

Geotechnical Asset Management (GAM) – WisDOT Initial Efforts

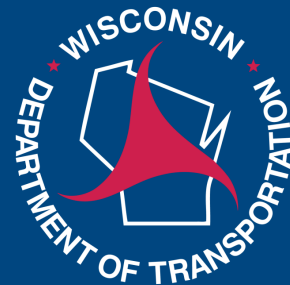
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Geotechnical Unit Supervisor

WisDOT Bureau of Technical Services

TRB Annual Meeting – Washington, DC

January 9, 2023



Outline

- Wisconsin Highway Research Program (WHRP)
- Project G21-06 Overview
- Next Steps



WHRP Project G21-06 – Geotechnical Asset Management (GAM) for Slopes

- Wisconsin Highway Research Program (WHRP)
- Develop GIS-based Geotechnical Asset Management (GAM) for Slopes framework to categorize slope failure risk potential along STH 35 segment (Crawford County)
- GAM-Slopes framework expandable elsewhere (with appropriate local adjustments)
- Potentially use to prioritize and plan future projects and maintenance

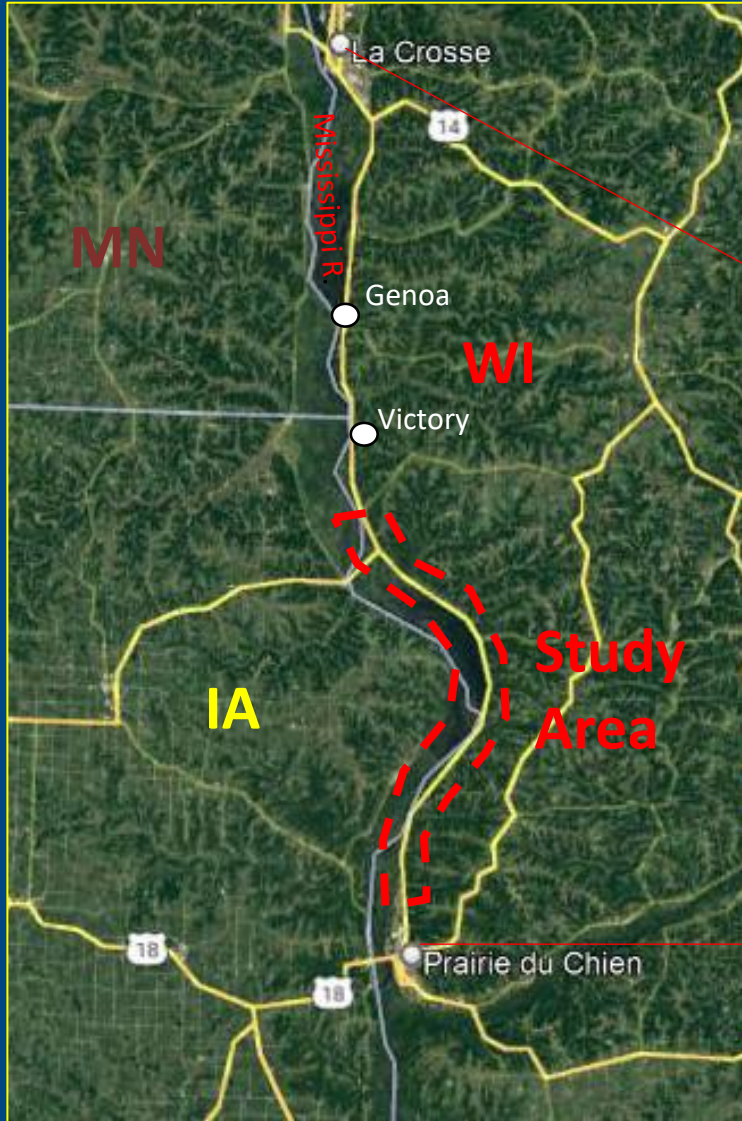


WHRP Project G21-06 – Geotechnical Asset Management (GAM) for Slopes

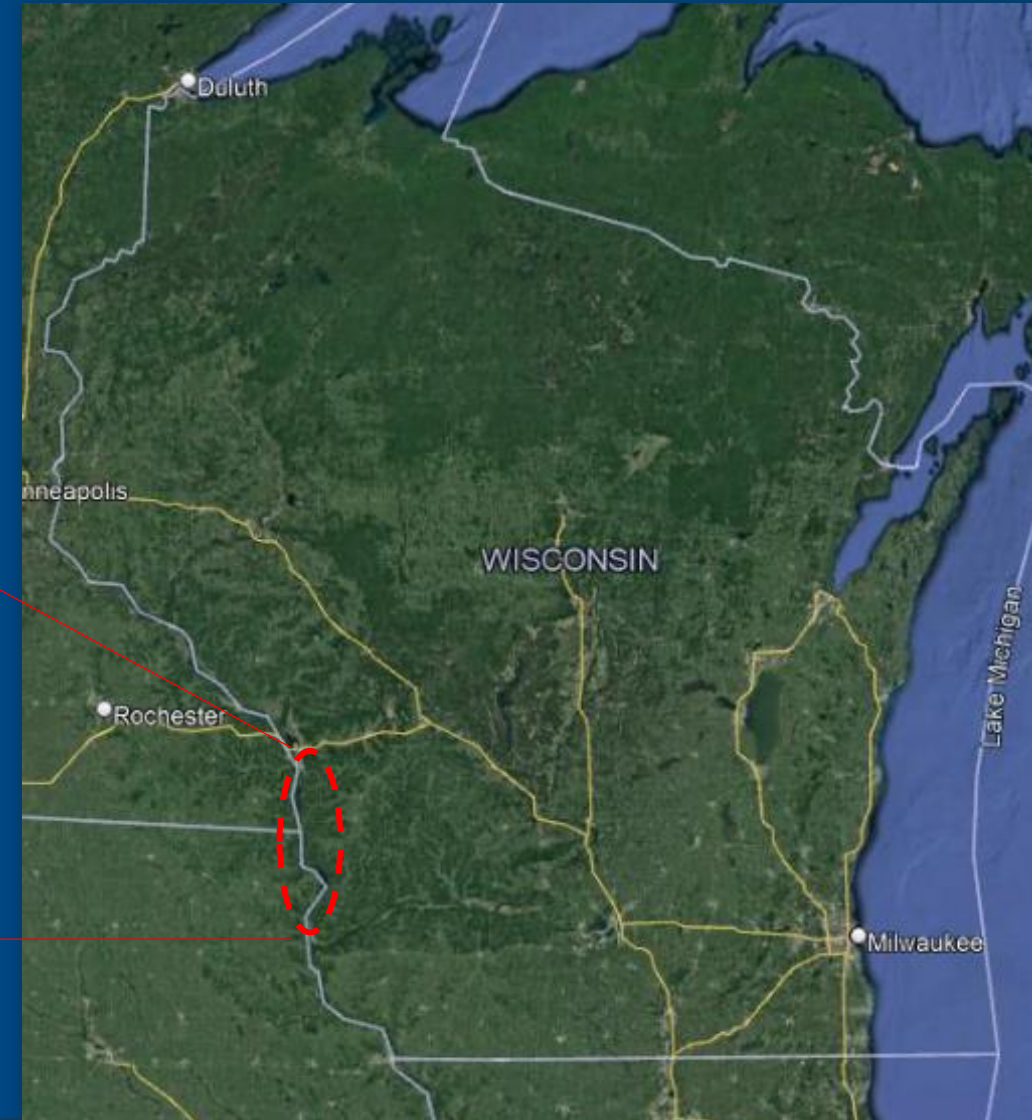
- 11 research team proposals submitted
- BGC Engineering, Inc. The logo for BGC Engineering, Inc. consists of the letters 'BGC' in a bold, purple, sans-serif font. The letters are contained within a white rectangular box that has three vertical purple lines on the left side, creating a stylized 'B'.
- Schedule: 2 years (Oct. 2020 – Sept. 2022)
- Budget: \$150,000



