Extreme Weather Vulnerability Study

Update on PennDOT Efforts

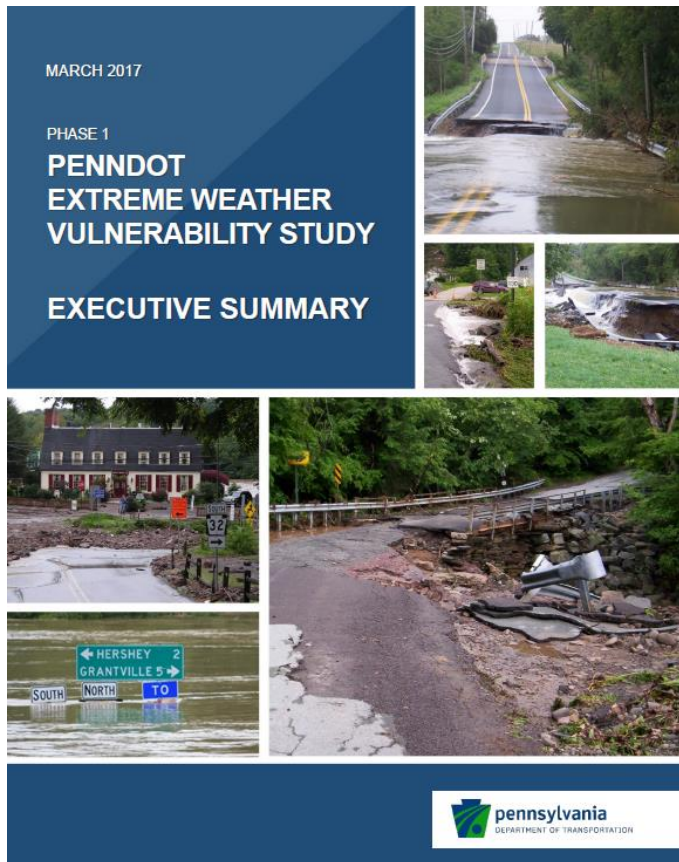**Doug Zimmerman**, Bureau of Planning and Research

Landslide Workshop 8-29-19

Agenda

o **Phase 1:**
   o PennDOT's Extreme Weather Vulnerability Study

o **Phase 2:**
   o FHWA Pilot Project
   o Designing for Resilience

o **Landslides:** Initial Thoughts

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Extreme Weather Vulnerability Study

MARCH 2017

PHASE 1

PENNDOT EXTREME WEATHER VULNERABILITY STUDY

EXECUTIVE SUMMARY

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- Initial study completed in March 2017

- Distributed to Districts, MPOs, other state agencies for planning purposes

- Updated in Fall 2017

- Additional updates underway

3

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Climate and Weather-Related Hazards

