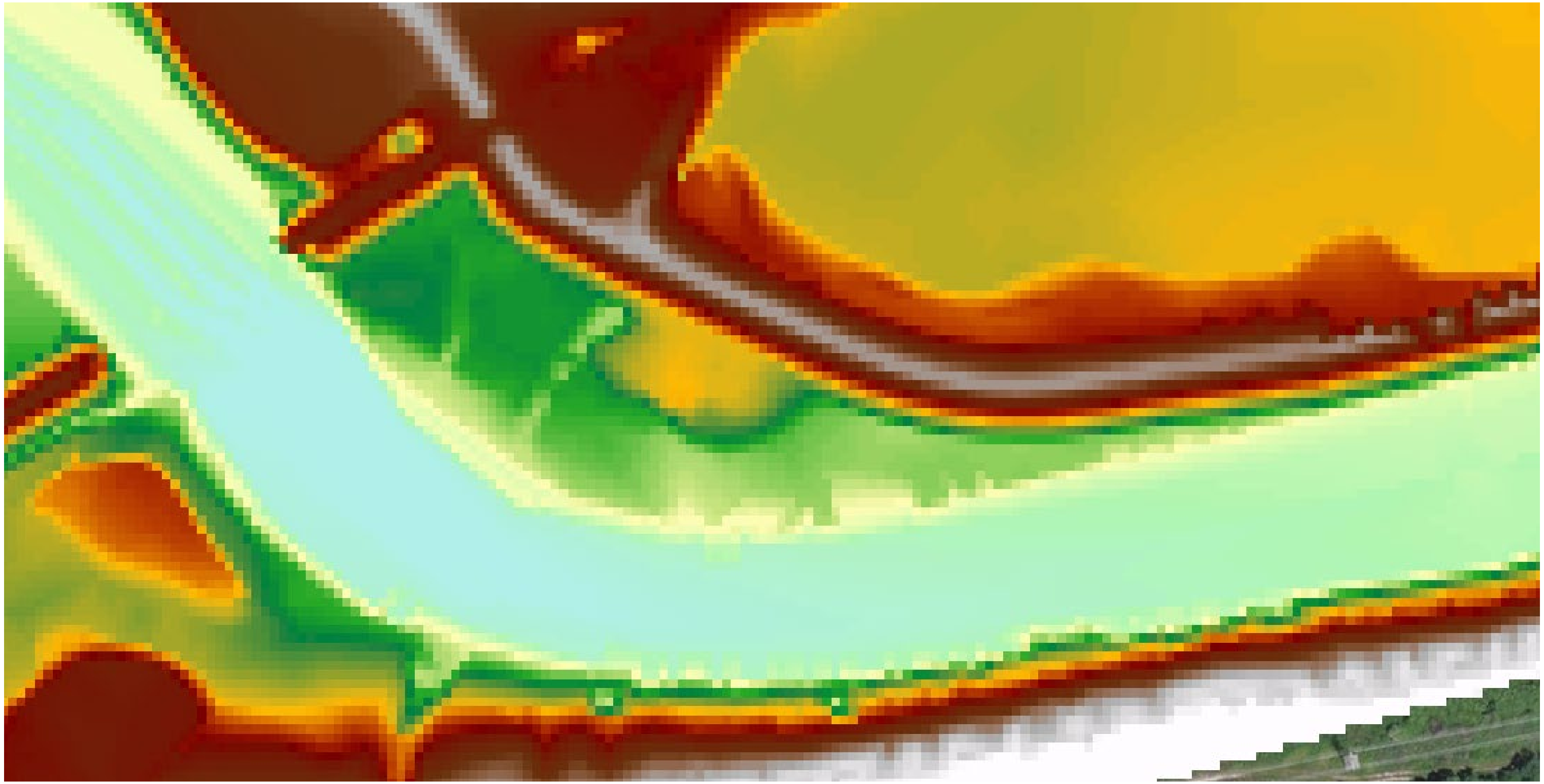
- Removal of bridges from terrain data is important for 2D modeling.
- High ground directs flow – determined directly from ground surface model.
- 1D modeling place cross sections at appropriate locations as work around.