STH 35 – Crawford County

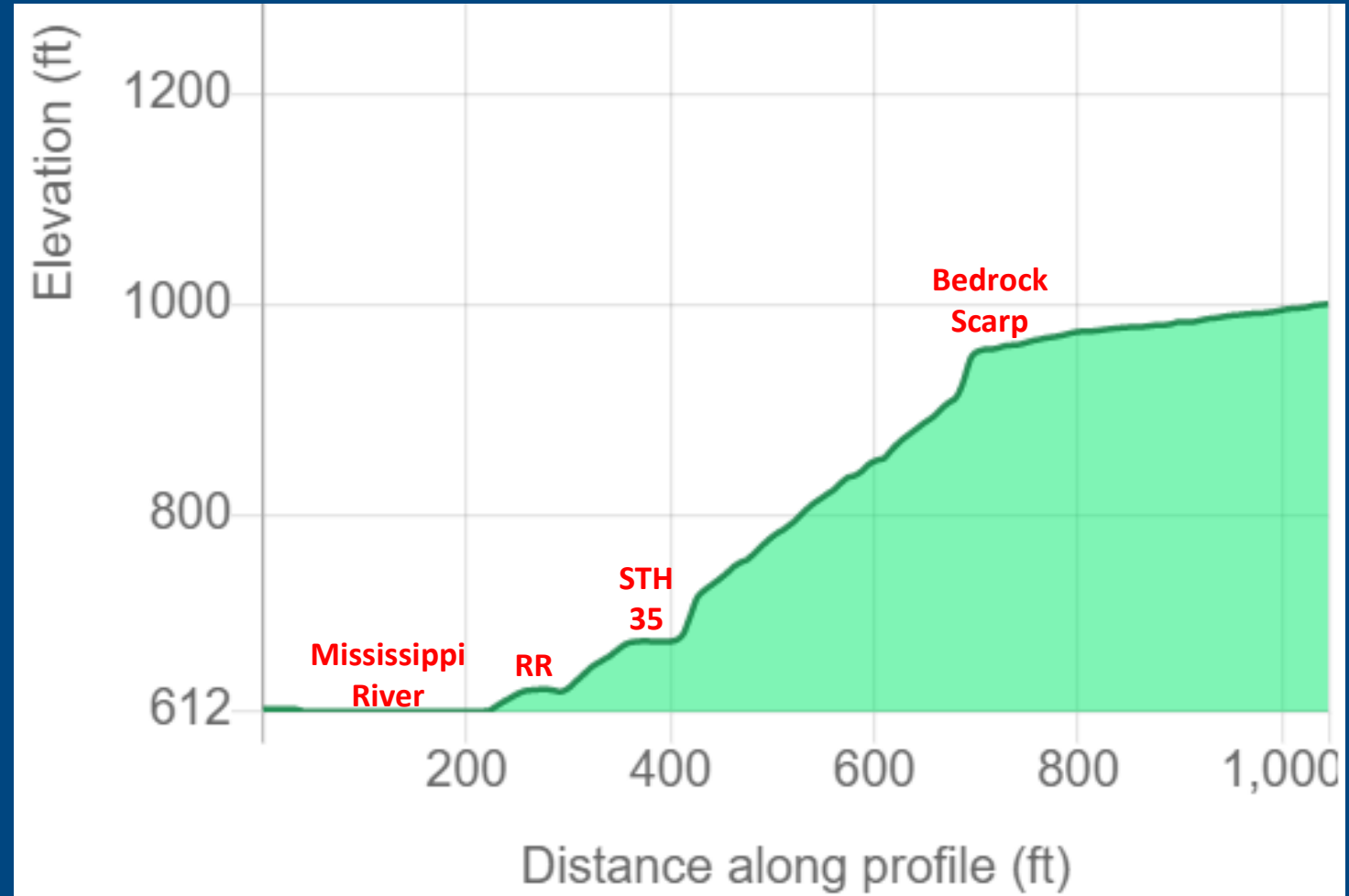
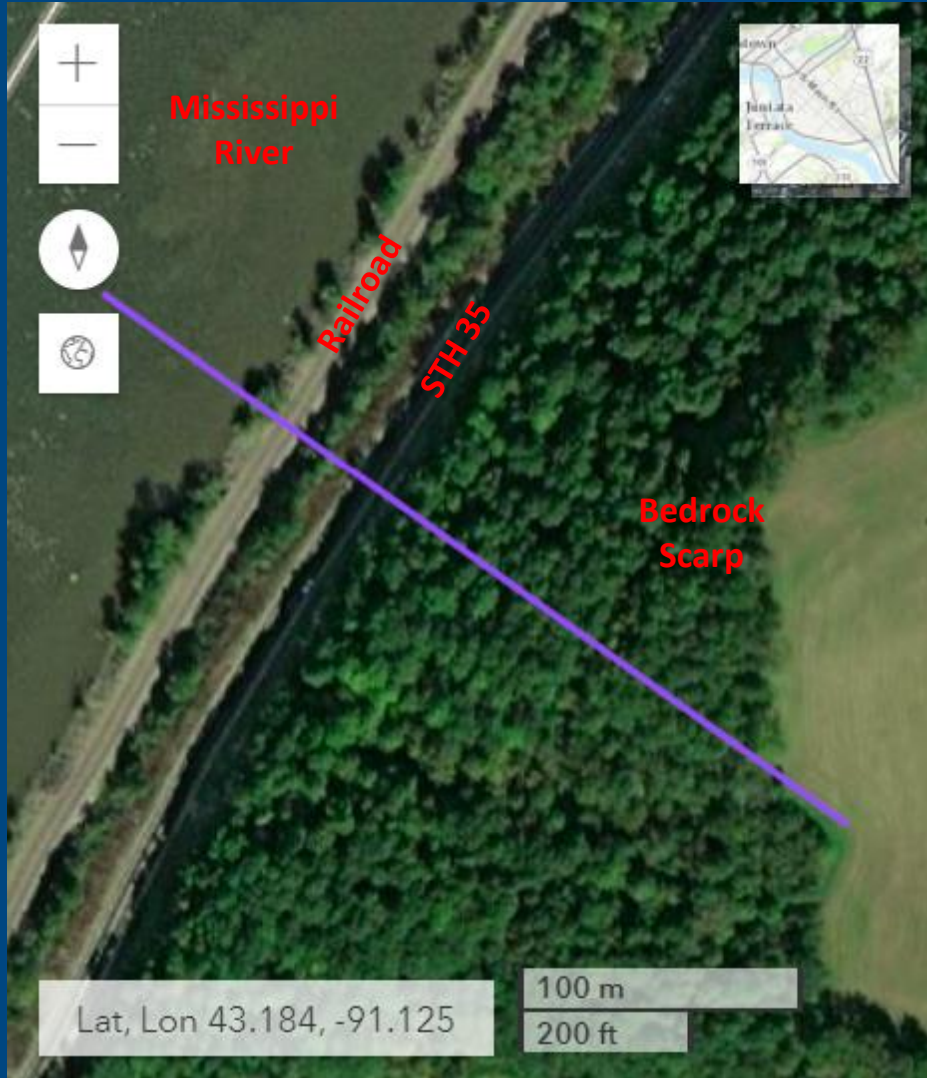


