

A topographic map of Summit, Ohio, showing contour lines and a road network. A white arrow points from a specific location on the map towards the right, where the main text is located. The map is partially visible on the left side of the slide.

# Development of Landslide Susceptibility Map for the County of Summit, Ohio

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# Why Study Landslides?

- From USGS, landslides annually cause:
  - \$3.5 Billion in damages
  - 25 to 50 fatalities
- CoSE sought to "...develop a comprehensive and effective strategy for reducing risks, damage and losses from landslides and slope movements..."



# Scope of Work

- County of Summit Engineer's (CoSE) Scope of Work included:
  - Landslide Inventory with site information and associated Inventory Map
  - Graphical User Interface (GUI) to allow CoSE to update Inventory
  - Landslide Susceptibility Map
  - Landslide Risk Map





APR 26 2004



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A vertical strip on the left side of the slide shows a topographic map of a streambank. It features contour lines, a stream channel, and various symbols representing geological features or infrastructure.

# Landslides in County of Summit

- Principally two types of slides observed:
  - Rotational Slides
  - Translational Slides
- Streambank Erosion common triggering mechanism.





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# Susceptibility Factors

- Intuitively, multiple factors come to mind:
  - Slope
  - Aspect
  - Soil Type
  - Depth to Groundwater
  - Depth to Bedrock
  - Geomorphology of the Site
- Many early Maps identified areas of steep slopes and/or soil types as always having a high susceptibility.





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A vertical strip on the left side of the slide shows a topographic map with contour lines, a road, and a yellow line. The background of the slide is a dark teal color with light teal contour lines.

# Development of Susceptibility Map

- Combine available data in GIS database
- Use Inventory of known slides to calibrate model
- Rank based on probability factors



# Susceptibility Factors

## Factors Included

- Slope
- Aspect
- Problematic Soil Types
- Highly Erodible Soils
- Proximity to Streams

## Factors Not Included

- Depth to Bedrock
- Hydrology
- Surficial Geology
- Glacial Geology
- Depth to Groundwater



# Exclusion of Factors

- Care taken to balance factors that appear to influence stability, but may not.
- For example, many slides occurred in "Till, sand, silt, clay – variable" as identified in the Surficial Materials Map. Yet, large areas of the same material did not have slides, and only the areas with steep slopes were prone to slides – so the import factor is slope, not surficial material.





# Inventory Findings

- No slides with an average slope above 30 degrees. We concluded this is because the slope is either a rock outcrop, or a rock mass with a thin veneer or soil probably held in-place by vegetation.
- Northeast and West facing slopes were prone to have slides at flatter slopes and/or with more competent materials than other slopes.



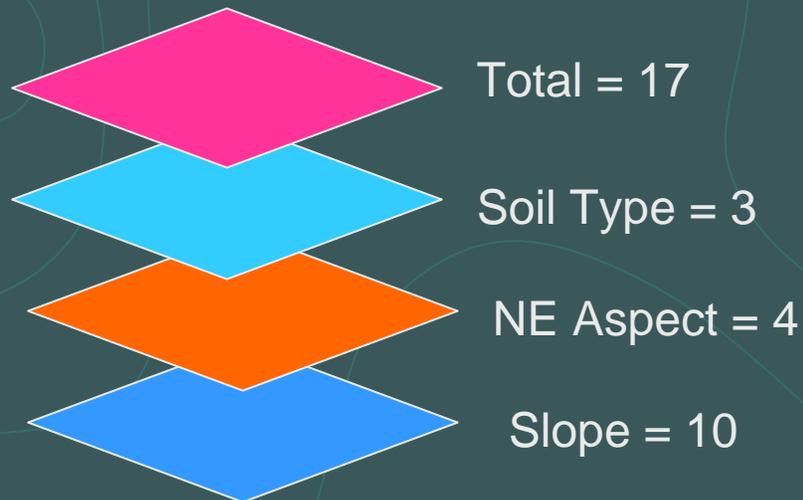
# Process

- Process is iterative – based on generating a ranking system, applying the model, and then adjusting the scores to refine the Map.