Flooding Considered a Primary Issue in Pennsylvania
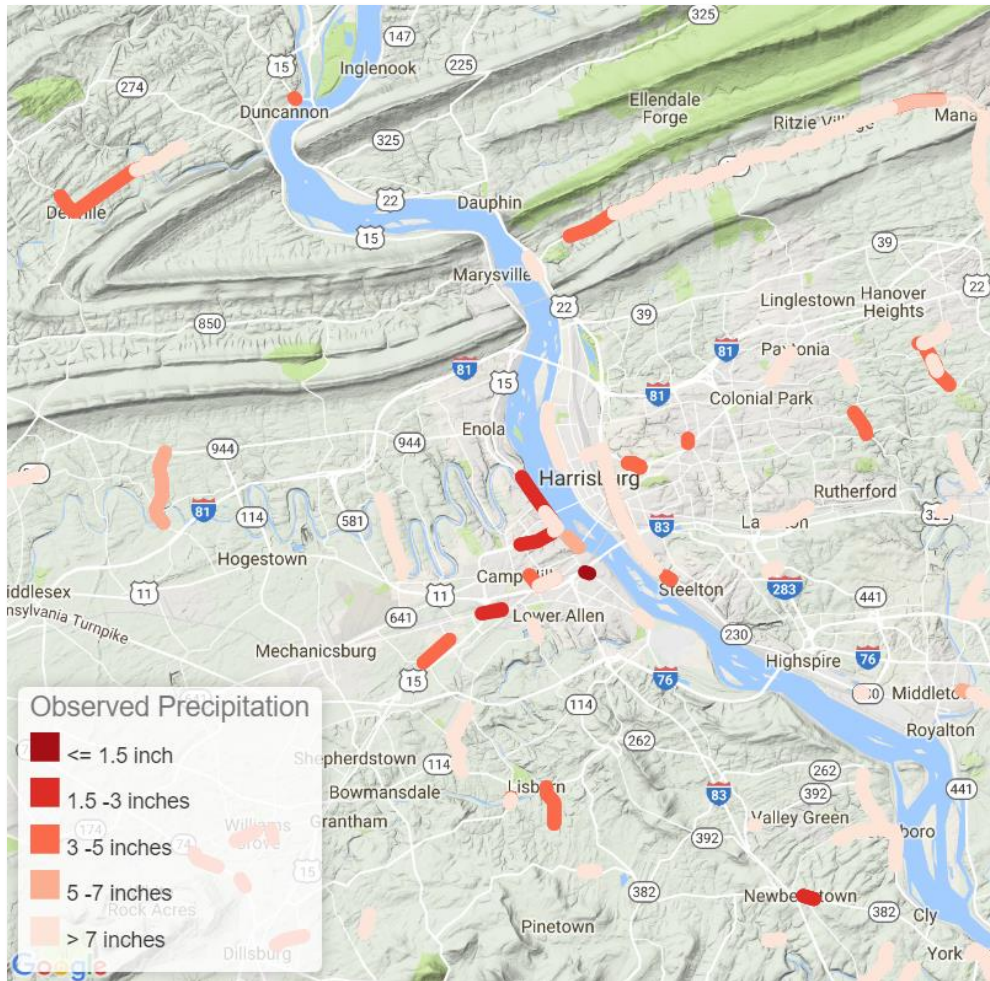
Flooding

Sea-Level Rise

