

# Terrain Modifications

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# Overview

- Terrain Modifications using XS Surface
- Terrain Modifications using Vector Modifications
- National Levee Database (NLD)



# Terrain Modifications using XS Surface

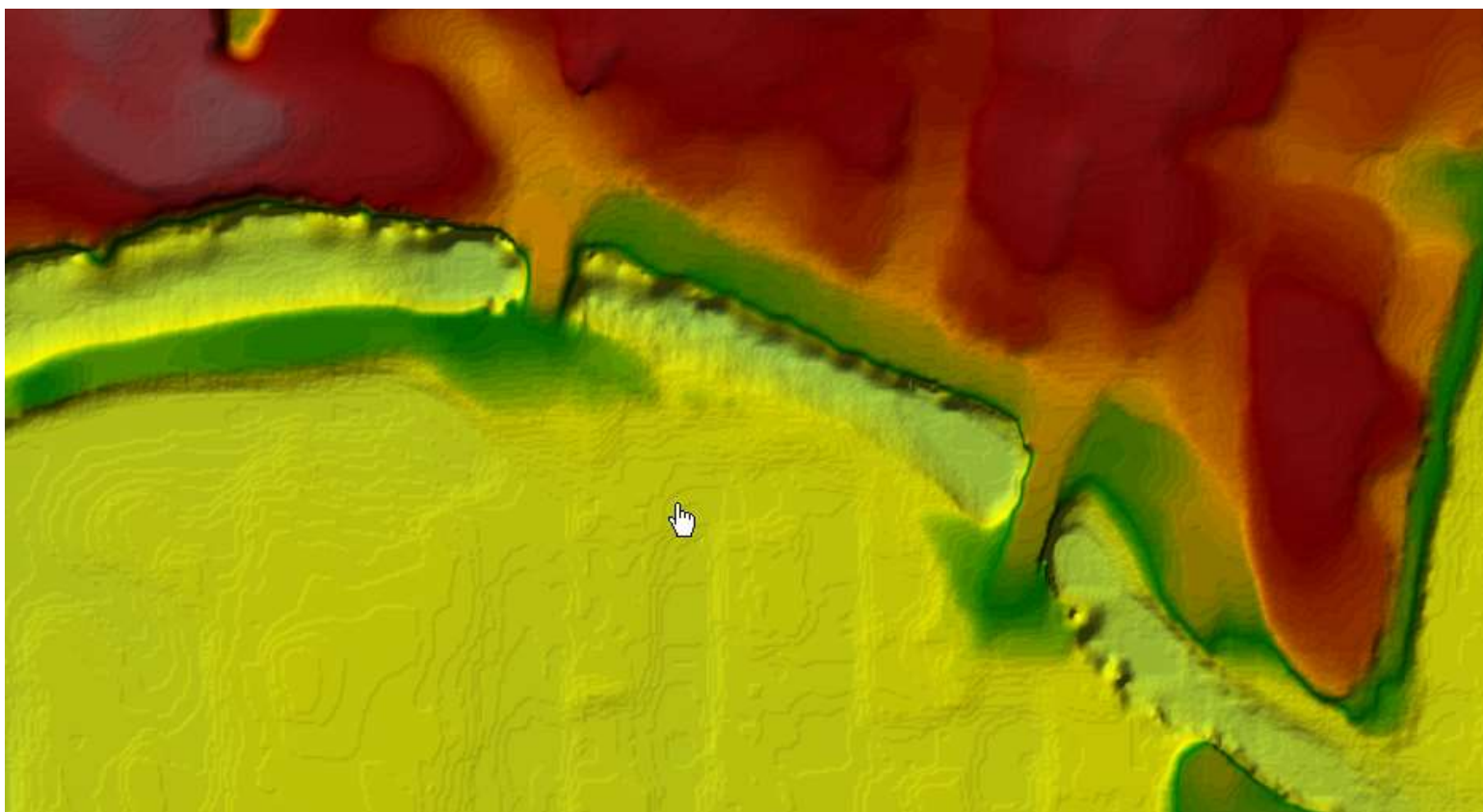


# XS Surface Example - Bridges



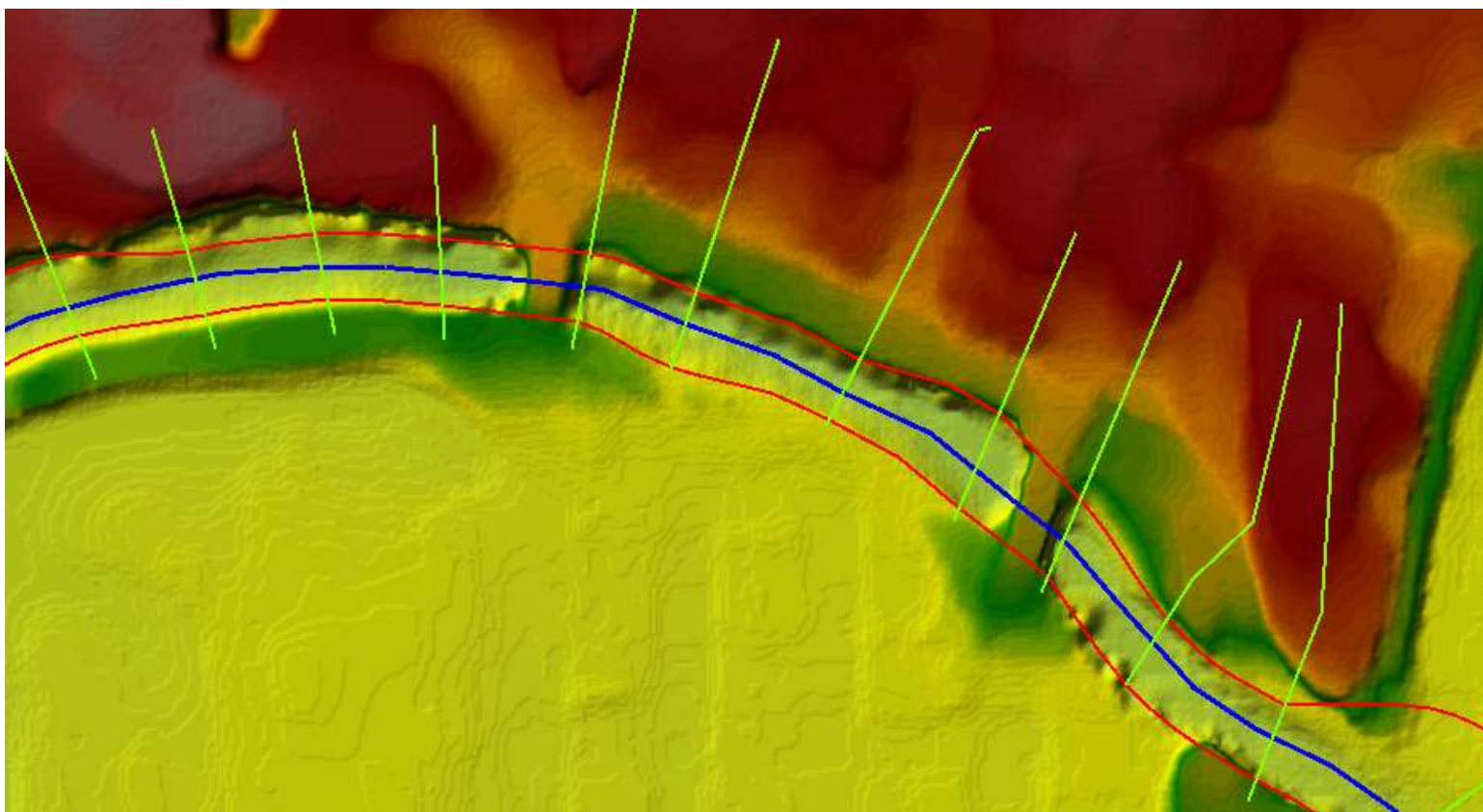


# XS Surface Example— Bridges in Terrain





# XS Surface Example – Channel Cross Sections







# XS Surface Example – Export Interpolated XS

The screenshot displays the HEC-RAS software interface. On the left, the 'RAS Geometry Properties' menu is open, showing options like 'Edit Geometry (BETA)', 'Validate Geometry', 'Save Geometry As...', 'Delete Geometry', 'Complete for computations (Debug)', 'Zoom to Layer', 'Remove Layer', 'Move Layer', 'Export Layer', 'Open Folder in Windows Explorer', and 'Save Geometry Data (Full Debug)'. The 'Export Layer' option is selected, and a sub-menu is visible with the following options: 'Create Terrain GeoTiff from XS's (Overbanks and Channel)', 'Create Terrain GeoTiff from XS's (Channel Only)', 'Create PointShapefile of XS-River Intersections', 'Create Polygon Shapefile of Geometry Region', and 'Create Polygon Shapefile for XS Vegetation Regions'. The 'Create Terrain GeoTiff from XS's (Channel Only)' option is highlighted. In the background, a 3D visualization of a river channel is shown with a yellow-green terrain and a blue channel. Overlaid on this is a 'Export Terrain' dialog box with the text 'Enter raster cell size' and a text input field containing the value '1'. The dialog box has 'OK' and 'Cancel' buttons.



# XS Surface Example – Merge Terrain Data



New Terrain Layer

Set SRS ...