Study area ~30 miles



Sources: Google Earth; wigrr.com

STH 35 – Generalized Cross Section



Source: Cambio™



STH 35 - Geology

Prairie du Chien
Group
(dolomite)

Jordan Formation
(sandstone) and
colluvium

St Lawrence Formation
(siltstone), Tunnel City
Group (silty sandstone)
and colluvium

Geologic
Description

Observed Failure
Mechanisms

Primarily medium-
to thick-bedded
dolomite

Planar, wedge, or
toppling

Fine- to coarse-
grained sandstone

Wedge or toppling

Siltstone to silty
dolomite

Planar, wedge and
raveling

Silty, shaley,
glaucconitic
sandstone

Sliding, raveling
and undercutting



STH 35 – Typical Slide Event



STH 35 – Field Reconnaissance



STH 35 – Slope Hazards Identified



Rockfall sourced from the upper colluvium (typically dislodged boulders that are $>1\text{yd}^3$)



Fragmental rockfall and rockslides sourced from the Jordan Sandstone



Shallow colluvial slides in the upper colluvium and lower colluvium/Lone Rock Formation

GIS-Based Model

Cambio™ Geohazard Management System

- Web-based GIS platform – spatial database for documenting geohazards and asset management
- Originally developed for pipeline and railway geohazard management
- Readily adapted to other linear infrastructure (e.g., highways)
- Customizable for different available data (e.g., LiDAR, USGS bedrock geology maps, precipitation data, pavement condition data, culvert proximity, event history, field mapping, etc.)