Fires

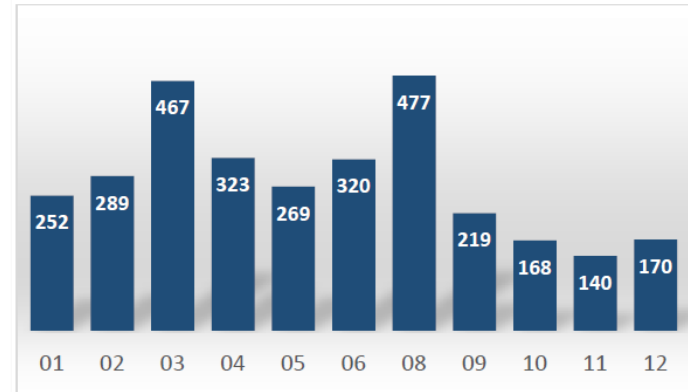Landslides
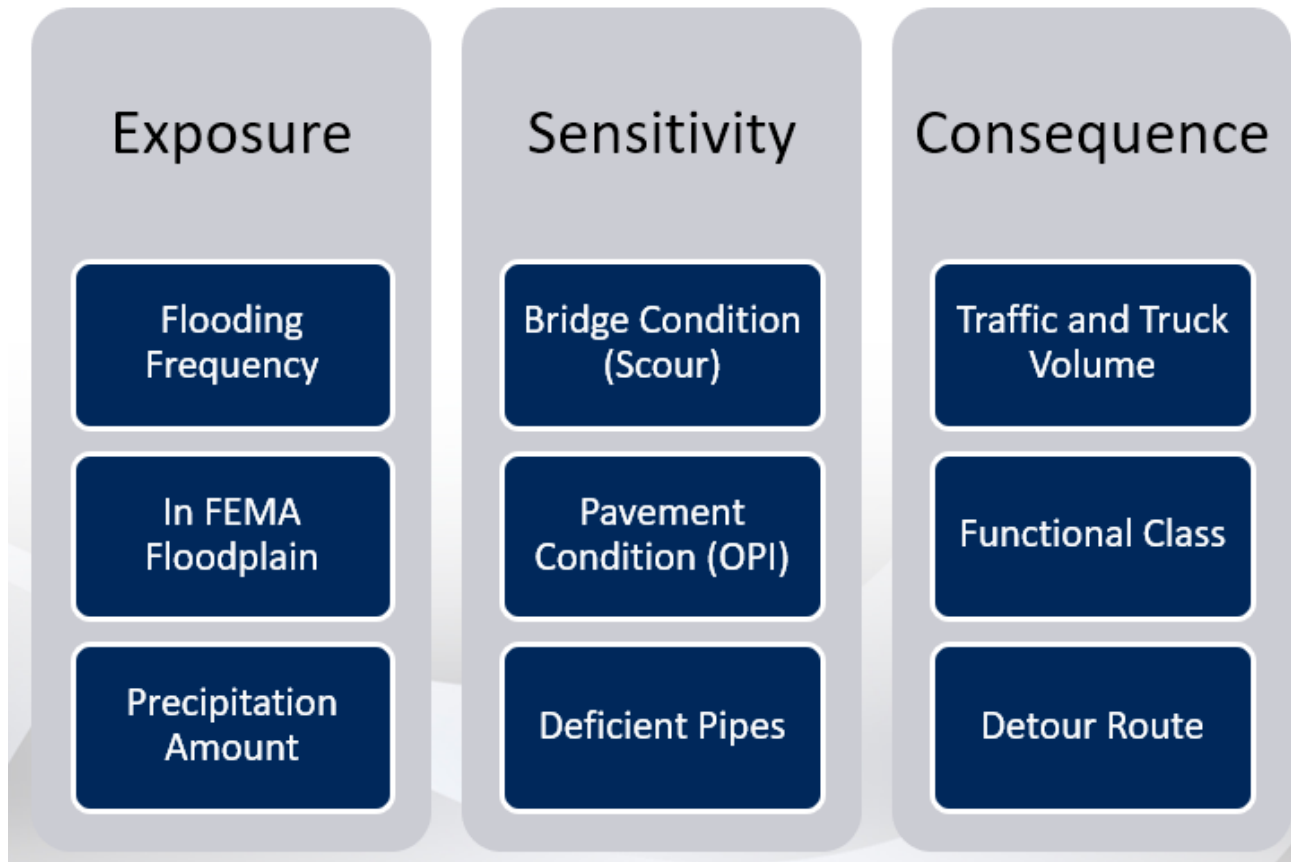
Earthquakes