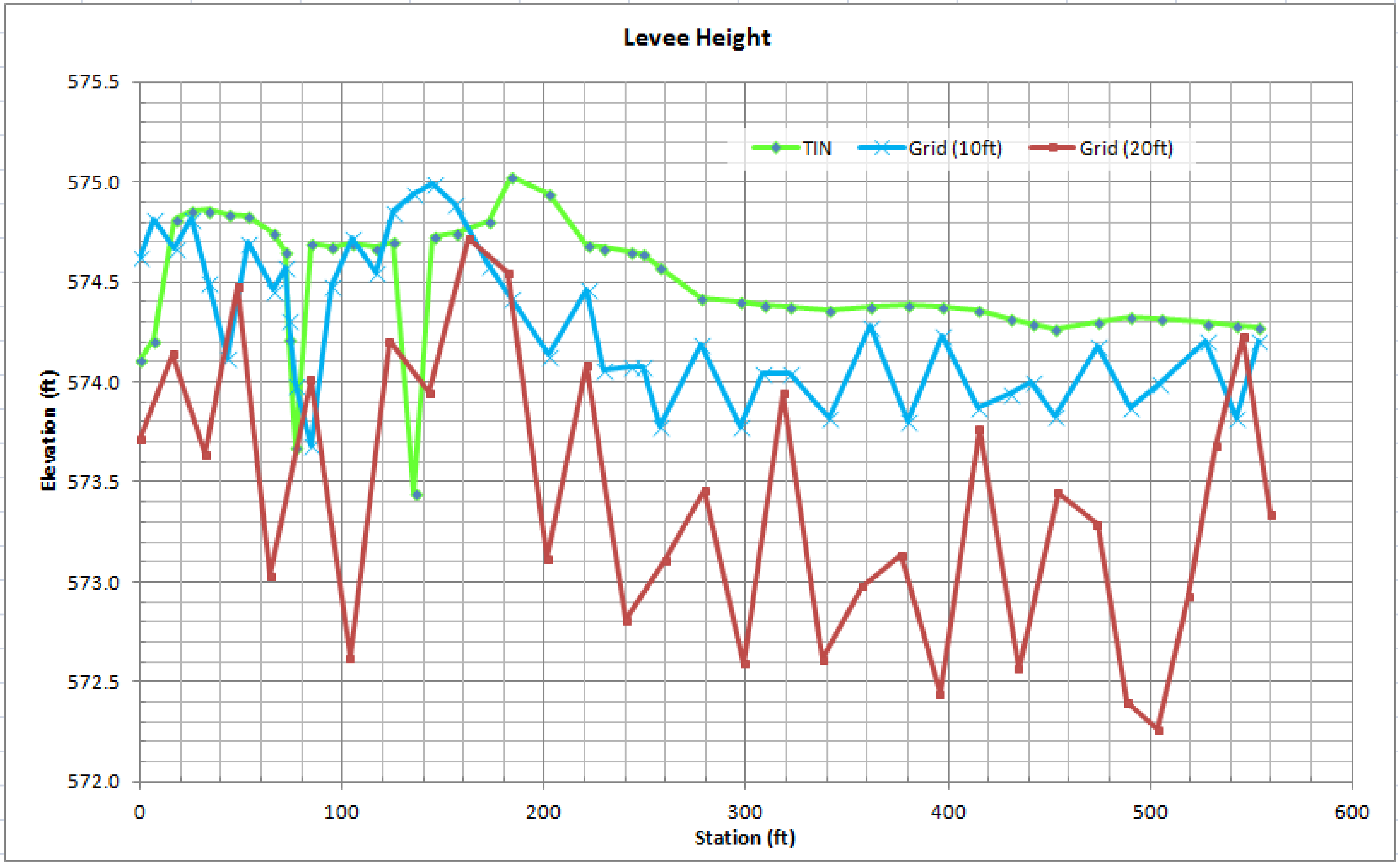
Terrain Cell Size Considerations

- Purpose – scale of model
  - Detailed bridge analysis requires piers be represented
  - Riverine model requires flow opening is represented
- Small enough to represent the land surface accurately, NOT any smaller
- Terrain model needs to accurately reflect linear features that direct flow. HEC-RAS uses a 2D computational grid as the underlying representation of terrain. 2D cell faces should be aligned with linear feature in the terrain.

