# Landslide Vulnerability Assessment Study

City of Westbrook

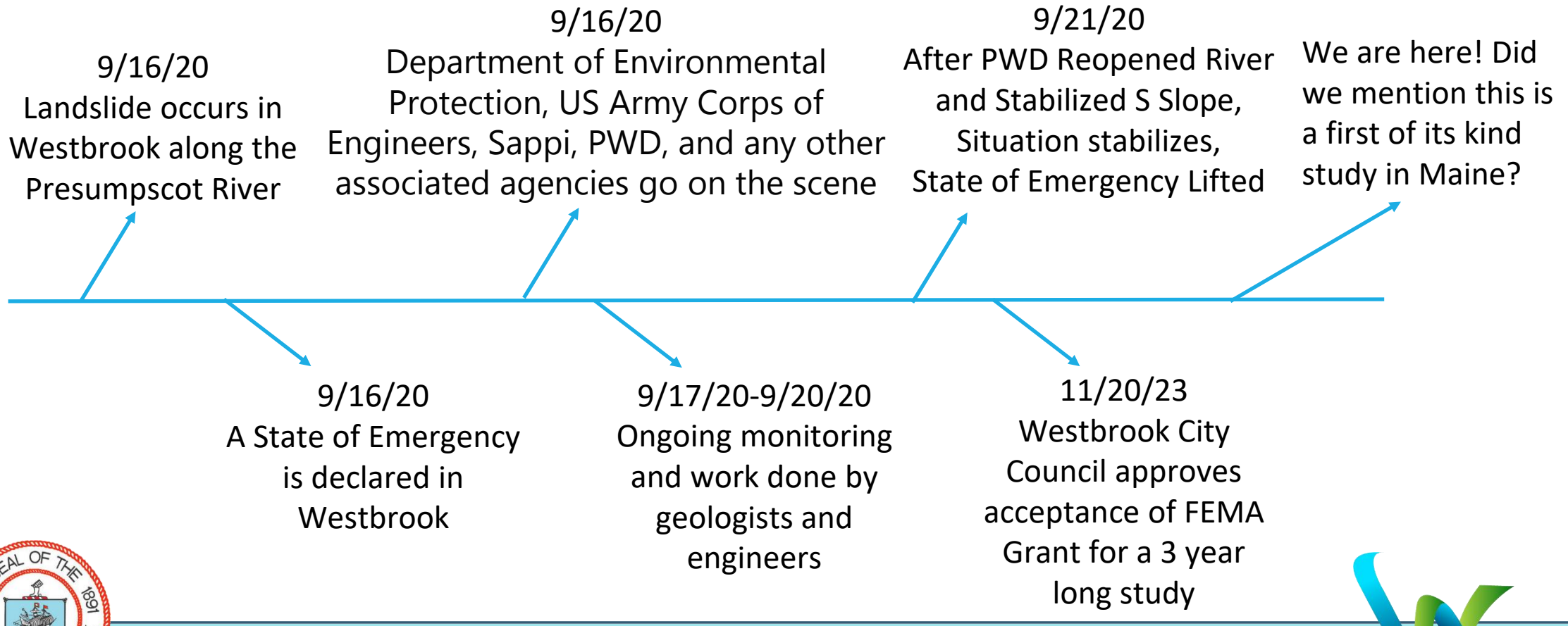
# Brief Introductions

# 2020 Landslide In the News…

- https://www.youtube.com/watch?v=60FKkUt6llk&list=PPSV


Westbrook, Maine

# Why Westbrook is taking on this task




Westbrook, Maine

# Why Westbrook is taking on this task

## This isn't the first landslide for Westbrook…

Sketch of the 1831 landslide by Professor Edward Hitchcock

May 5th, 1831

View into the 1868 landslide crater from near the Presumpscot River, looking roughly north from Westbrook Historical Society