High Winds

High Temperature Days

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Historic Flooding Vulnerabilities

Sources:

- ❏ Road Condition Reporting System (RCRS) 511
- ❏ FEMA Floodplain Maps
- ❏ NOAA Weather Data

5

Risk Assessment Criteria

Exposure	Sensitivity	Consequence
Flooding Frequency	Bridge Condition (Scour)	Traffic and Truck Volume
In FEMA Floodplain	Pavement Condition (OPI)	Functional Class
Precipitation Amount	Deficient Pipes	Detour Route

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Historic Flood Risk Mapping

Automated the historic risk mapping process to support on-going monitoring

Flooding Vulnerability
High Risk Road Segments
(Percentile Ranges)

- Top 1% of Risk Score
- 5%
- 10%
- 15%
- 20%
- 25%
- Other Vulnerable Segments

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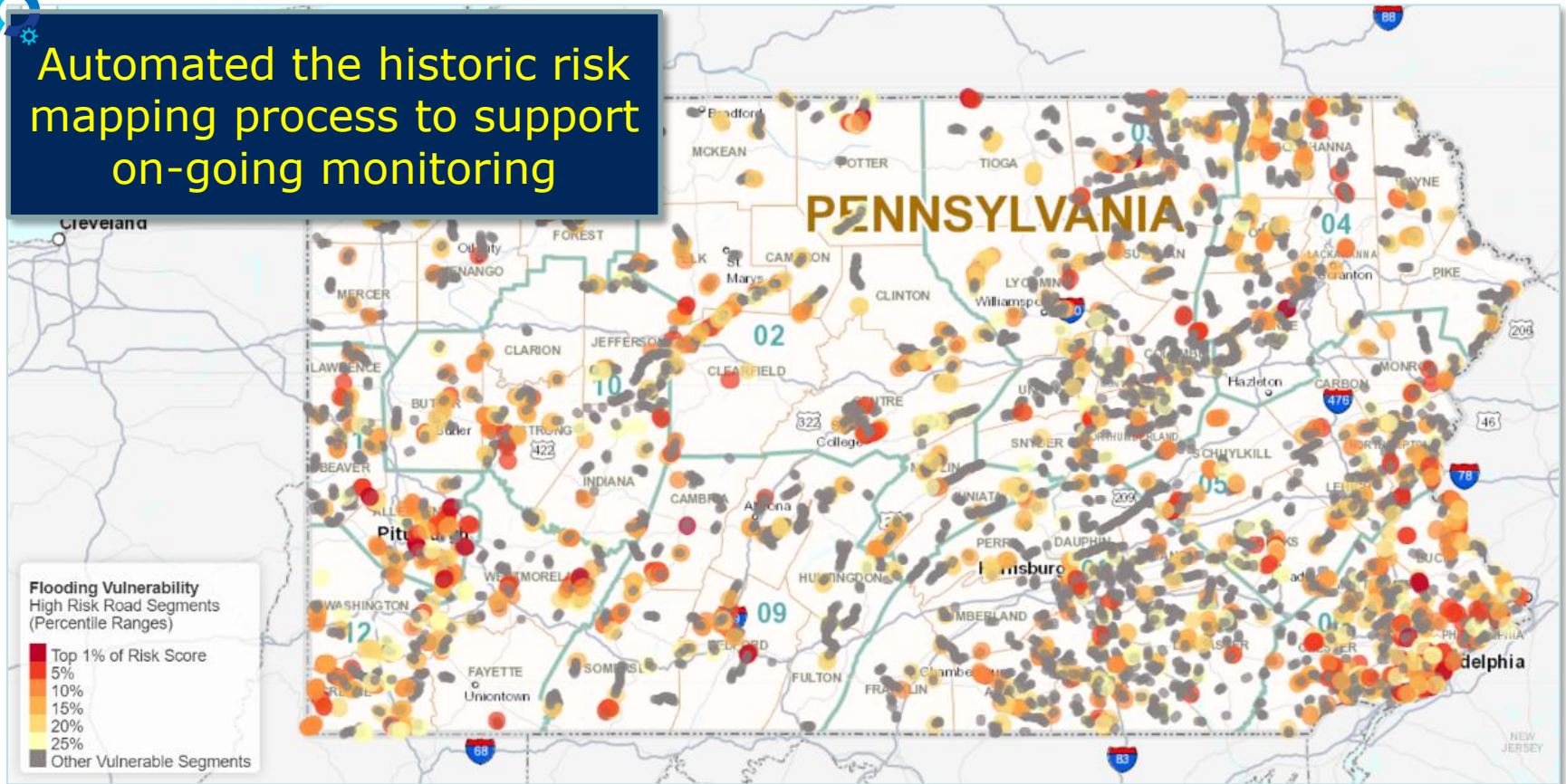
Pilot Forecast Analyses [Climate Change Scenarios]

Only Conducted for Allegheny, Delaware and Lycoming Counties

http://s3.amazonaws.com/tmp-map/climate/future-flooding-risk-assessment.html

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Current Home for Resiliency Data

- ## PennDOT PennShare Site

http://pennshare.maps.arcgis.com/apps/MapSeries/index.html?appid=29bf9f06045f47feb9888193674f8a95

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FHWA Pilot Study

FHWA Pilot Project Goals

Provide a detailed template for conducting H&H studies that include climate change impacts

Case study in evaluation of adaptation strategies and cost-effectiveness

Evaluating planning-level climate flooding forecasts from PennDOT's Extreme Weather Vulnerability Study
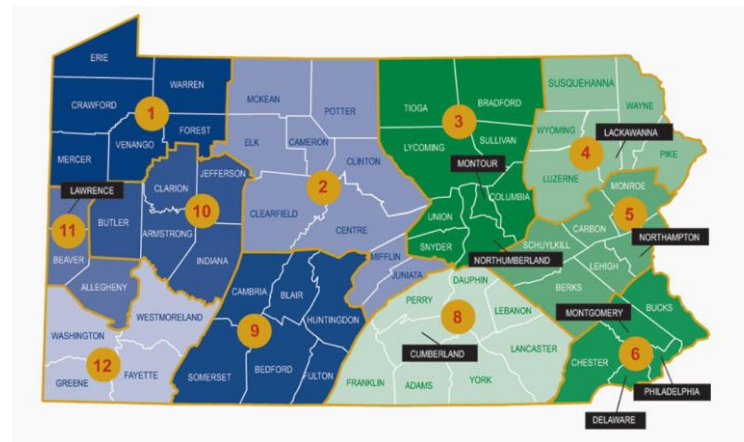
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Study Locations and Coordination

1 site location in:

- **Allegheny County**
- **Delaware County**
- **York County**

Metropolitan Planning
Organizations (MPOs)

PennDOT Central Office:

- PennDOT Bureau of Planning & Research
- Planning and Programming
- Highway Design
- Bridge Design

PennDOT District Offices

Designing for Resilience

Focus Areas

- **Internal Workgroup**
  - Focusing on design, construction and maintenance
  - Traffic Operations separate workgroup

- **Multiyear initiative**
  - Some items implemented in 6-12 months; others will take longer.