Input Terrain Files

	Filename	Projection	Cell Size	Rounding	Info
	ChannelOnly.tif	PROJCS["unnamed",GEOGCS["NAD83",DATU...	5	1/16	
	muncie_clip.flt		5	(na)	

Output Terrain File

Rounding (Precision): 1/32 ☐ Create Stitches ☐ Merge Inputs to Single Raster

Vertical Conversion: Use Input File (Default)

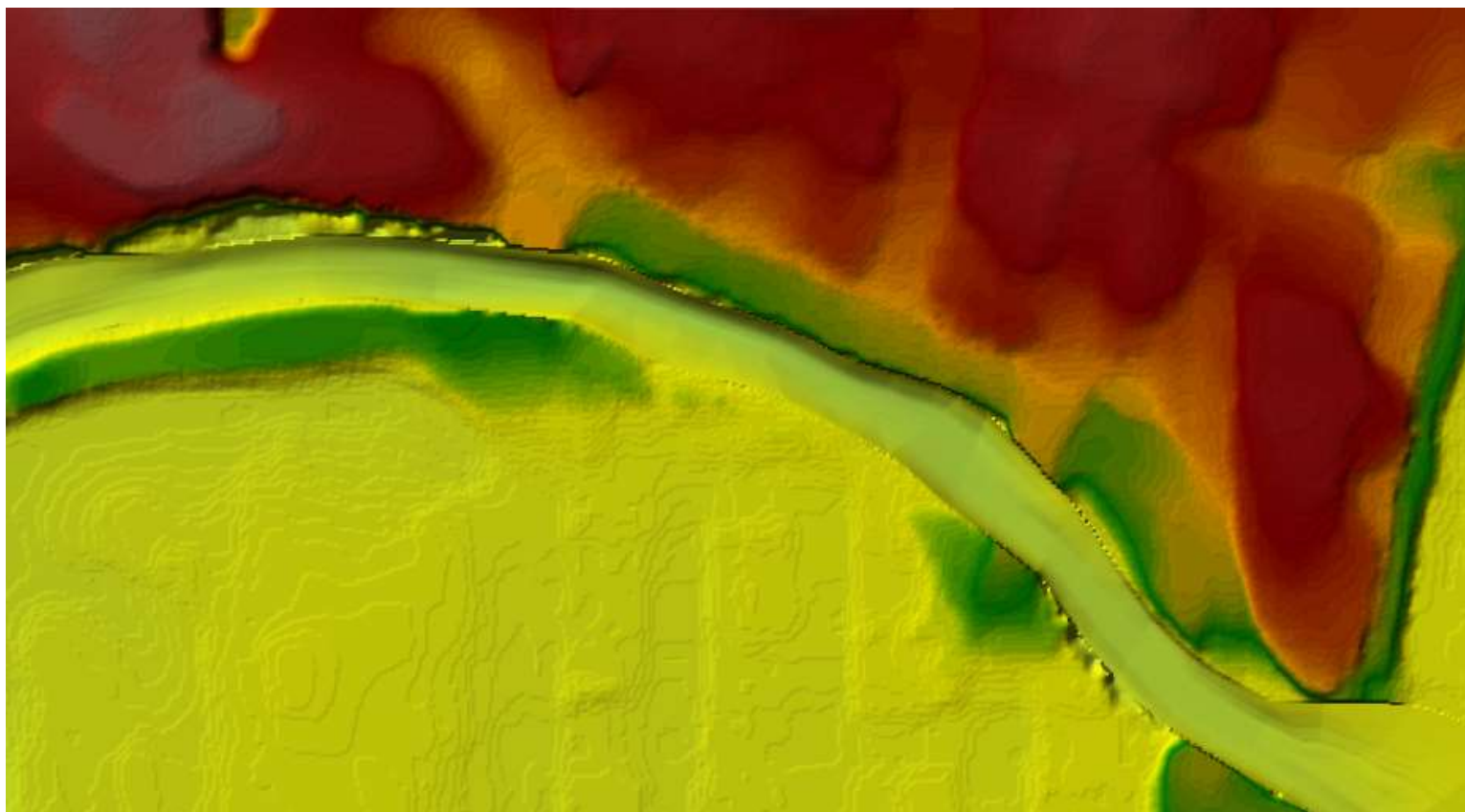
Filename: C:\...q0heccta\Documents\\_Projects\RAS Examples\2D Examples\Muncie\TerrainMods\Terrain.hdf