November 22, 1868

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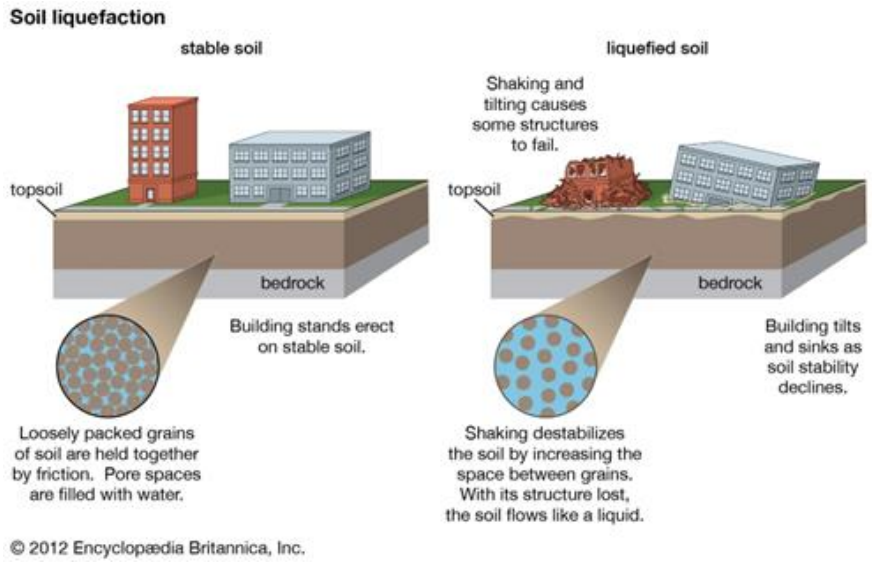
# Causes of Landslides:

- Increase the driving force
  - Construction of a building
  - Heavy rains perched above a clay layer
- Decrease the resisting force (at the toe of a slope)
  - Excavation
  - Erosion
- Compromising/changing the strength of the underlying soil by liquefaction, which is an increase in water pressure such that soil particles are not touching.
  - Construction related activities such as blasting or vibrations
  - Earthquakes

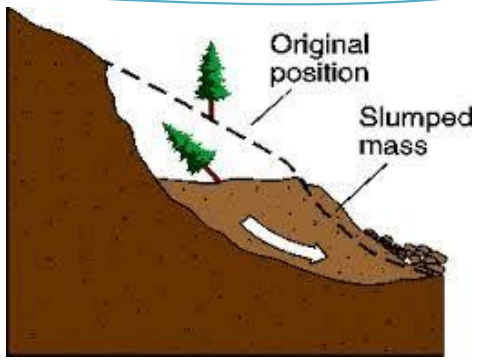


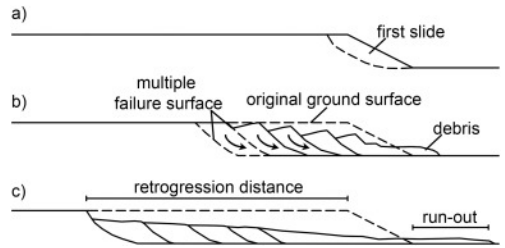
# Presumpscot Formation

- A glacial marine sediment consisting of clay, silt and fine sand-size particles deposited in the sea as an ice sheet receded.
- As the ice sheet receded, bedrock rebound resulted in lifting the sediments above the marine limit.
- Resulting deposit is characterized by a low undrained shear strength and significantly reduced remolded shear strength (highly sensitive).