- **Short term items**
  - E.g. Use of geotextiles to prevent loss of approach embankments and to encapsulate pipe backfill.

- **Update H & H Manual**
  - Incorporate revised USGS regression equations, as well as updates to stream stats database.

14

Designing for Resilience

- H&H Design Flood Considerations
  - Changing drainage area characteristics
  - *USGS StreamStats* is being updated in conjunction with regression equations
  - Other hydrologic methods can evaluate land use changes

1999 2005 2008

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Photo Credit: Google Earth, Dallas, PA

Landslides-Rockfalls

Existing Data Compilation

Historic Road Closures (RCRS)

Rockfall Sign Locations

PennDOT Slide Projects (MPMS)

USGS Land Slide Locations (*Southwest PA*)

https://pubs.usgs.gov/of/1974/0121/report.pdf

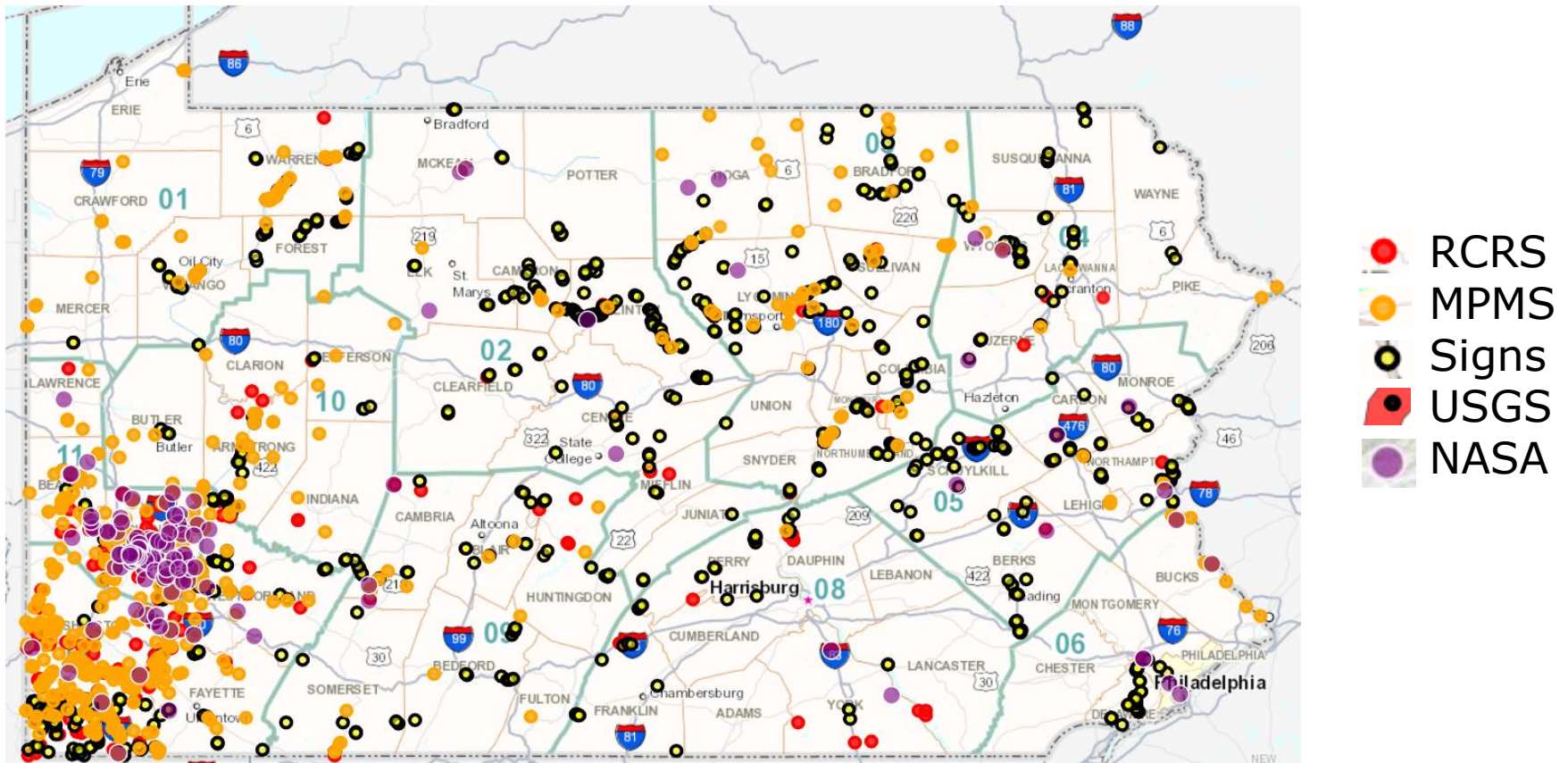Digitized by Southwestern Pennsylvania Commission (SPC)
https://www.spcregion.org/data_recent.asp