Create Cancel





## XS Surface Example – Final Terrain



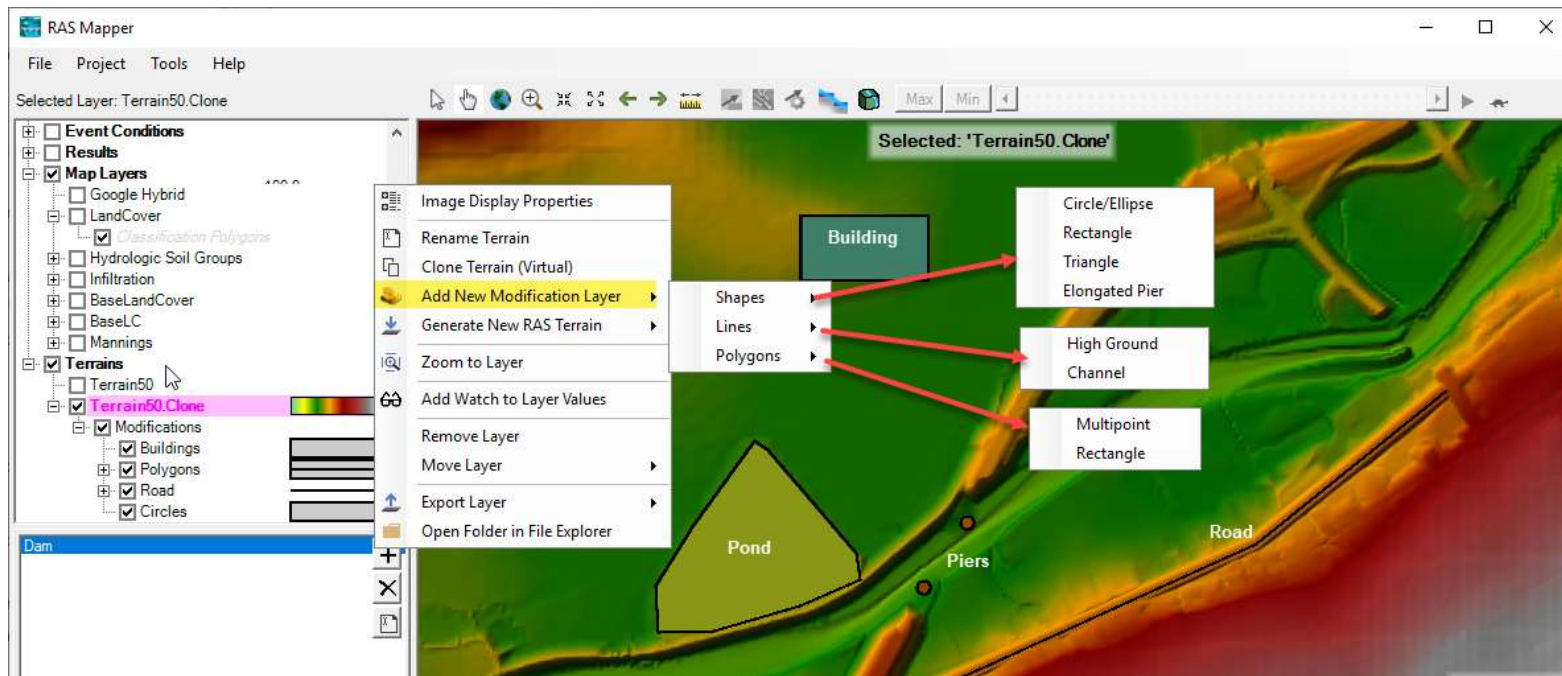


# Terrain Modifications using Vector Modifications



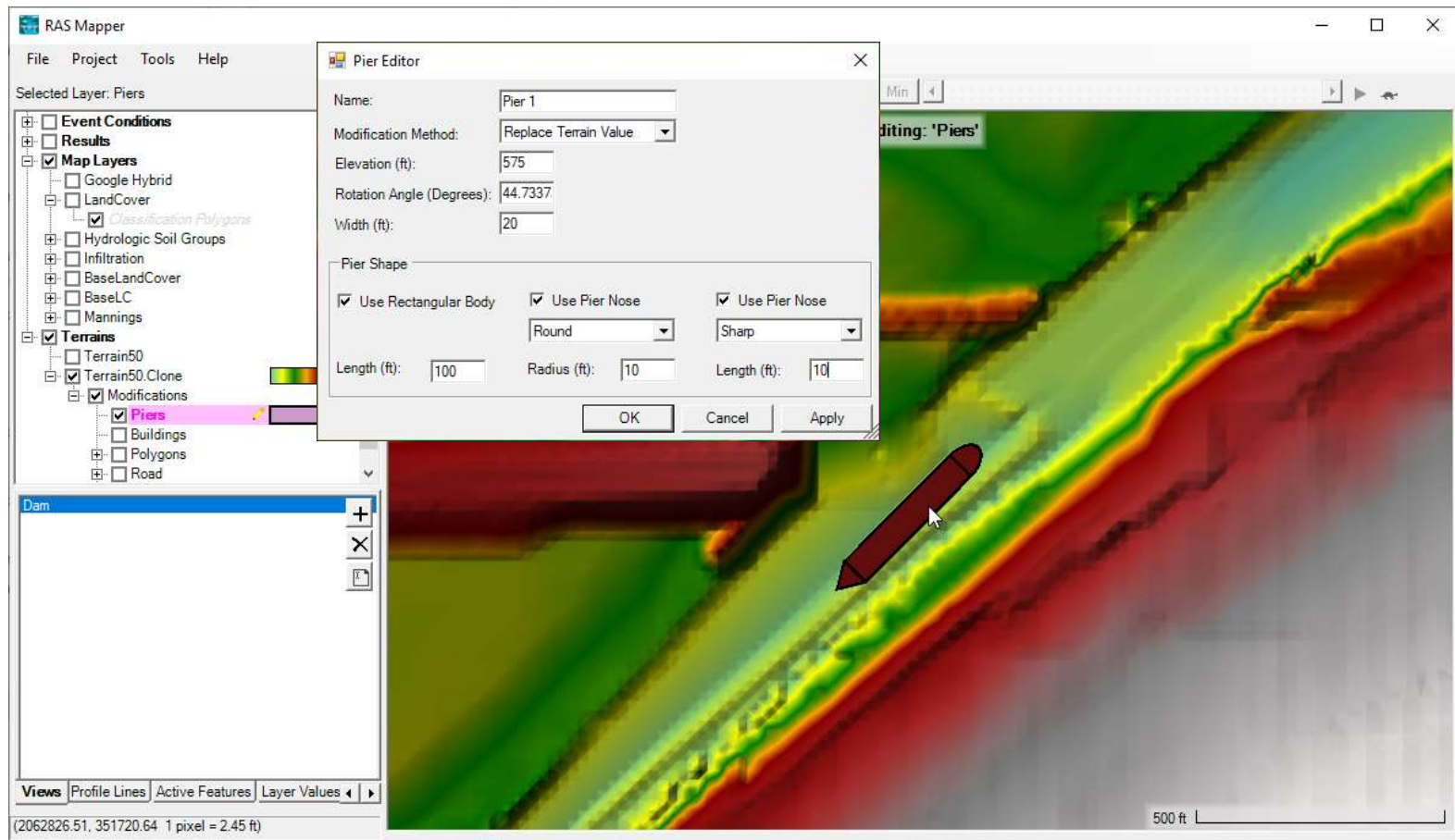
# Vector Terrain Modifications

- Vector Overrides to Terrain Layer
  - Simple Shapes (Piers), Lines (Channel, Roads, Levees), Polygons (Areas, Buildings)