Cambio™ for WisDOT

The screenshot displays the Cambio™ for WisDOT interface. On the left, a map shows a highway segment highlighted in yellow and green. A legend titled 'Highway' lists 'Scores Segments' (A-F) and 'Events'. Below the map is a table with columns: Segment ID, Route, Region, County, Milepoint, Risk Grade, No. Events, No. GeoAssets, No. Non-GeoAssets, and Description. The first row is highlighted in blue, with the 'No. Events' cell circled in red. On the right, the 'Event View' for segment 35-7273 is shown, with 'Segment Information' and 'Event Information' sections. The 'Event Information' section includes fields for Start milepoint, End milepoint, Event type (Rockfall), Date (May 11, 2020), Closure time, Length road affected, Accident type, and Damage. A 'List of Events' table is also visible, with the first row circled in red. A red dashed box highlights the 'Event View' header and the 'Event Information' section. A red line connects the circled 'Event' in the 'List of Events' table to the 'Event View' window.

Segment ID	Route	Region	County	Milepoint	Risk Grade	No. Events	No. GeoAssets	No. Non-GeoAssets	Description
35-7273	35			72.73		3	3	0	
35-7543	35			75.43		2	3	1	

Date	Event
2020-05-11	9
2021-03-18	6
2021-03-18	6

Segment Information	Event Information
Segment ID: 35-7273	Start milepoint: 72.82
Route: 35	End milepoint: 72.86
Region: Region	Event type: Rockfall
County: County	Date: May 11, 2020
Milepoint: 72.73	Closure time (full): 0.5
Description: Description	Closure time (partial): 1
Risk grade: Risk grade	Length road affected: 33
	Cost to respond: Cost to respond
	Accident: Accident
	Damage: Approximately 70 ft of barrier wal
	Notes: The event was reported from a database provided to BGC from WisDOT (WisDOT Site 8). The event is coincident to site MP 72.8 Cut Slope Rockfall and Slide and was visited during the April 2021 BGC