# How GIS Builds the Map

- GIS Constructs a series of polygons for each attribute and assigns the given value. Then the polygons are summed for the Total Score.

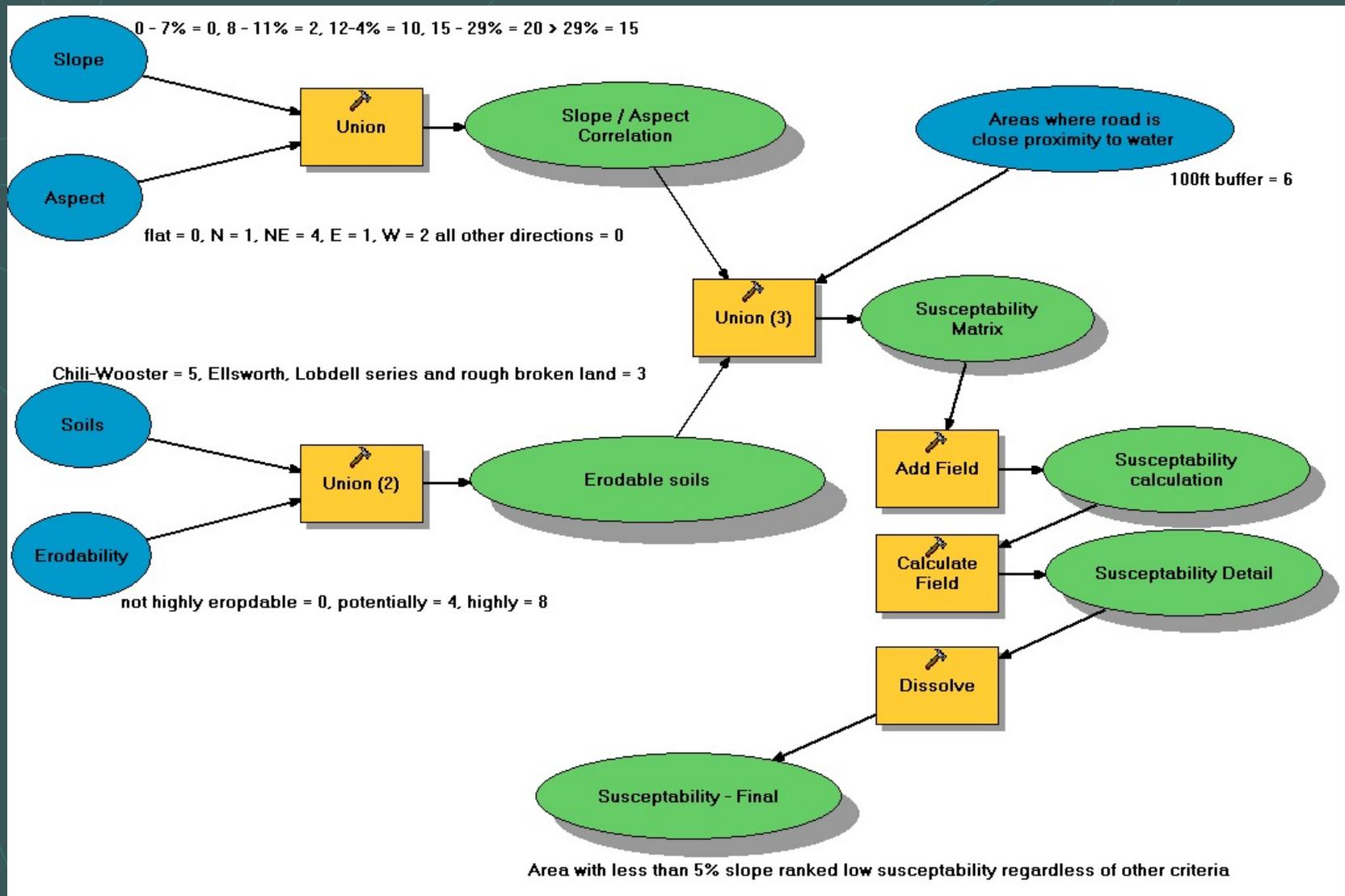


# Final Rankings

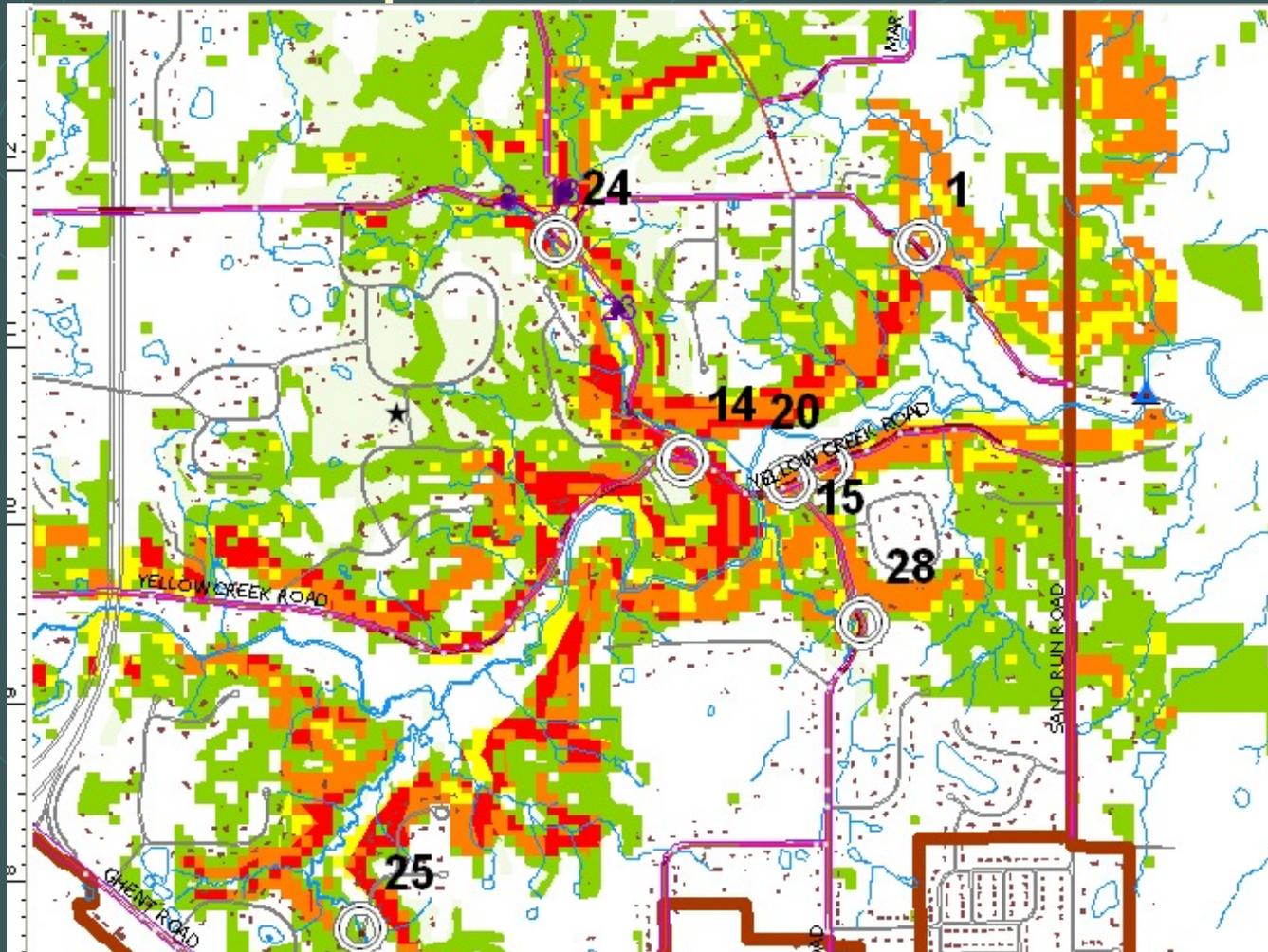
Category	Total Score
Very Low	0-5
Low	6-15
Moderate	16-22
High	23-30
Very High	31+