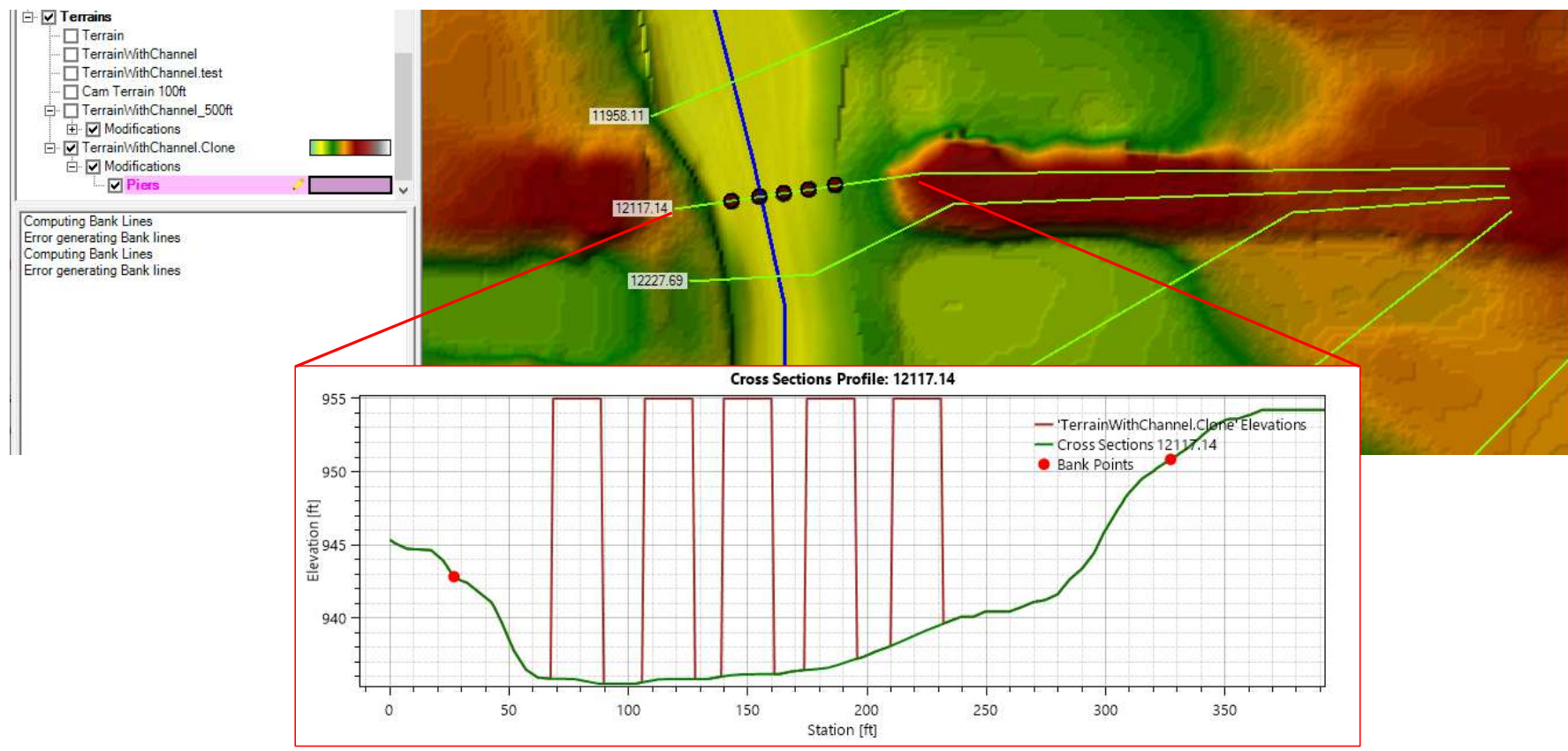


# Shapes - Piers





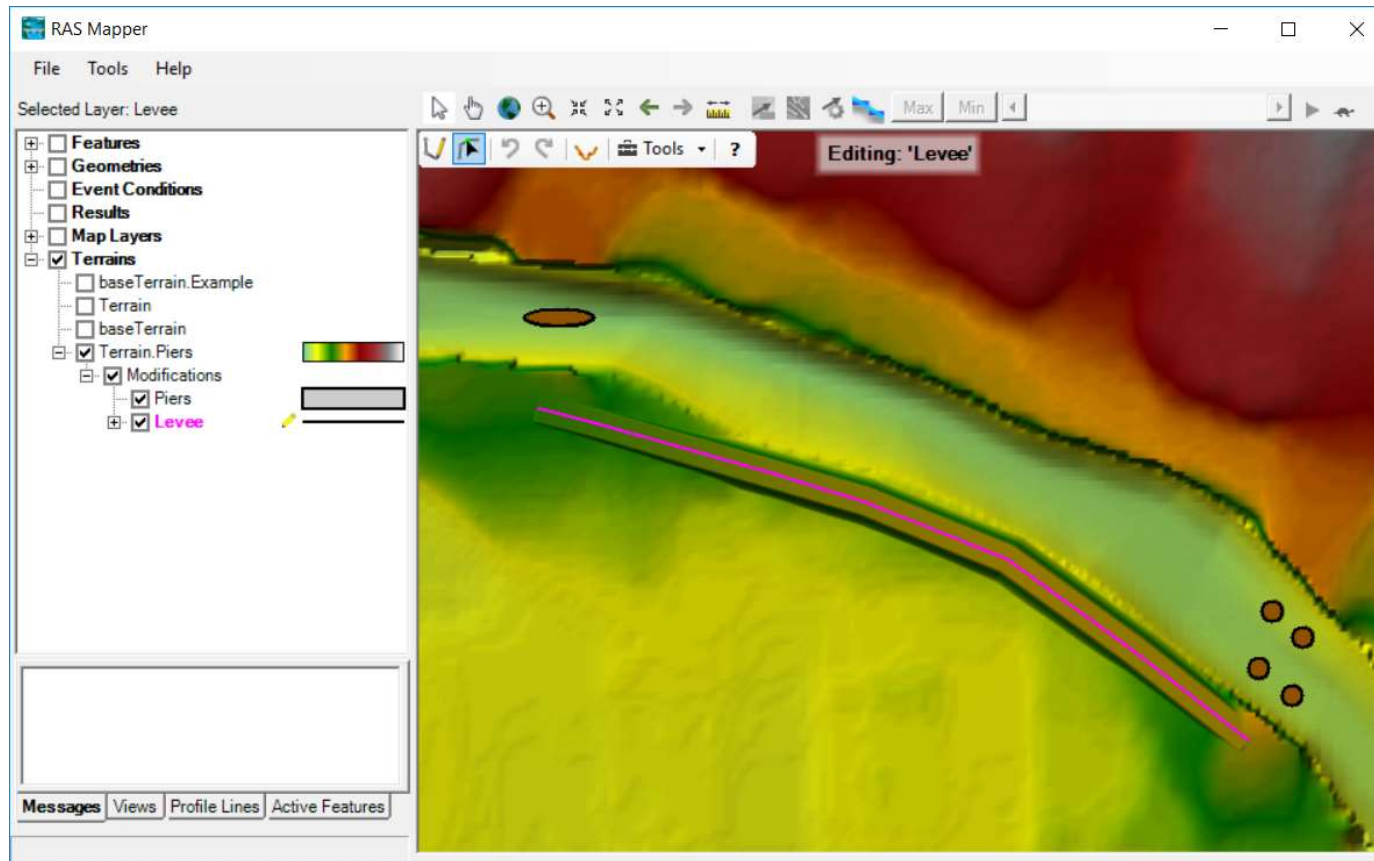
# Terrain Modifications







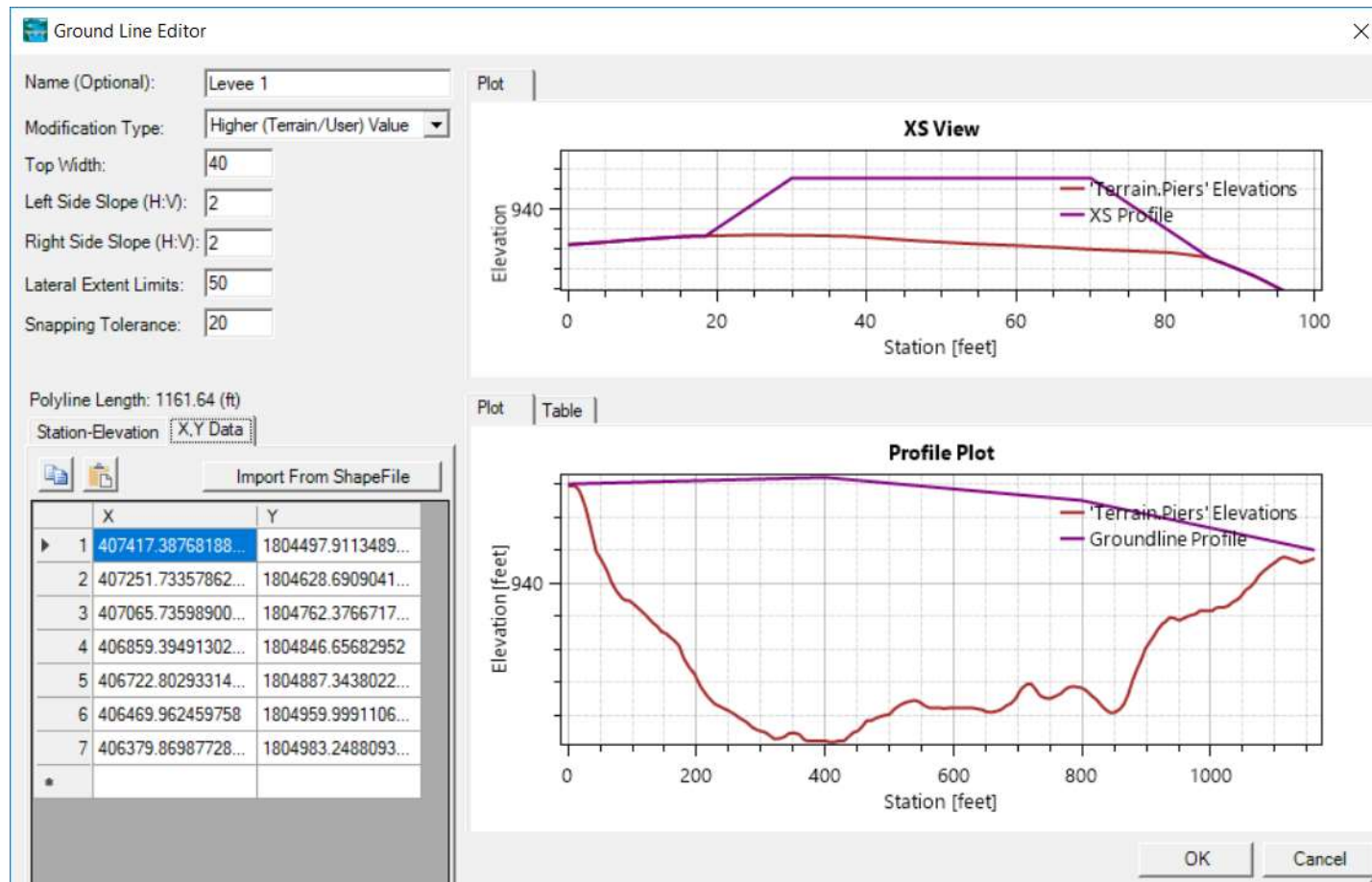
# Lines - High Ground





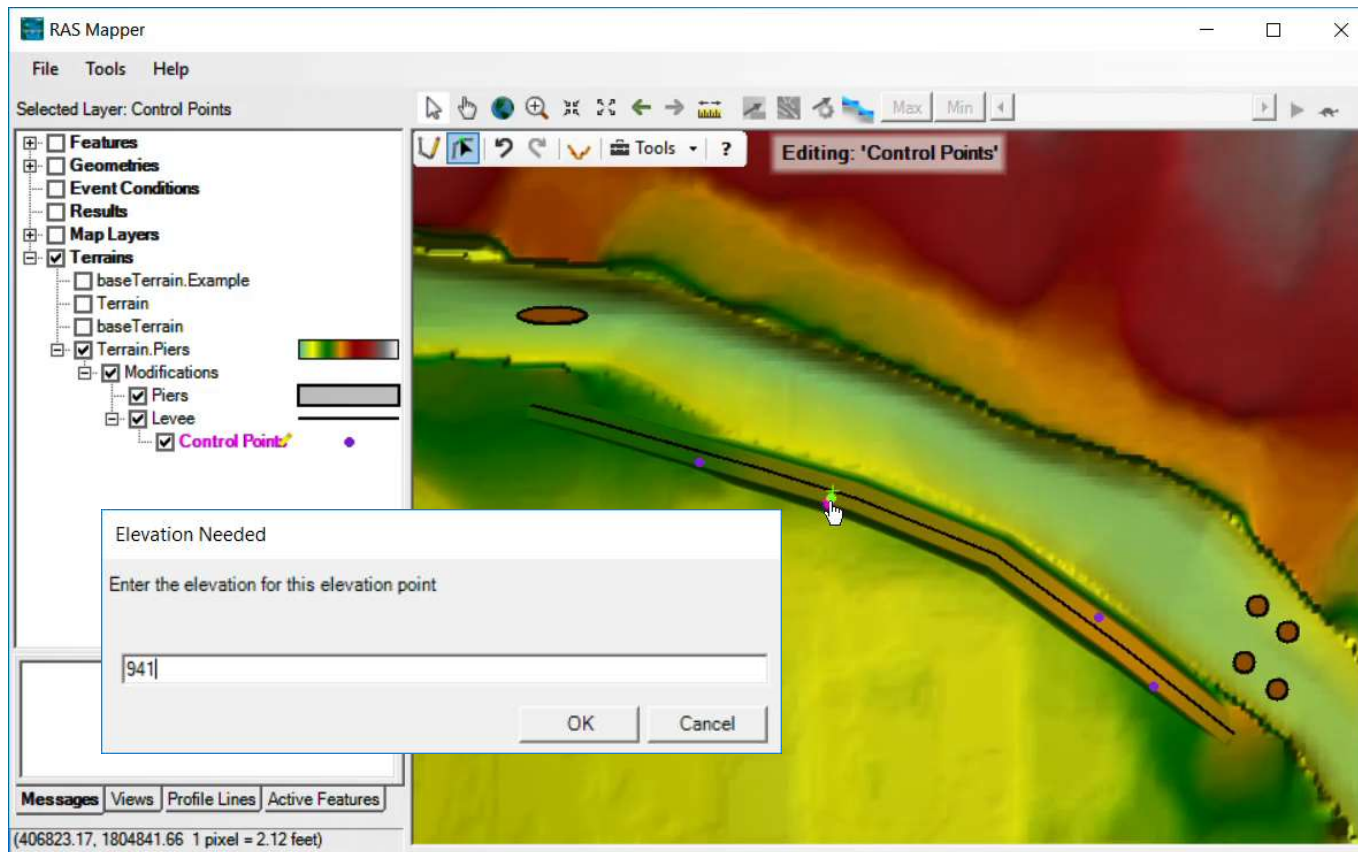


# Lines – High Ground





# Lines – Elevation Control Points

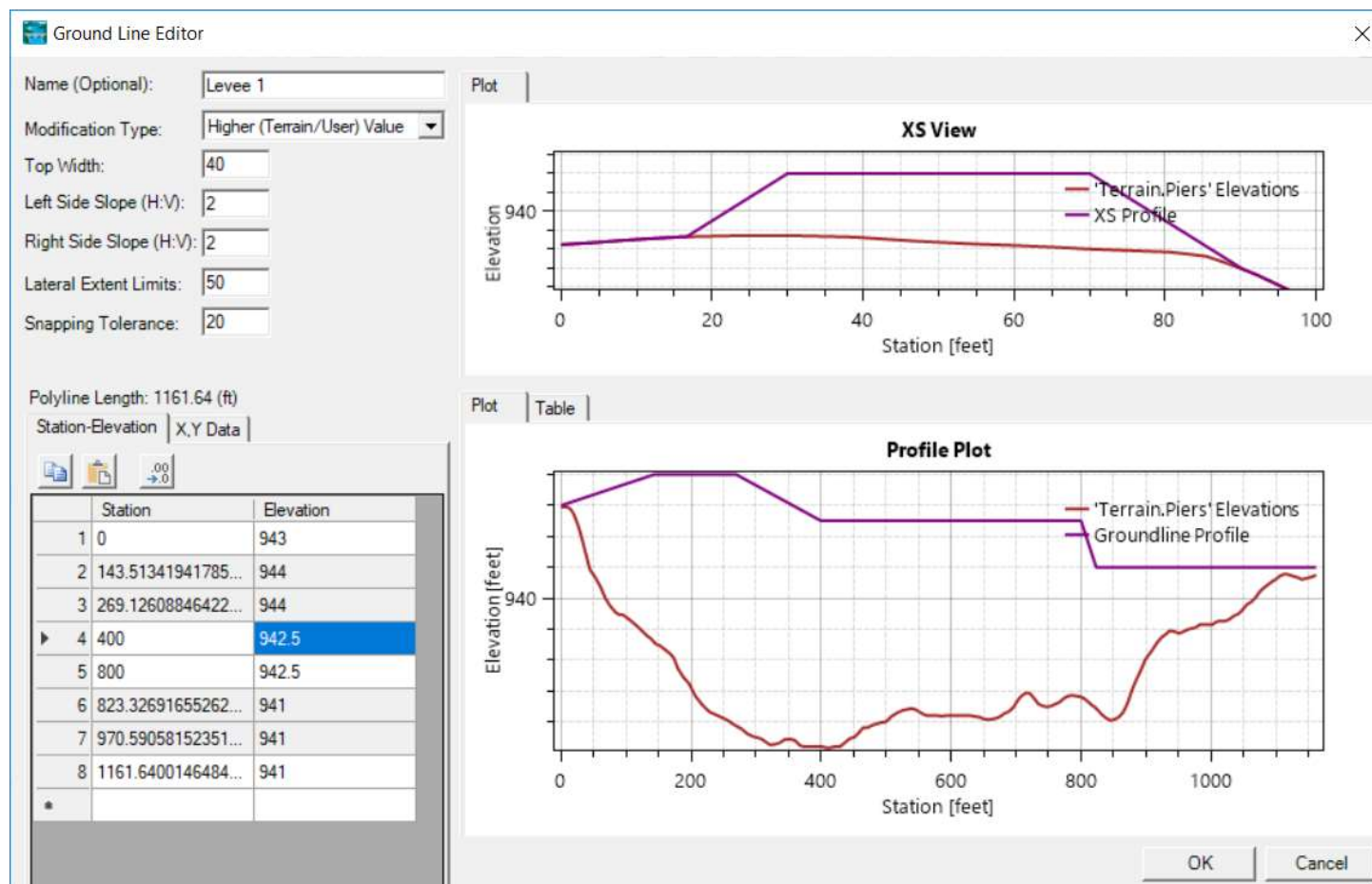




# Lines – Elevation Control Point

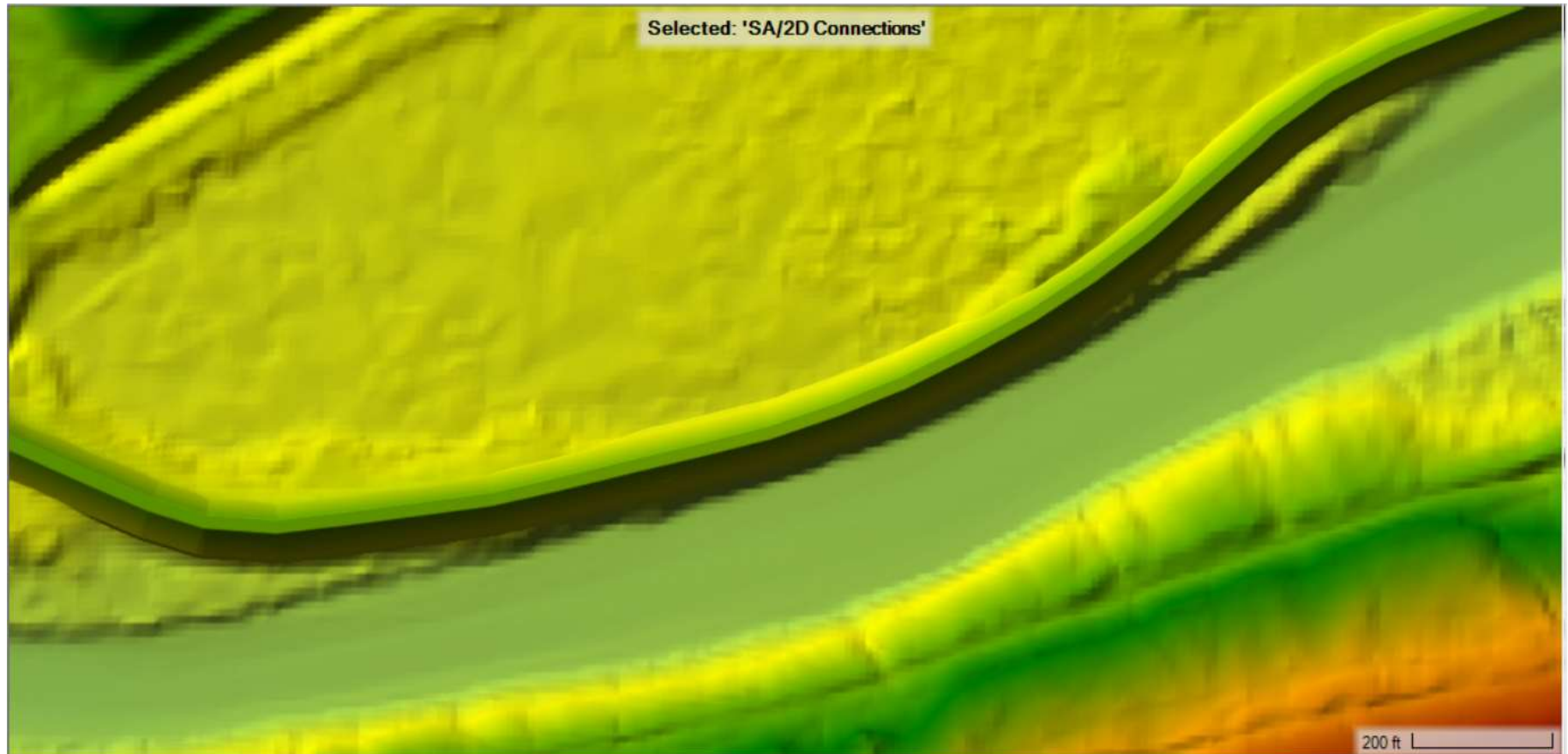


- Elevation control points shown in grey





# Lines, Levee Lines





# National Levee Database (NLD) Download Tool





# NLD - Example



←

National Levee Database

HOME

ADVANCED SEARCH

DASHBOARD

MAP

EXPLORE

MORE

SIGN IN

SYSTEMS

DETAILS

Start a new search

DOWNLOAD DATA

5 System(s) Found

Muncie Sanitary District - WPC facility

Location: Delaware , Indiana

Muncie North Central Levee System

Location: Delaware , Indiana

Muncie South Levee System

Location: Delaware , Indiana

Muncie Northeast Levee System

Location: Delaware , Indiana

Muncie Northwest Levee System

Location: Delaware , Indiana

HIDE LIST

Layer Controls

Tables (CSV)

Google Earth (ZIP)

Shapefile

GeoJSON

Full Tables (CSV)

Full Google Earth (ZIP)

Full Shapefile

Full GeoJSON





# NLD - Download

RAS Mapper

File Project Tools Help Debug

Select

- Set Projection...
- Add Web Imagery...
- Add Reference Layer...
- Download Data
  - USGS Terrain
  - GRiD Terrain
  - National Levee Database Features (NLD)
- Create New RAS Terrain...
- Create New Geometry...

Terrains

- Terrain
- WithChannel