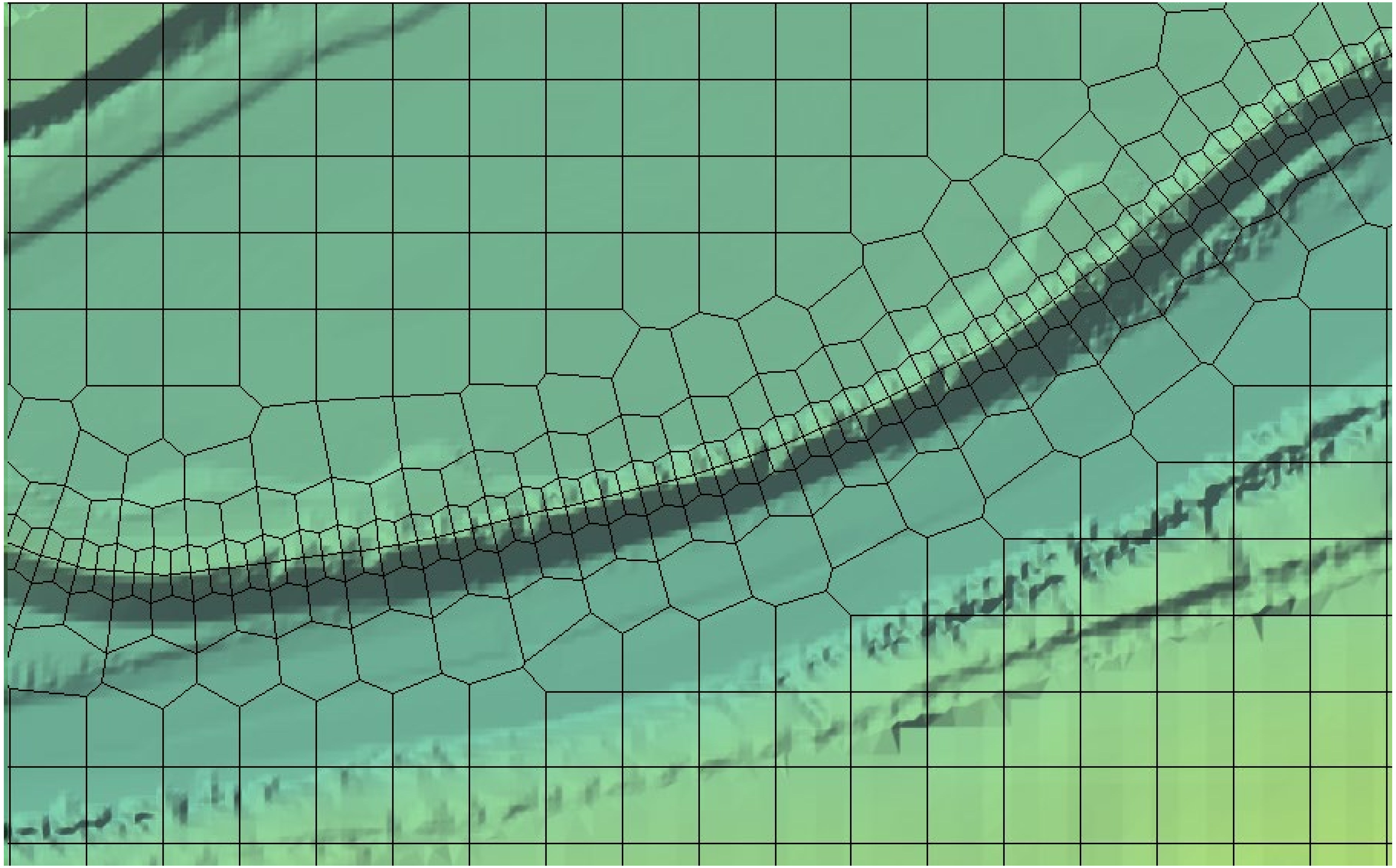
Raster Cell Size



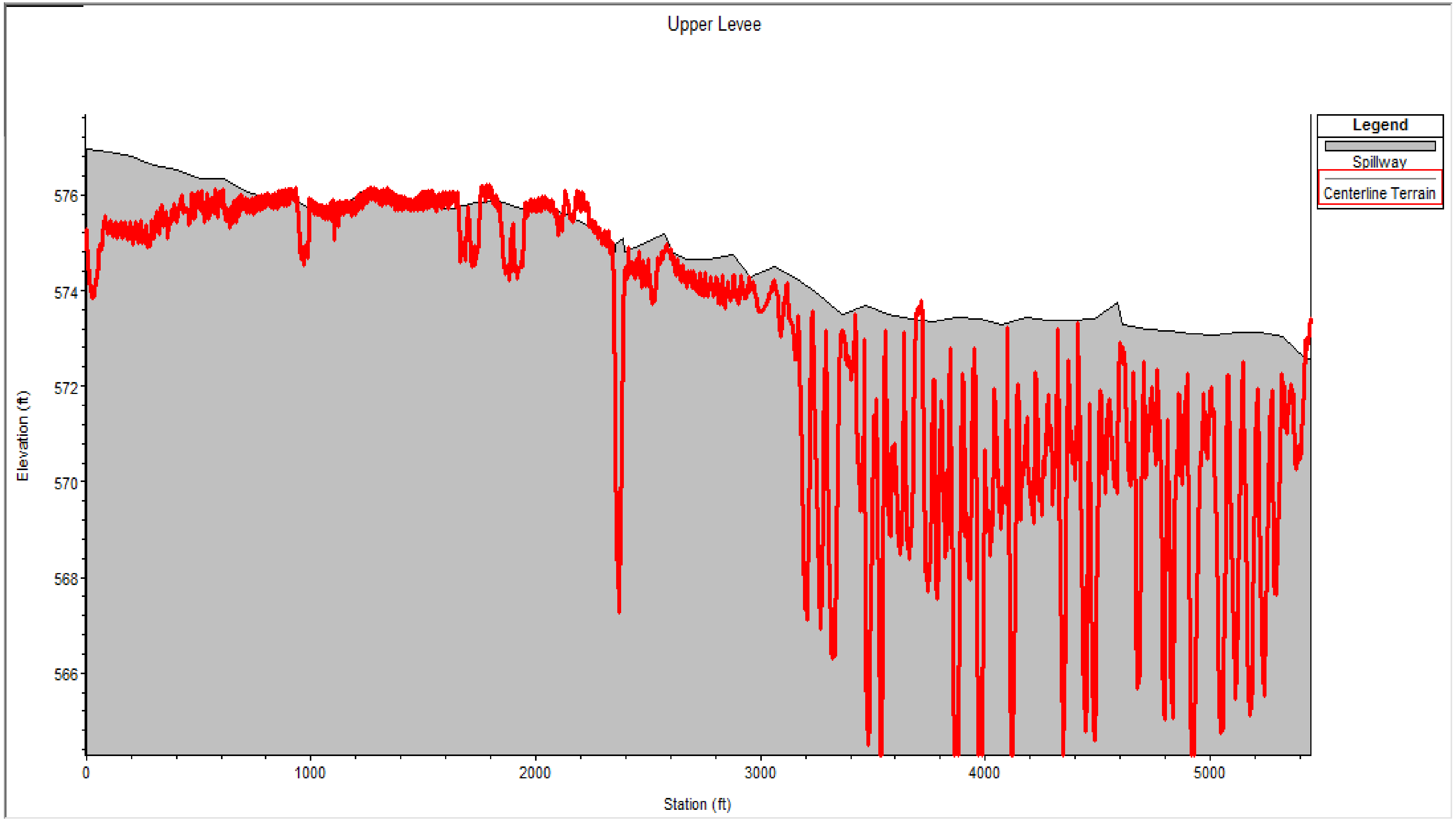
Raster Cell Size



HEC-RAS Terrain Fixes



Hydraulic Structure Elevations

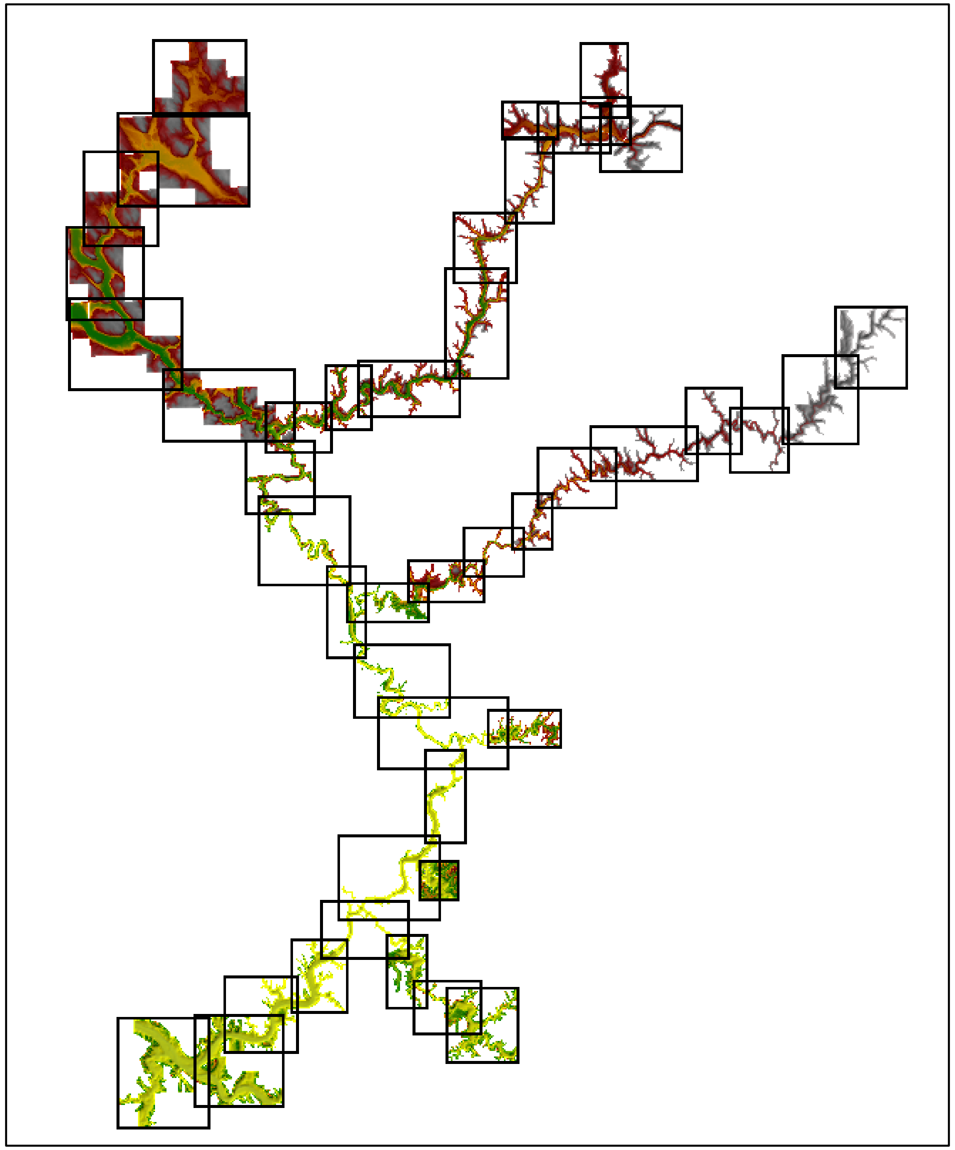


Terrain Model Development Summary

- Terrain models are developed as TINs
- Model is typically exported to a Grid for visualization and analysis
  - TINs are more difficult to render
  - TINs are more expensive to store
  - Calculations with TINs more difficult than with rasters
- Grid-cell size determines the effective accuracy of the resulting terrain model
  - How are you going to represent a levee in a raster with a 20ft grid cell?

Terrain in RAS Mapper

- Uses GeoTIFF format
  - Tiled data for more efficient storage
  - Compressed data for efficient storage
  - Pyramided data for fast visualization
    - Allows for on-the-fly inundation mapping
- One Layer for Multiple Terrain Models
- No file size limitations – BigTiFF supported