# Two Types of Failure

- Single rotational slides
- Retrogressive slides

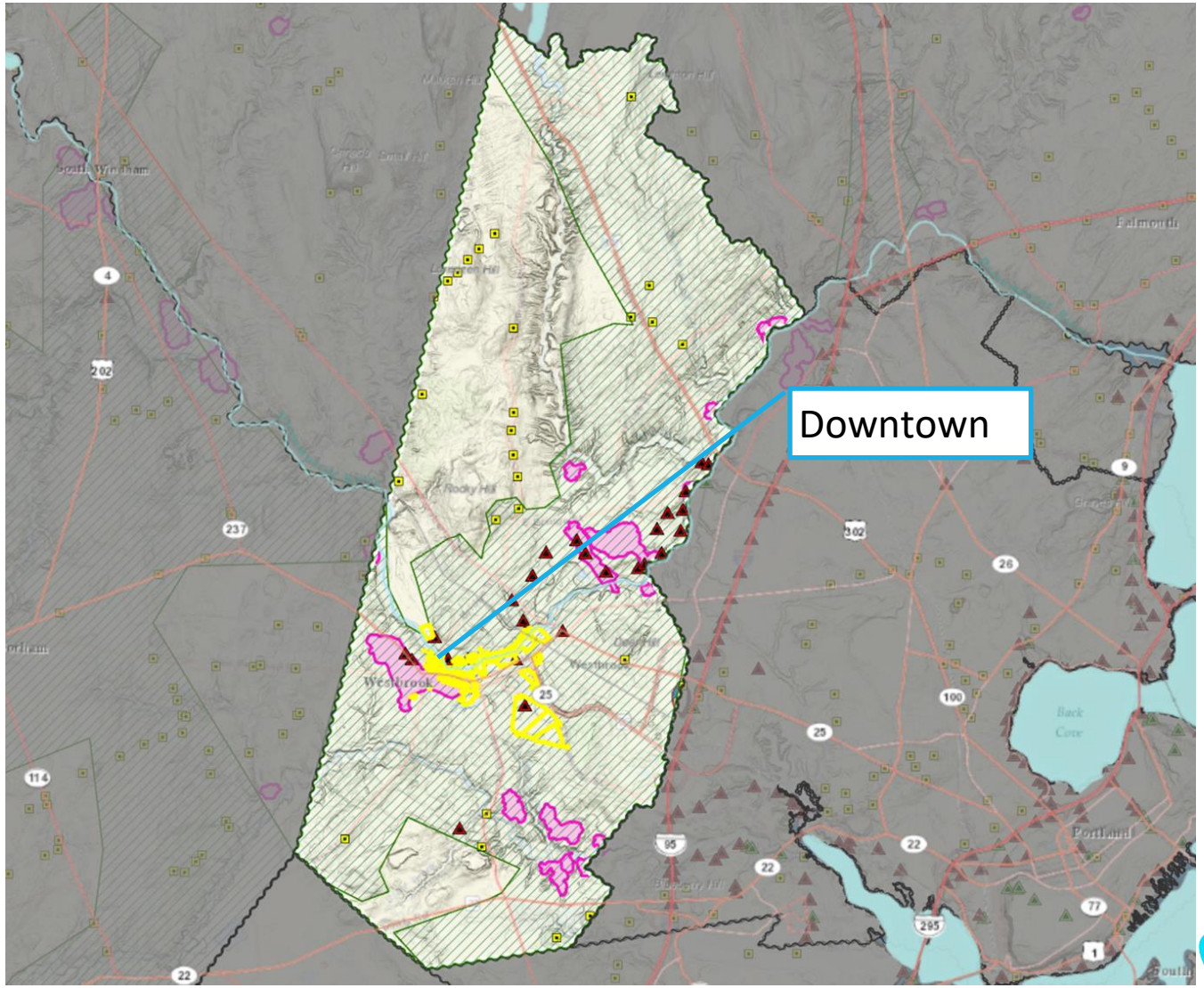


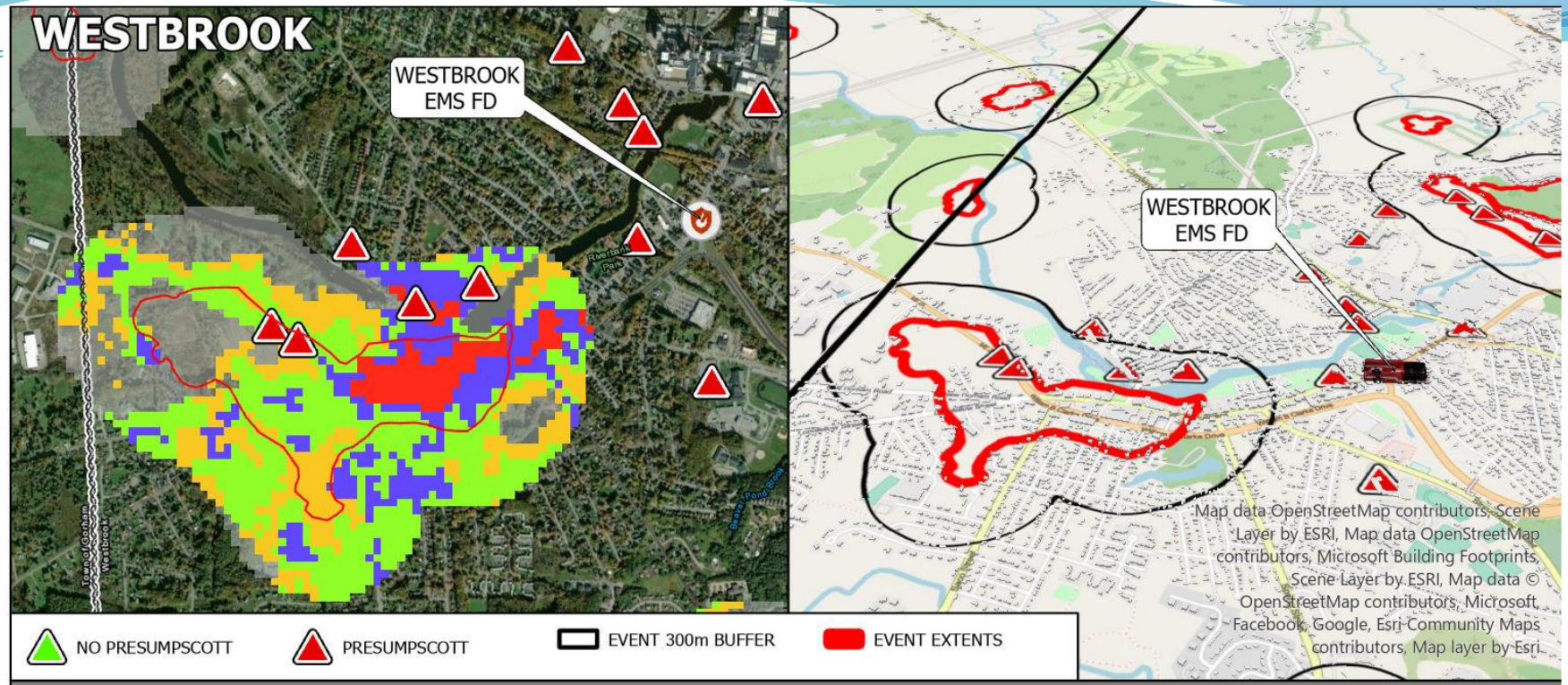




- The rotational slides typically occur in thick deposits of the Presumpscot Formation along the Maine coast because of oversteepening due to wave erosion at the toe. This erosion is promoted by highly erodible silt layers interbedded in the silty clay.

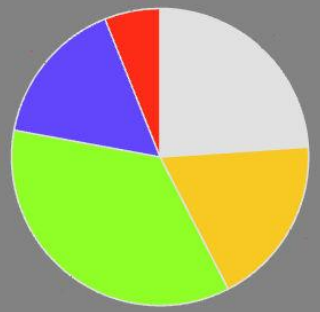
- The retrogressive slides occur more commonly in the Presumpscot Formation inland from the coast and adjacent to a small river due to lower strengths and highly sensitive, i.e. the disturbed shear strength was much lower than the intact shear strength.

- TEST BORING- NO PRESUMPSCOT
- TEST BORING - PRESUMPSCOT Fm
- BEDROCK OUTCROP
- MGS - MAPPED LANDSLIDE EVENTS
- APPROXIMATE GROWTH AREAS