[hillshade]

AOI  
TIN

Messages Views Profile Lines Active Features Layer

Download Levee Data from NLD

Import Extents

Extent Source: Current View

Product Query

Data Type: Levee Data Query Products

Available Data Products (4)

Filter: Apply Only Show

	Name	SystemID	Web
1	Muncie South Levee System	3905270004	<a href="#">Link</a>
2	Muncie North Central Levee System	3905270002	<a href="#">Link</a>
3	Muncie Northwest Levee System	3905270003	<a href="#">Link</a>
4	Muncie Northeast Levee System	3905270001	<a href="#">Link</a>

Add Selected Remove Selected Products for Download: 4 of 4 Estimated Download Size: Unknown

Adjustments

- Ensure Levee features have elevation data (from System Layer)
- Ensure Levee features are oriented with System Layer

Download Directory: ...Downloads\NLD

Open Folder After Download

Download Close



# NLD – All Data Features



RAS Mapper

File Project Tools Help Debug

Selected Layer: PumpStation

**Features**

- ☐ Profile Lines
- ☒ Geometries
- ☐ Plans
- ☐ Event Conditions
- ☐ Results
- ☒ Map Layers
  - ☐ Land Cover
  - ☐ LandCoverUSGSGrid
  - ☐ LandCoverCombined
  - ☐ Google Satellite
  - ☒ NLD
    - ☒ PumpStation
    - ☒ RAS Merged Alignments
    - ☐ System
    - ☒ LeveeArea
    - ☐ Borehole
    - ☐ ClosureStructure
    - ☐ CrossSection
    - ☐ Floodwall
    - ☒ GravityDrain
    - ☐ Centerline
    - ☐ LeveeCrossing
    - ☐ LeveeStation
    - ☐ Pipe
    - ☐ PipeGate
    - ☐ OtherAlignments

- ☒ Terrains
- ☐ Terrain
- ☒ WithChannel

[hillshade]

Selected: 'PumpStation'