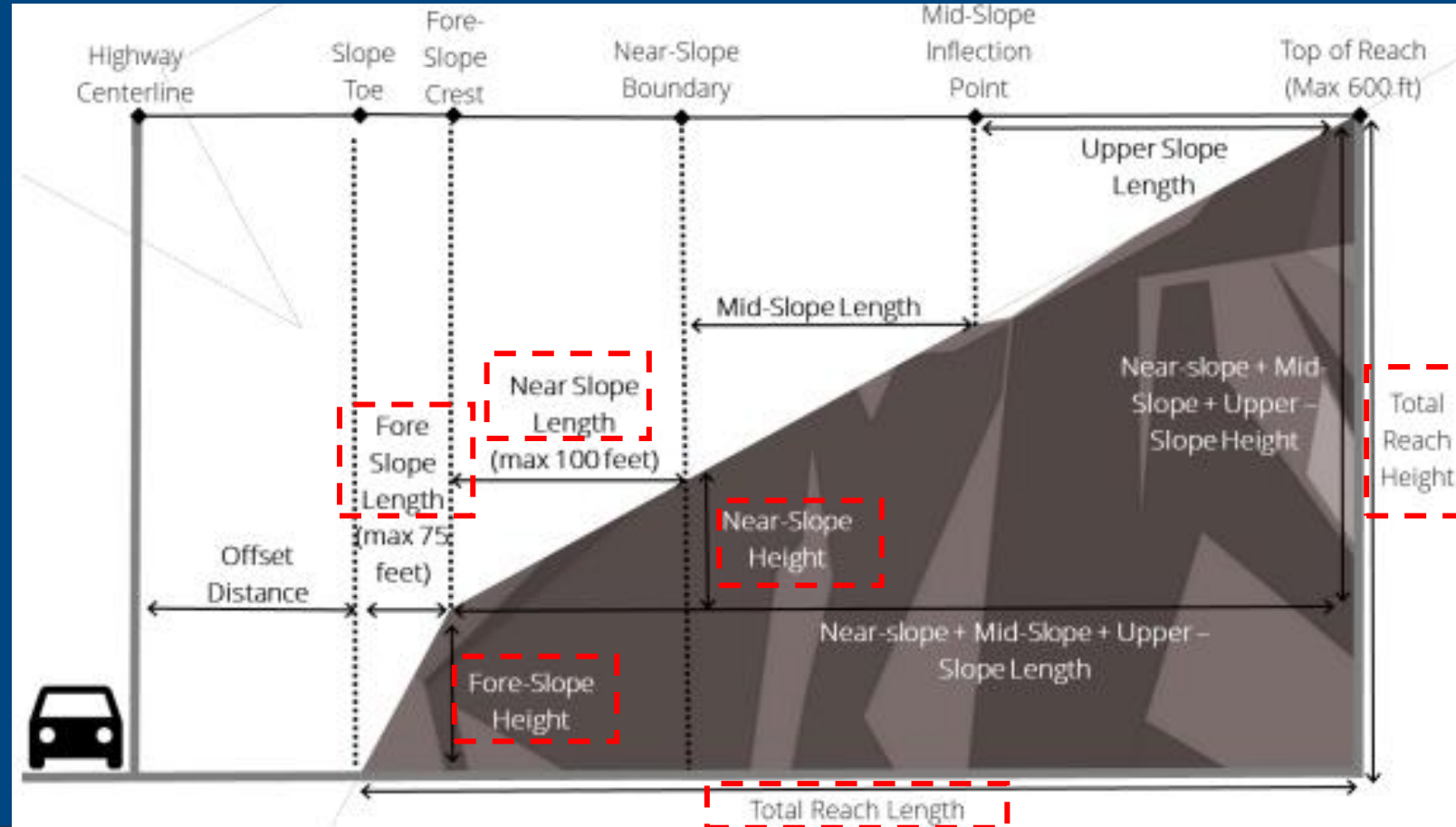


Susceptibility Model



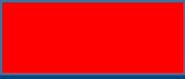
Current Model Inputs (Up-Slope Hazards)

- Fore-slope height & angle
- Near-slope angle
- Total slope angle
- Cut slope geology