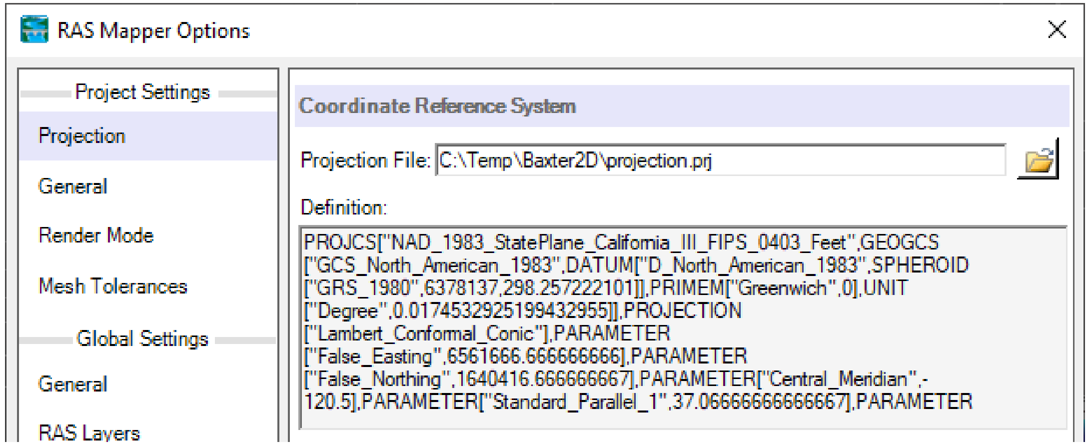


Terrain in RAS Mapper

- Various formats are supported
  - Binary Floating Point Raster (FLT)
  - Esri Arc/Info Grid format
  - GeoTIFF (still rounds and compresses)
  - Others (e.g. USGS DEM, etc)
- Imported data is rounded to based on precision selected
  - Default is 1/32 (~0.03 ft) (1/128 for metric)
- Recommended that a projection is defined for the RAS Mapper project first.

Projection

- Data used in RAS Mapper must be a common coordinate system.
- Projection will be used to reproject Terrain data that is imported into RAS Mapper.
  - Defined using esri PRJ file.
- Web Imagery will be projected on-the-fly to RAS Mapper coordinate system.