AOI  
TIN

Messages Views Profile Lines Active Features Layer

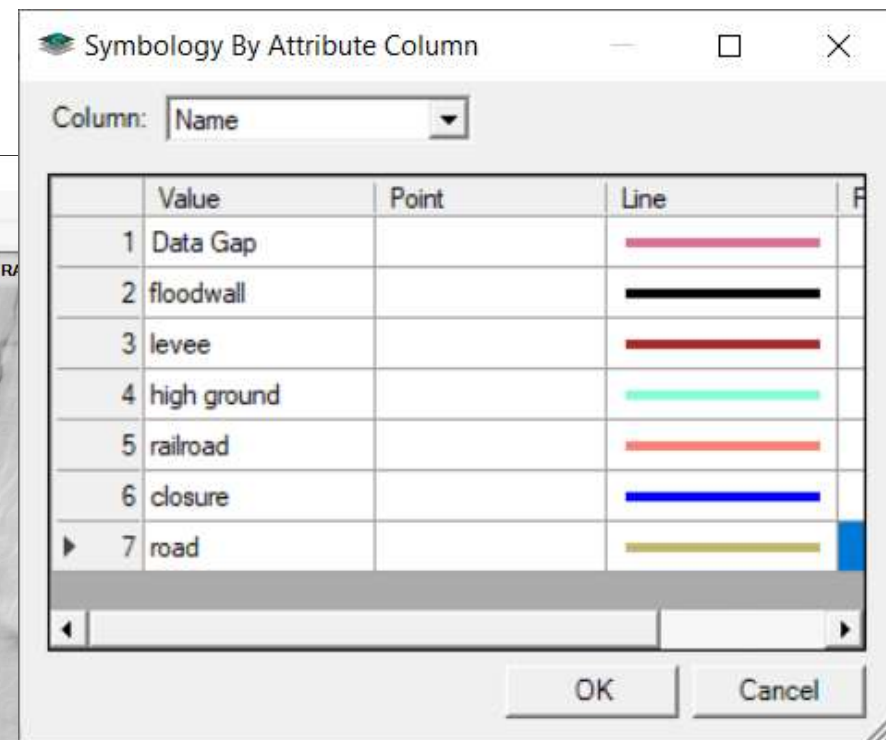
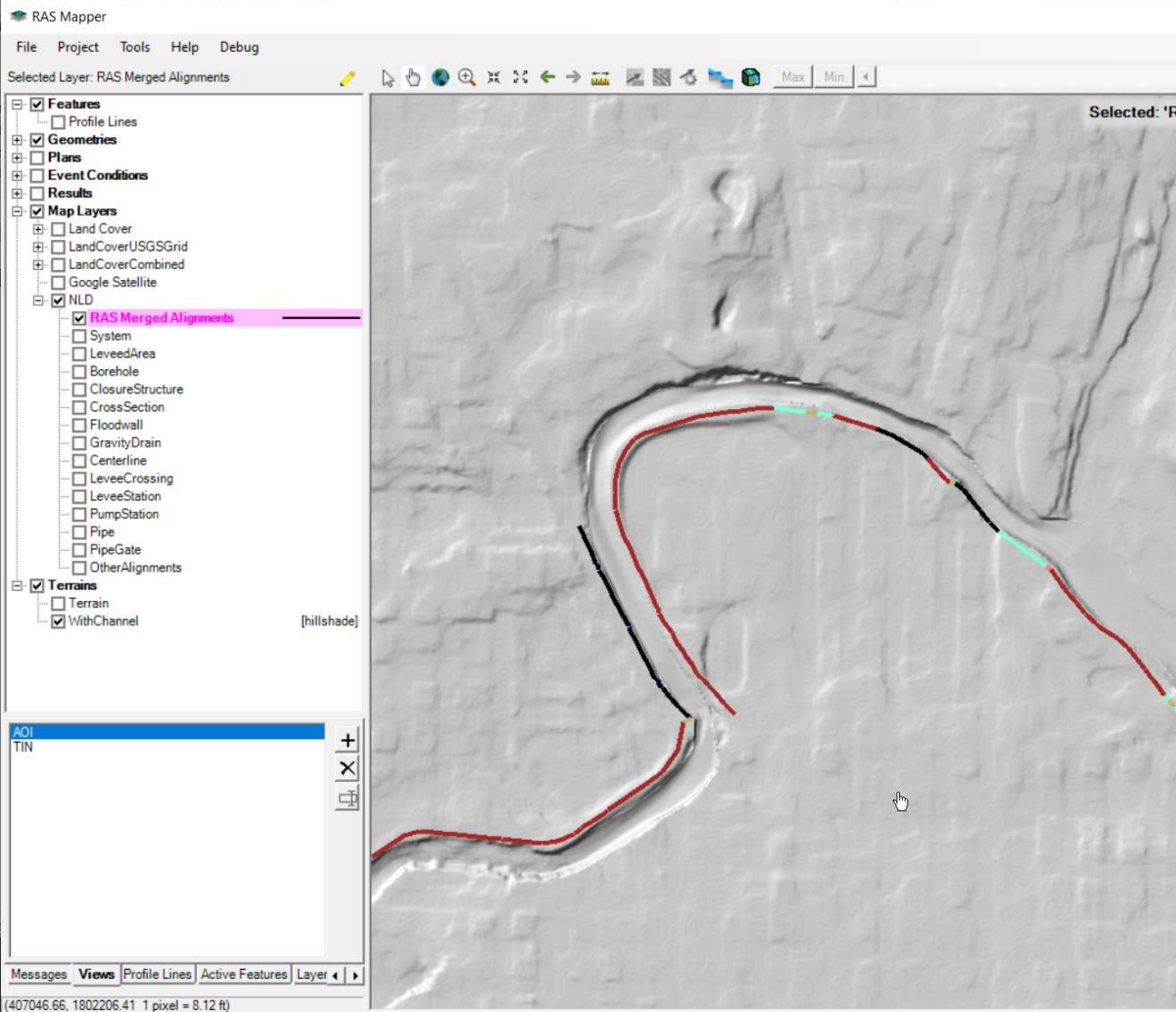
(403207.45, 1802774.58 1 pixel = 8.12 ft)

Name

- ☐ Borehole.geojson
- ☐ Centerline.geojson
- ☐ ClosureStructure.geojson
- ☐ CrossSection.geojson
- ☐ Floodwall.geojson
- ☐ GravityDrain.geojson
- ☐ LeveeCrossing.geojson
- ☐ LeveeArea.geojson
- ☐ LeveeStation.geojson
- ☐ OtherAlignments.geojson
- ☐ Pipe.geojson
- ☐ PipeGate.geojson
- ☐ PumpStation.geojson
- ☐ RAS Merged Alignments.dbf
- ☒ RAS Merged Alignments.prj
- ☐ RAS Merged Alignments.shp
- ☐ RAS Merged Alignments.shx
- ☐ System.geojson



# NLD – Merged Features







# Levee System Layer



	FID	SystemName	SystemID	Name	Width	Left Slope	Right Slope	
►	0	Muncie South Levee System	3905270004	Data Gap				
	1	Muncie South Levee System	3905270004	floodwall	1.8			
	2	Muncie South Levee System	3905270004	floodwall	1.8			
	3	Muncie South Levee System	3905270004	levee	9	3	3	
	4	Muncie South Levee System	3905270004	floodwall	1.5			
	5	Muncie South Levee System	3905270004	high ground				
	6	Muncie South Levee System	3905270004	levee	8	3	3	
	7	Muncie South Levee System	3905270004	high ground				
	8	Muncie South Levee System	3905270004	railroad				
	9	Muncie South Levee System	3905270004	floodwall				
	10	Muncie South Levee System	3905270004	floodwall	1.6			
	11	Muncie South Levee System	3905270004	closure				
	12	Muncie South Levee System	3905270004	floodwall	1.6			
	13	Muncie South Levee System	3905270004	levee	12	3	3	
	14	Muncie South Levee System	3905270004	floodwall	1.7			
	15	Muncie South Levee System	3905270004	levee	16	3	3	
	16	Muncie South Levee System	3905270004	high ground				