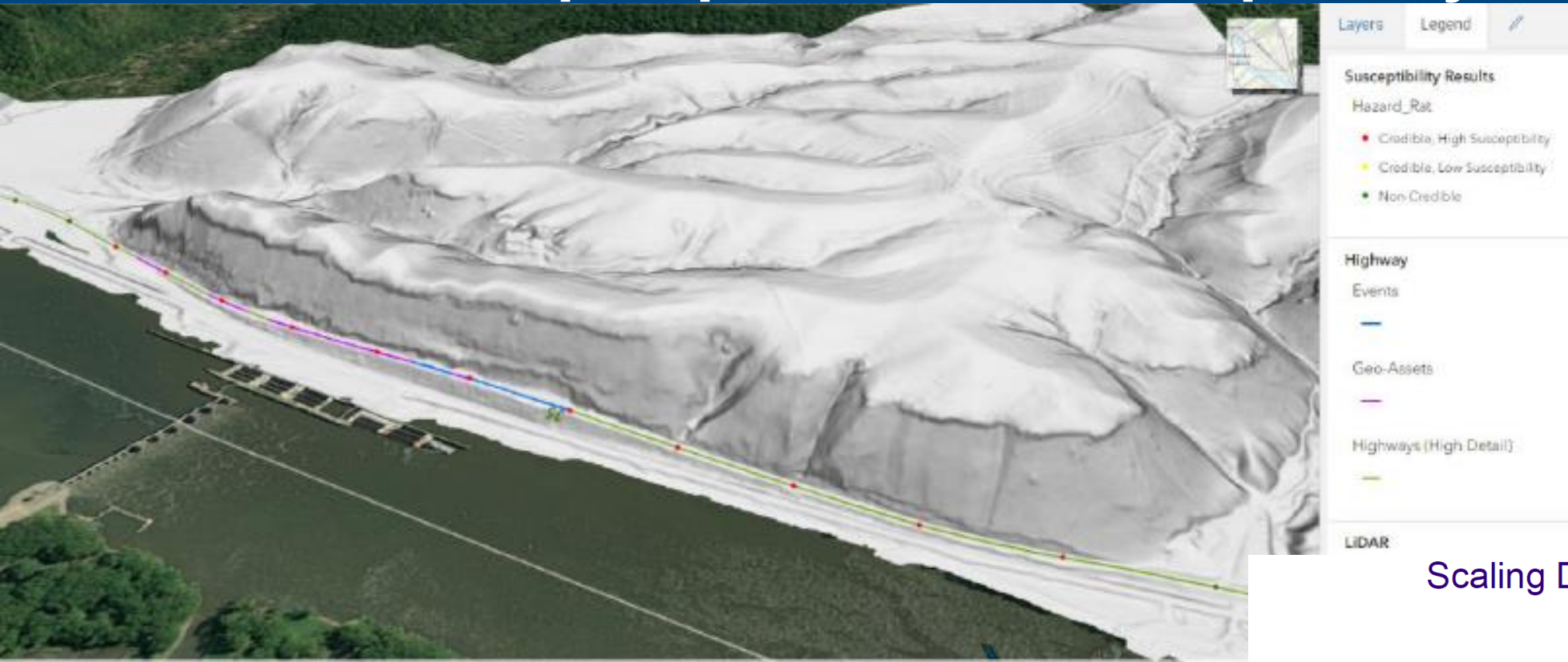
Geometric Data from LiDAR



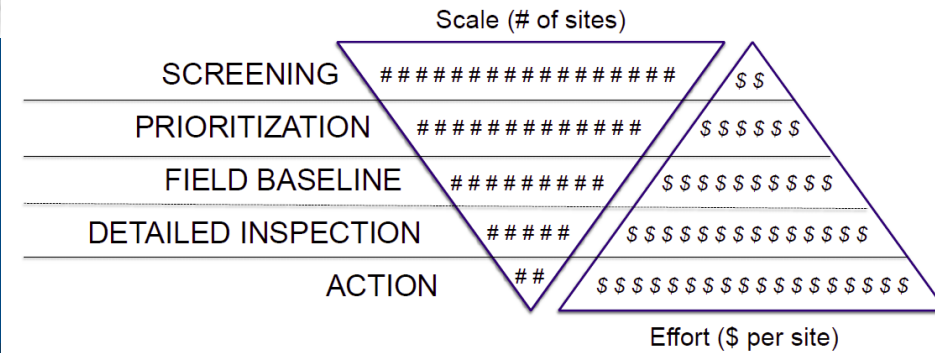
Susceptibility Model Categorization

- Susceptibility model weighs model inputs based on correlation between the presence or absence of observed hazard
- Susceptibility categories:
 - Non-Credible Hazard (low)  (56%)
 - Credible Hazard, Low-Susceptibility (medium)  (17.5%)
 - Credible Hazard, High-Susceptibility (high)  (26.5%)
- Initial screening - identify sites for additional investigation to better understand slope failure susceptibility
- Prioritize additional work and/or remedial measures

Upslope Hazard Susceptibility



Scaling Down Approach



Note: Slide information prepared by BGC for project report.

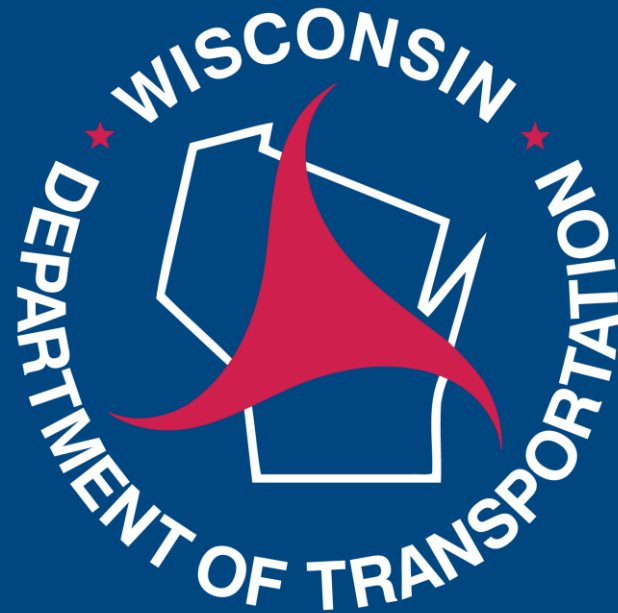


FUTURE STEPS

- Improve Tracking - Engage maintenance staff to track slope instability events (costs) & early indicators? **Early discussions underway**
- Develop slope failure RISK maps?
Requires higher-level discussions of consequences (costs/impacts)
- Expand to other parts of the state with historic slope stability issues?
WGNHS plans to complete more detailed geologic mapping of WI-35 corridor
- Pooled-fund study to continue GAM efforts?
Evaluating opportunities
- **NEED TO FIND WAYS TO DEMONSTRATE BENEFITS OF GAM!**
Justify the cost of a preemptive program; engage decision makers



THANK YOU - QUESTIONS?



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