NASA Landslide Catalog Points

https://maps.nccs.nasa.gov/arcgis/apps/webappviewer/index.html?id=824ea5864ec8423fb985b33ee6bc05b7

17

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Existing Data Mapping

http://s3.amazonaws.com/tmp-map/dot/ls/penndot-rcrs-pnt.html

RCRS
MPMS
Signs
USGS
NASA

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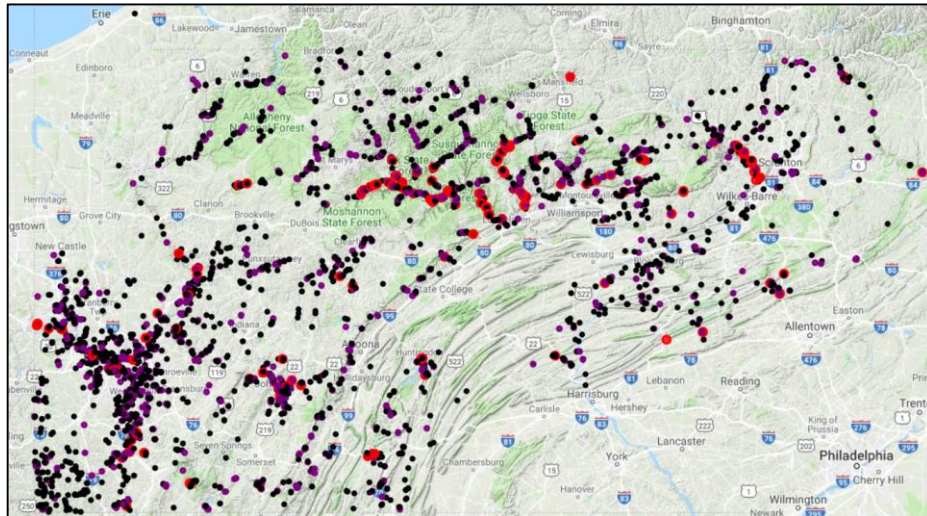
Evaluation of Steep Slopes Near Roads

- Use Digital Elevation Model (DEM) data to calculate and identify locations with steep slopes

Classified Slopes:
- 40 to 49% = black
- 50 to 70% = purple
- Greater than 70% = red

http://s3.amazonaws.com/tmp-map/dot/ls/rms-high-slope-geology.html

- Initiated research on what other factors indicate susceptibility to slides or rock falls (e.g. precipitation, soil, geology, sun direction, etc.)?

19

Assessing Available Predictive Models
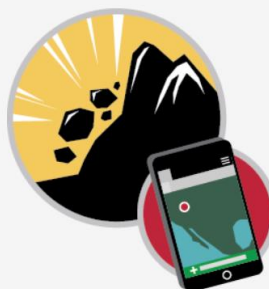
Global Landslide Hazard Assessment Model (LHASA) with Global Landslide Catalog (GLC) data

https://pmm.nasa.gov/landslides/index.html

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Landslide Next Steps

- Identify other data sources
- Work with research partners to identify slide causal factors
- Investigate current practices by District Offices
- Better track slide performance measures and trends
- Develop a risk formula to prioritize; or predict landslides?
- Share information within PennDOT-Planning Partners
- Identify climate change impacts
- Assemble and review mitigation strategies

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