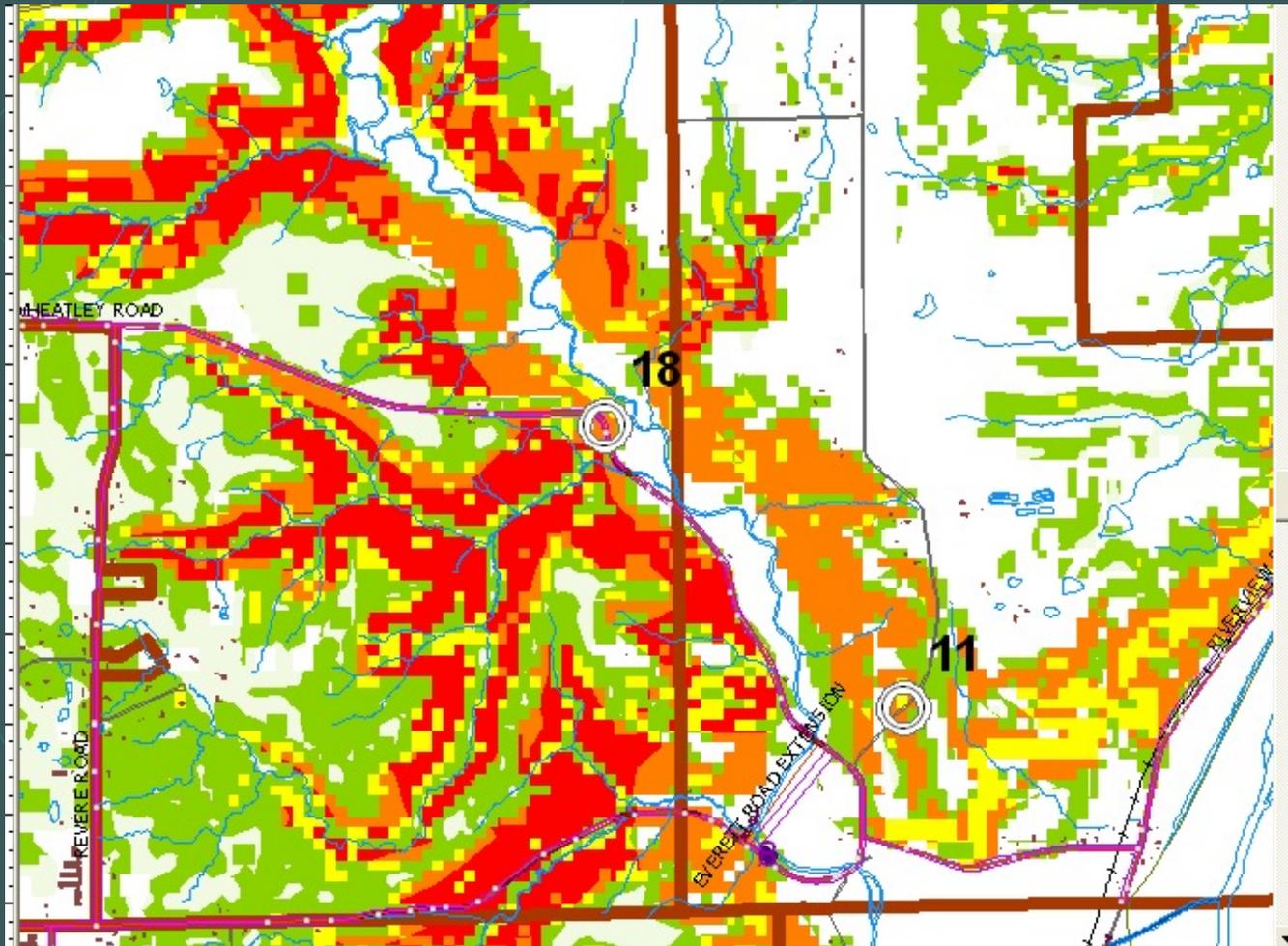
# Analysis Model



# Bath Township Sites

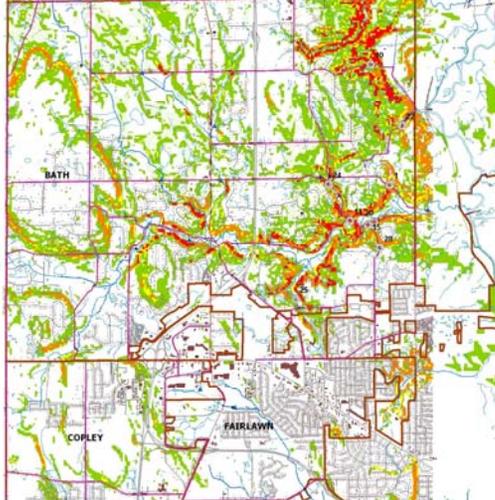
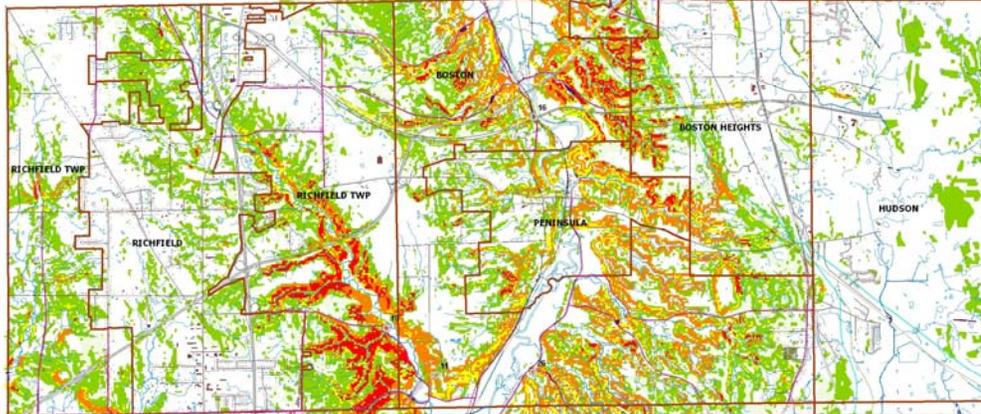
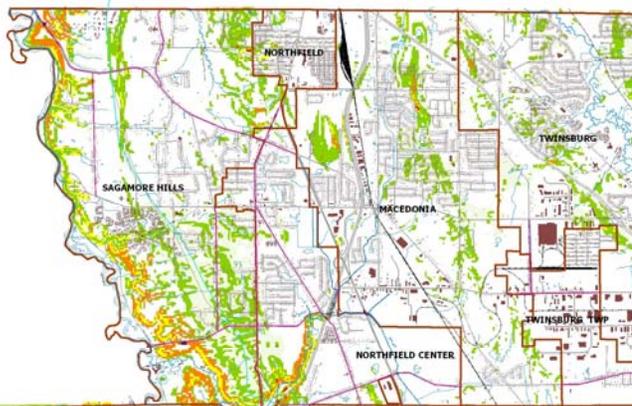


# Revere Road



# Final Map

- Legend**
- Remediated Landslides
  - Bridges
  - Culverts
  - ★ Stream Gages
  - Hydrology
  - County Highways
  - Ditches
  - Guard Rails
  - Right of way
  - Jurisdictional Boundaries
  - Landslides
- Landslide Susceptibility**
- Very Low Susceptibility
  - Low
  - Moderate
  - High
  - Very High Susceptibility



**Summit County  
Landslide Study  
Susceptibility Map**

1:21000

0 3,550 7,100 14,200 Feet

Map Scale: 1:21,000  
Map Date: 2008  
Map Projection: NAD 83 UTM Zone 18N  
Map Datum: NAD 83  
Map Units: Feet

Map prepared by:  
Gannett Fleming  
GEODECISIONS  
SUMMIT COUNTY  
OHIO



# Conclusion

- Identification of High Susceptibility areas can result in new Building Code and Zoning requirements to mitigate.
- Can provide mitigation in high risk areas to avoid road closures.
- Cost of mapping comparable to remediation cost at one site.
- Database allows for monitoring of low priority sites and input of new sites.