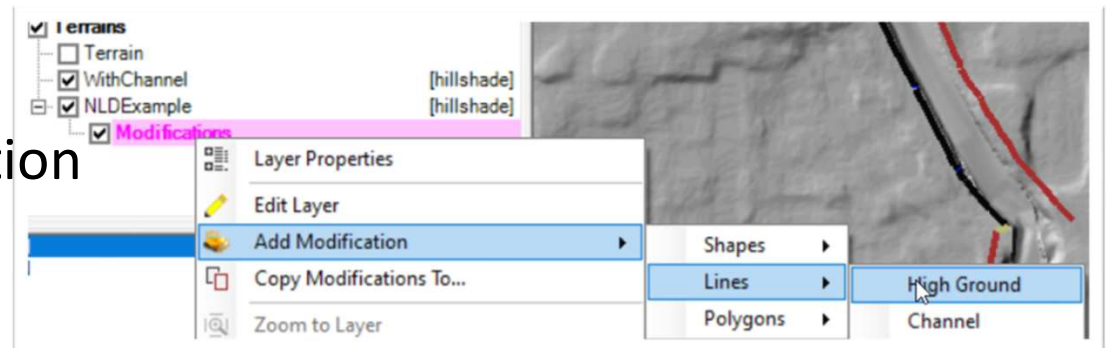
# Using NLD for Terrain Modification



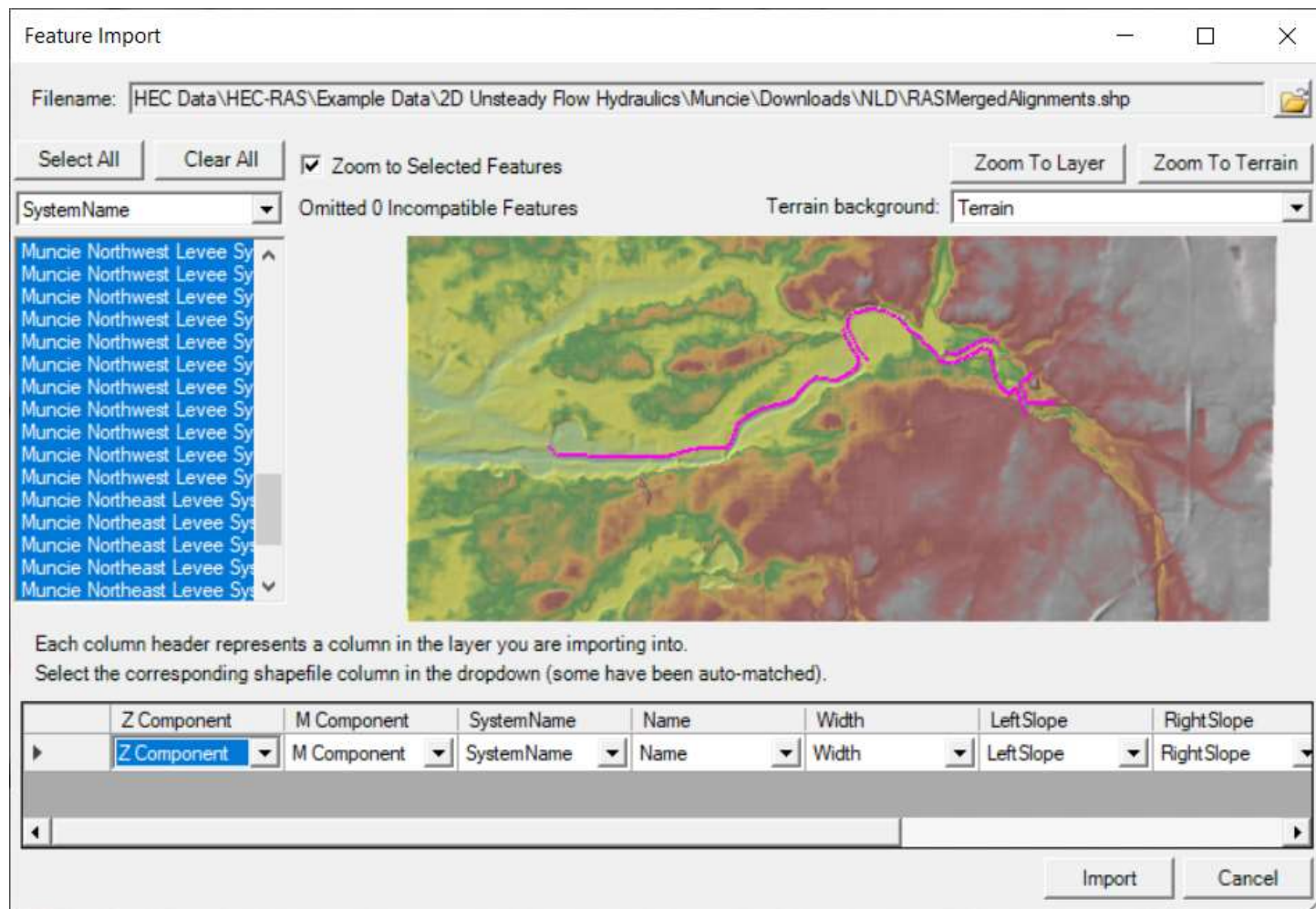
## 1. Clone Terrain



## 2. Add High Ground Modification



## 3. Import Features (Merged Layer) Right-click on modification group while in Edit mode







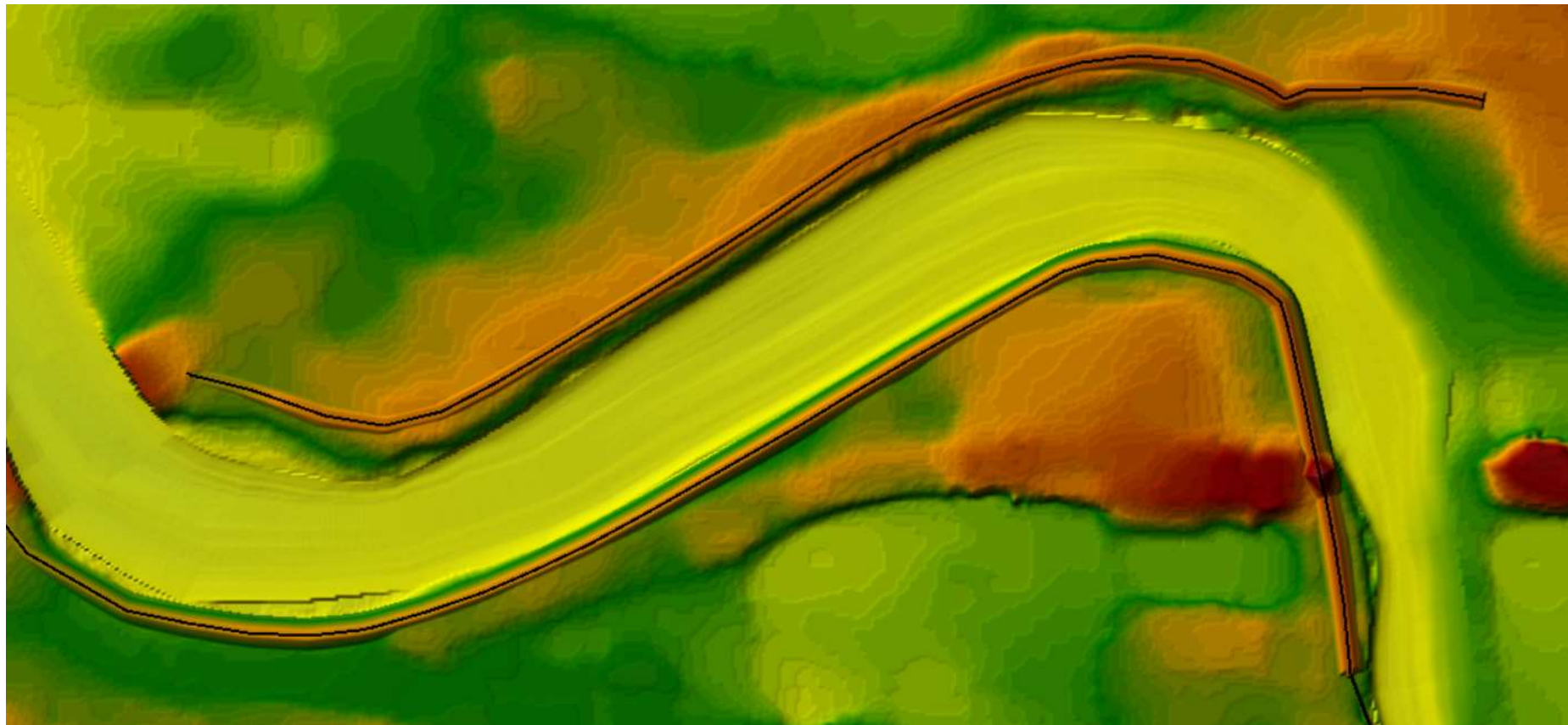
# High Ground Modification

FID	SystemName	Name	Elevation Type	Width	LeftSlope	RightSlope	Max Extent	Transition Percent	Elev Pt Tolerance	Computed System Name	Profile
0	Muncie South Levee System	Data Gap	TakeHigher					1	50	Muncie South Levee System	(2 Points)
1	Muncie South Levee System	floodwall	TakeHigher	1.8	0.1	0.1	7.2	1	50	Muncie South Levee System	(10 Points)
2	Muncie South Levee System	floodwall	TakeHigher	1.8	0.1	0.1	7.2	1	50	Muncie South Levee System	(4 Points)
3	Muncie South Levee System	levee	TakeHigher	9	3	3	36	1	50	Muncie South Levee System	(10 Points)
4	Muncie South Levee System	floodwall	TakeHigher	1.5	0.1	0.1	6	1	50	Muncie South Levee System	(7 Points)
5	Muncie South Levee System	high ground	TakeHigher					1	50	Muncie South Levee System	(2 Points)
6	Muncie South Levee System	levee	TakeHigher	8	3	3	32	1	50	Muncie South Levee System	(17 Points)
7	Muncie South Levee System	high ground	TakeHigher					1	50	Muncie South Levee System	(2 Points)
8	Muncie South Levee System	railroad	TakeHigher					1	50	Muncie South Levee System	(10 Points)
9	Muncie South Levee System	floodwall	TakeHigher	2	0.1	0.1	8	1	50	Muncie South Levee System	(3 Points)
10	Muncie South Levee System	floodwall	TakeHigher	1.6	0.1	0.1	6.4	1	50	Muncie South Levee System	(10 Points)
11	Muncie South Levee System	closure	TakeHigher	2	0.1	0.1	8	1	50	Muncie South Levee System	(2 Points)
12	Muncie South Levee System	floodwall	TakeHigher	1.6	0.1	0.1	6.4	1	50	Muncie South Levee System	(5 Points)
13	Muncie South Levee System	levee	TakeHigher	12	3	3	48	1	50	Muncie South Levee System	(15 Points)
14	Muncie South Levee System	floodwall	TakeHigher	1.7	0.1	0.1	6.8	1	50	Muncie South Levee System	(7 Points)

- Flood walls and closure structure defaults – 2ft width, 0.1 side slopes
- “Levee System” is computed – allows for continuous interpolation from segment to segment



# Modification Example





# High Ground Line Editor

Ground Line Editor

Name: levee

Modification Method: Higher (Terrain/User) Value

Top Width (ft): 16

Left Side Slope (H:V): 3

Right Side Slope (H:V): 3

Max Extent Width (ft): 64

Control Point Snapping Distance (ft): 50

Polyline Length: 3190.00 (ft)

Station-Elevation | X,Y Data

	Station	Elevation
1	0	948.43
2	0.93	948.47
3	3.70	949.04
4	3.70	949.04
5	130.65	949.18

☒ Update Terrain and Plots On Data Change

Plot

☐ Plot Terrain

**XS View**

Elevation [ft]

Station [ft]