Projection Files

- Not all PRJ files are the same

```
PROJCS["NAD_1983_StatePlane_Pennsylvania_South_FIPS_3702_Feet",
GEOGCS["GCS_North_American_1983",
DATUM["D_North_American_1983",
SPHEROID["GRS_1980",6378137,298.257222101]],
PRIMEM["Greenwich",0],
UNIT["Degree",0.0174532925199432955]],
PROJECTION["Lambert_Conformal_Conic"],
PARAMETER["False_Easting",1968500],
PARAMETER["False_Northing",0],
PARAMETER["Central_Meridian",-77.75],
PARAMETER["Standard_Parallel_1",39.93333333333333],
PARAMETER["Standard_Parallel_2",40.96666666666667],
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UNIT["Foot_US",0.30480060960121924]]
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PROJCS["NAD_1983_StatePlane_Pennsylvania_South_FIPS_3702_Feet",
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PRIMEM["Greenwich",0.0],
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PARAMETER["False_Northing",0.0],
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VERTCS["NAVD_1988",
VDATUM["North_American_Vertical_Datum_1988"],
PARAMETER["Vertical_Shift",0.0],
PARAMETER["Direction",1.0],
UNIT["Foot_US",0.3048006096012192]]
```
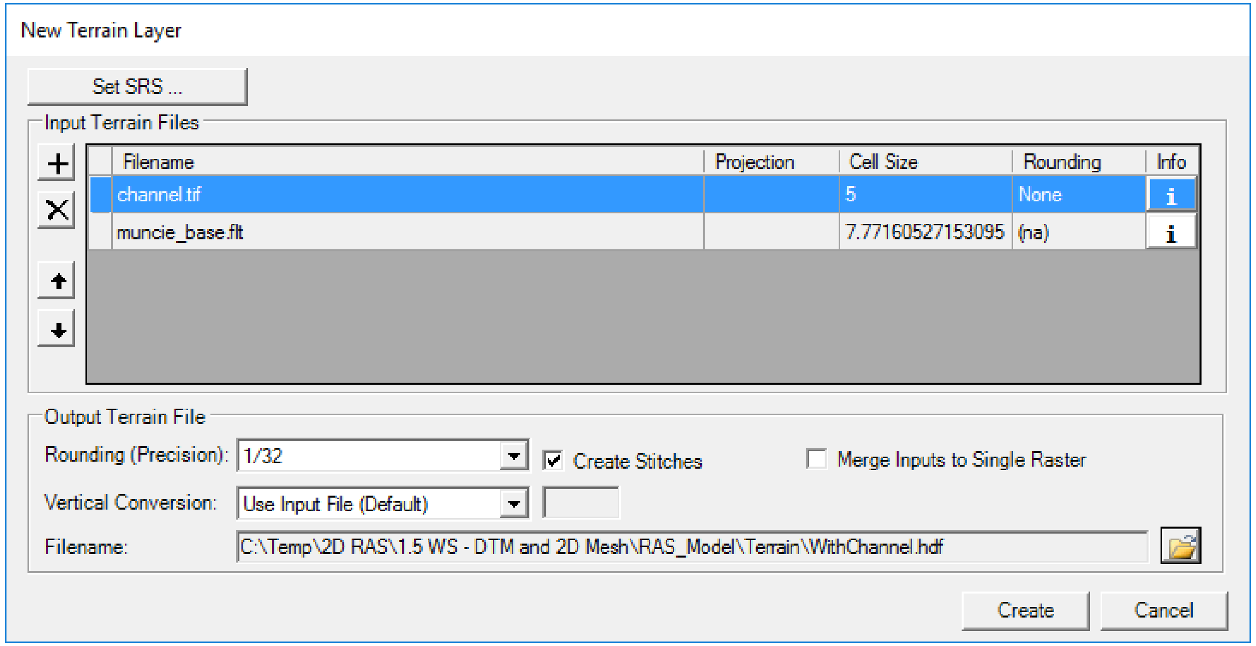
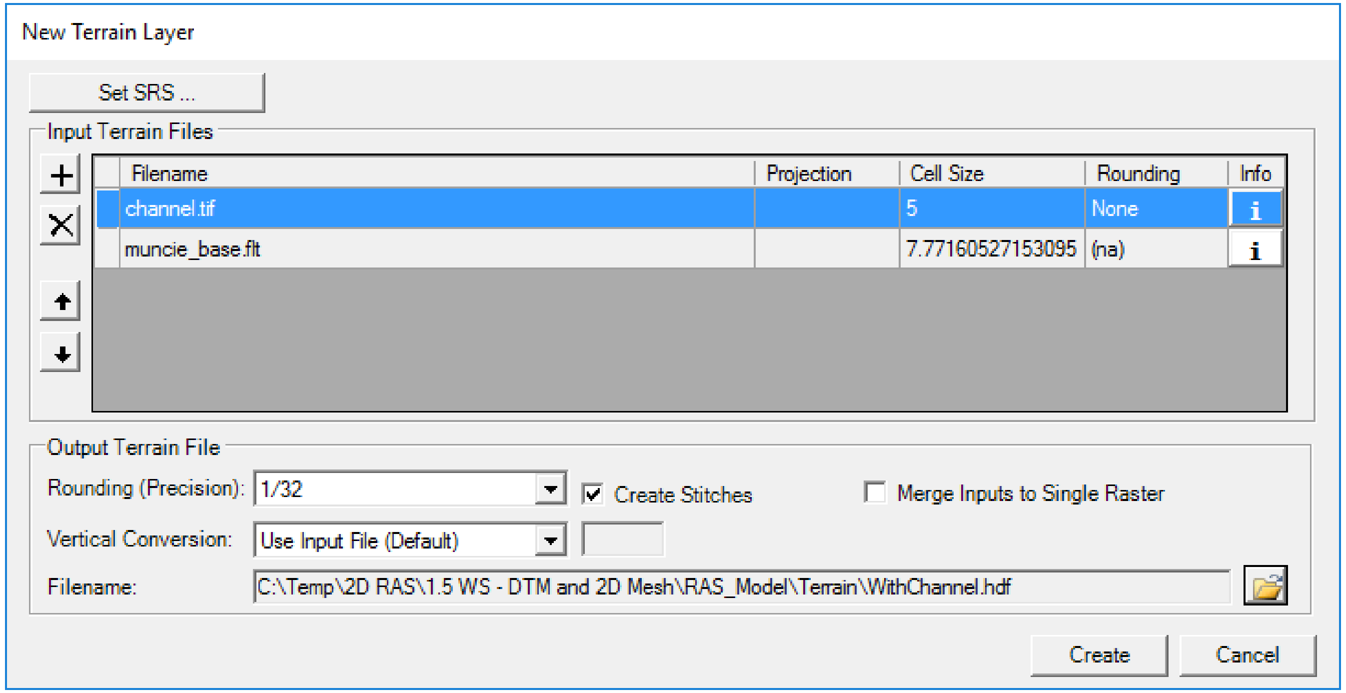