XS Profile

**Profile Plot**

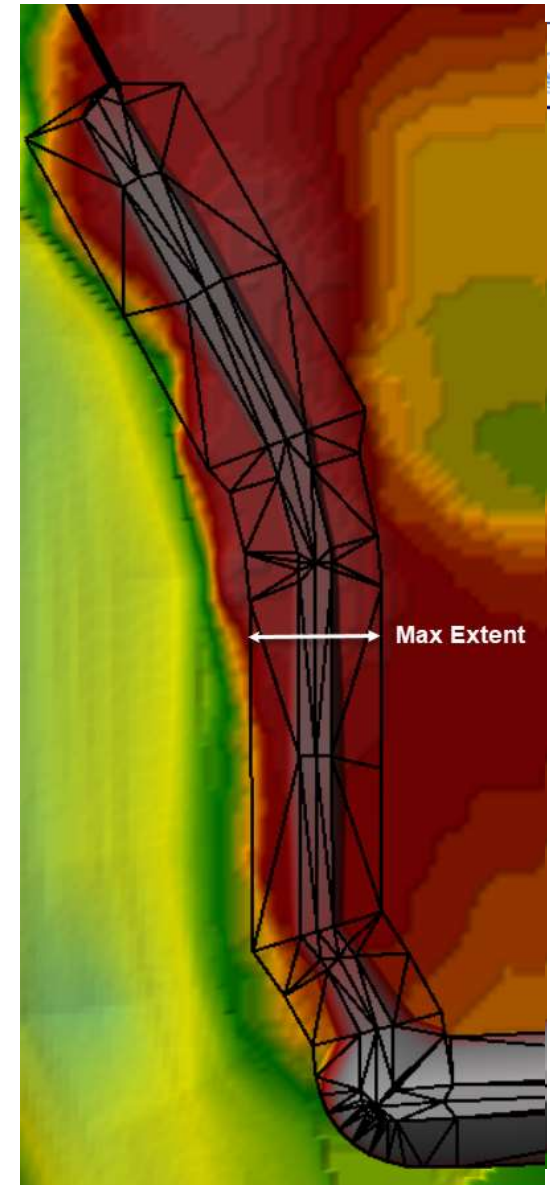
Elevation

Station [ft]

'NLDEExample' Elevations

Groundline Profile

OK Cancel







# Interpolation along Line Modification

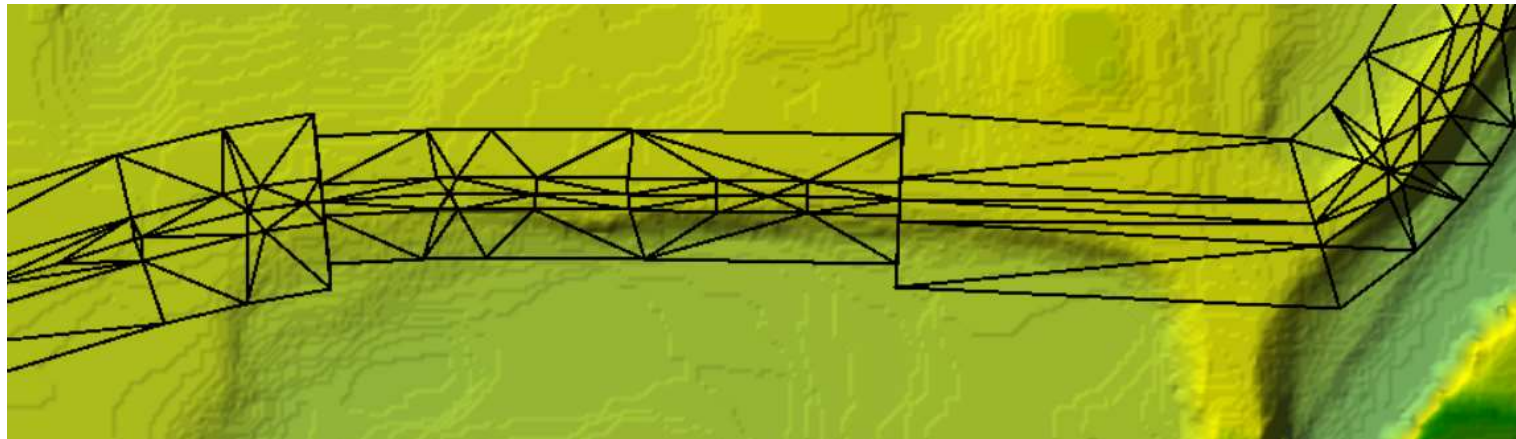




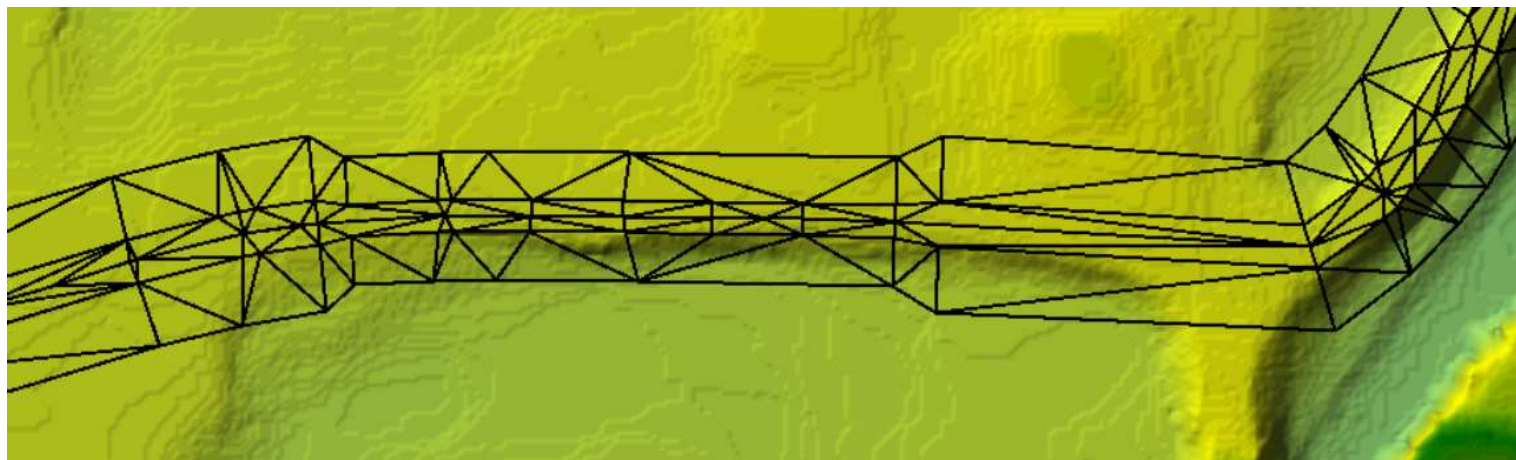
# Interpolation – Feature Transition



- None



- Some



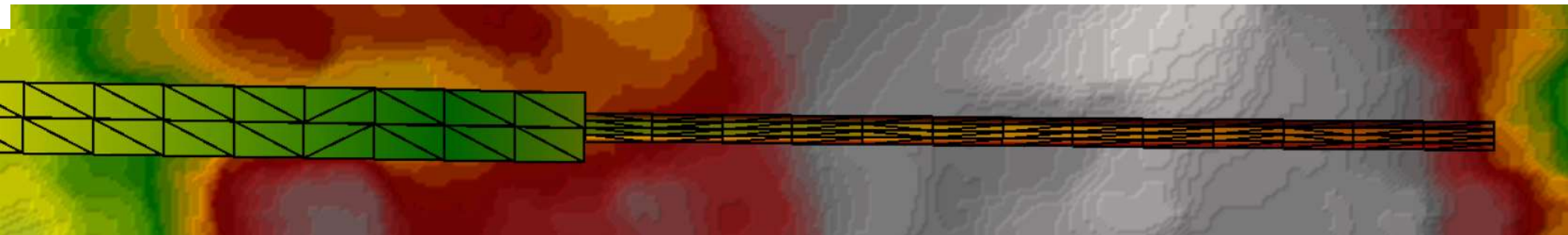




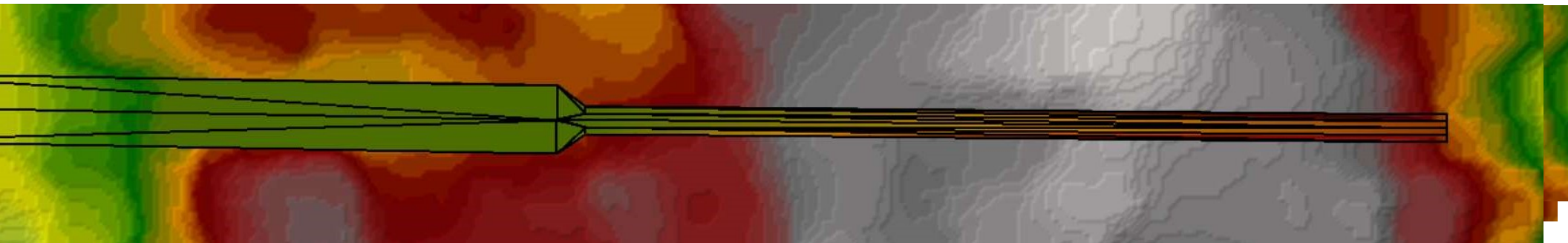
# Interpolation – System Name



FID	SystemName	Name	Elevation Type	Width	Left Slope	Right Slope	Max Extent	Transition Percent	Elev Pt Tolerance	Computed System Name
0		Channel 2	TakeLower	20	4	4	40	2	50	
1		Channel 3	TakeLower	100	4	4	100	0	50	



FID	SystemName	Name	Elevation Type	Width	Left Slope	Right Slope	Max Extent	Transition Percent	Elev Pt Tolerance	Computed System Name
0	fakeit	Channel 2	TakeLower	20	4	4	40	2	50	fakeit
1	fakeit	Channel 3	TakeLower	100	4	4	100	1	50	fakeit







# Terrain Modification – Focus Areas

- Triangulation
  - Fast
  - Reliable
  - Provide limited user controls
- Rendering
  - Fast
- Consideration for expansive use of new capability
  - Handle good people doing “bad” things 😊

# Questions?