Terrain Importer

- Add files – allows user to select rasters for import
- Order raster files based on Priority on what cell value should be used if there is overlap by the terrain models.
  - Highest Priority to the top



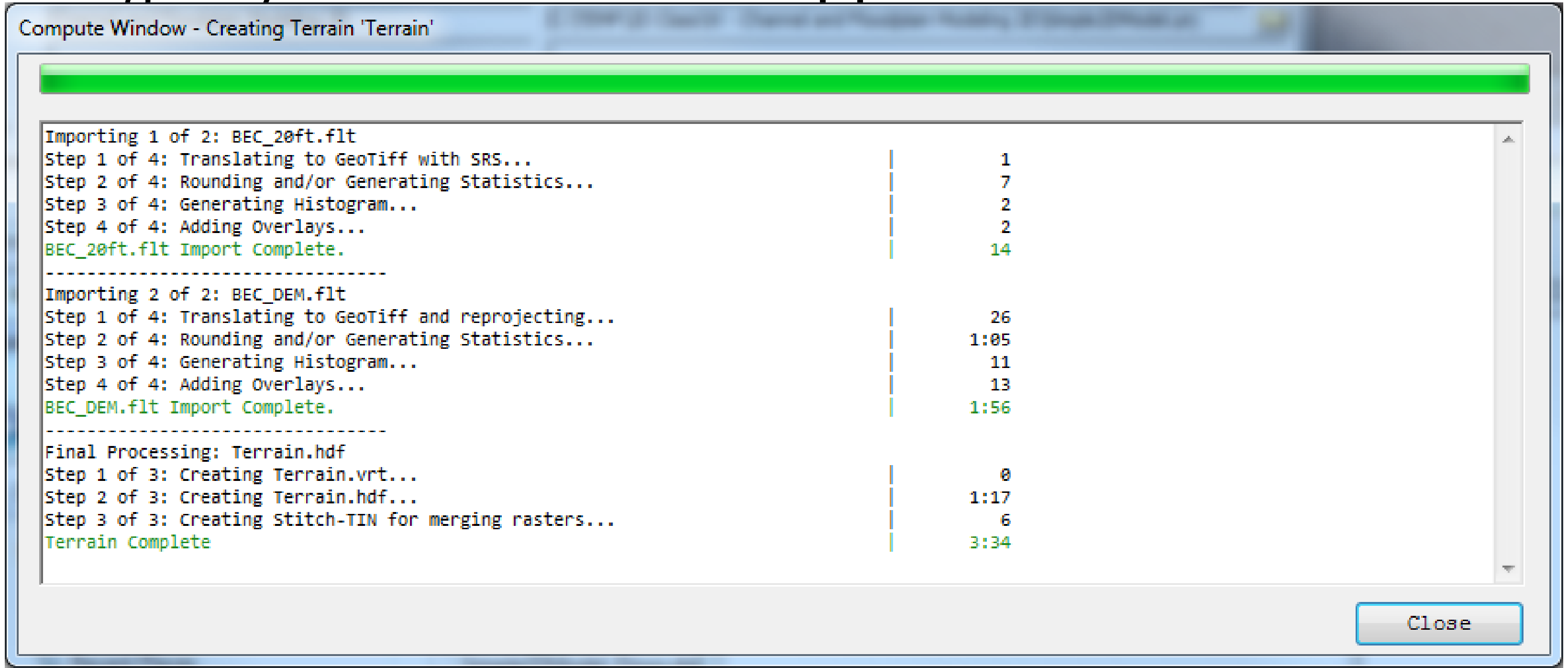
Terrain Importer

- Rounding – Precision which data is stored
- Terrain Filename and Folder
  - name.tilename.tif file for each imported terrain tile
  - name.hdf file contains “stitch” information for data gaps
  - name.vrt file contains statistics info and color ramp info



Terrain Importer

- Data is projected (translated) and rounded for all data
- Data is pyramided and compressed
- TIN is created for overlapping regions
- Terrain.hdf is the single layer loaded to RAS Mapper



Questions?

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