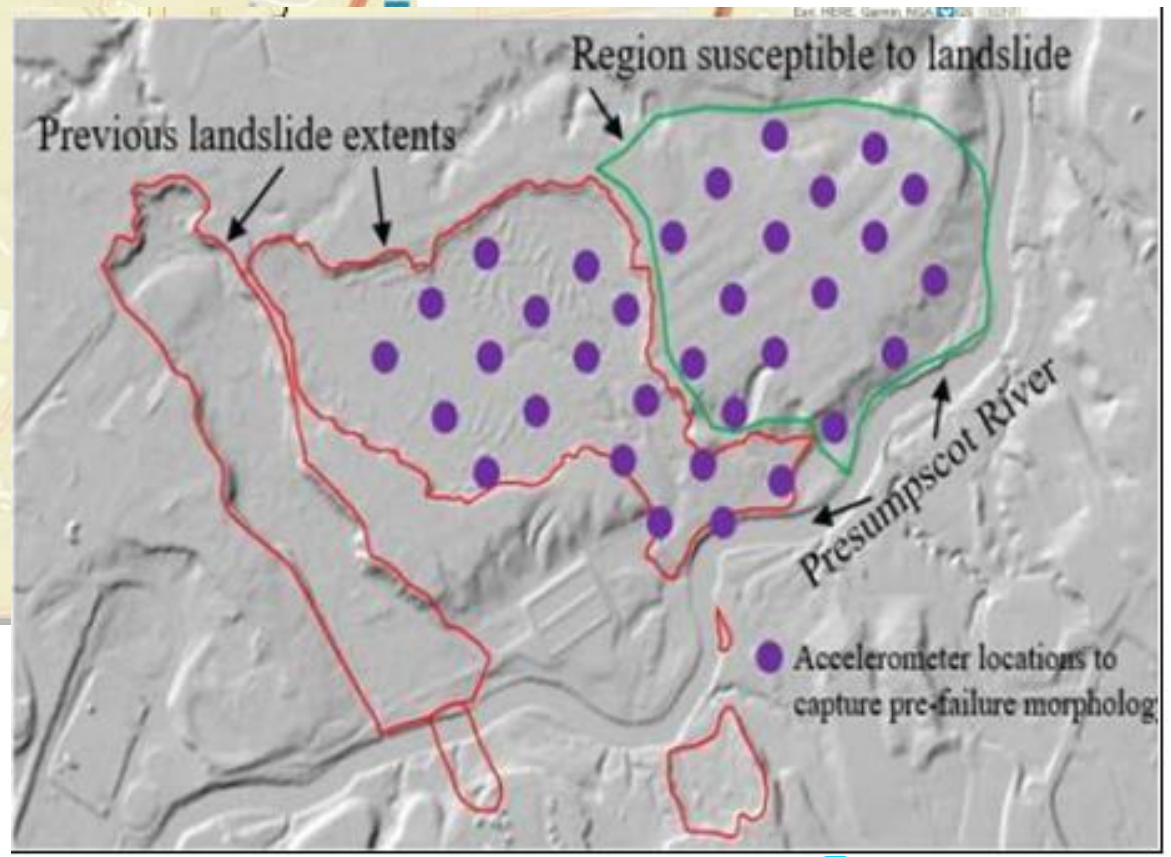

## WESTBROOK EVENT Land Use/Development Acreage (300 meter buffer)



- UNDEVELOPED - 23.9% (484,200.0)
- DEVELOPED - SPARSE 18.5% (374,400.0)
- DEVELOPED - LOW 35.5% (718,200.0)
- DEVELOPED - MEDIUM 16.1% (324,900.0)
- DEVELOPED - HIGH 6.0% (122,400.0)

SEAL OF THE CITY OF WESTBROOK 1814 1891

Westbrook, Maine


SEAL OF THE CITY OF WESTBROOK 1814 1891

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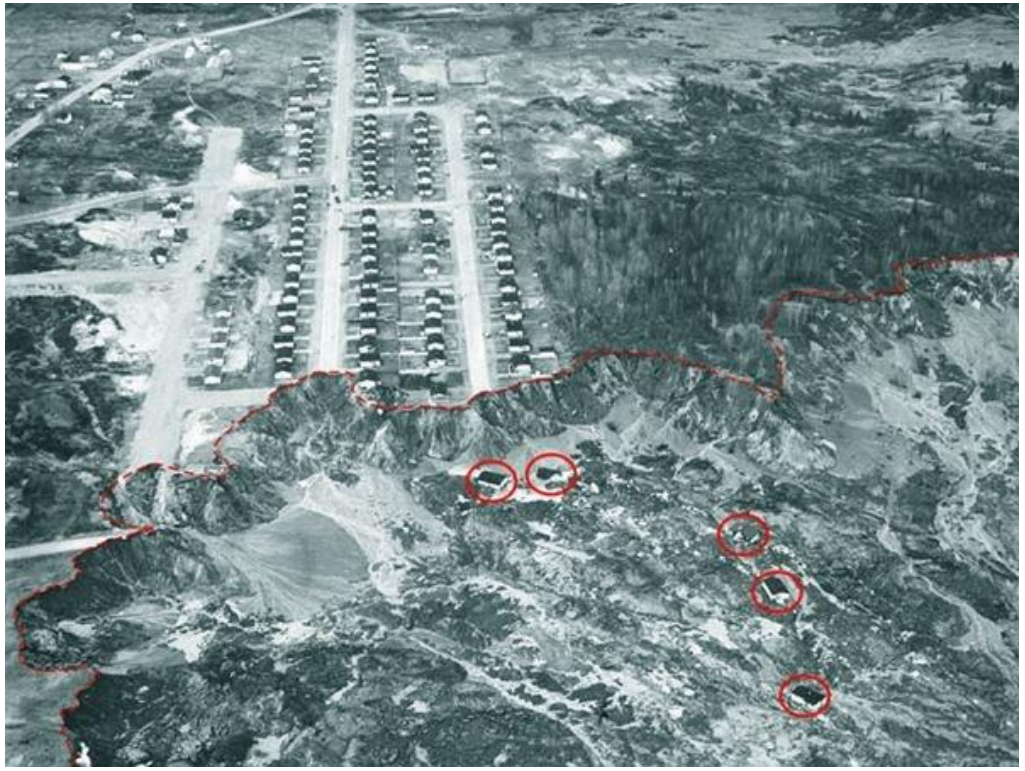
# Key Takeaways

- 12 Documented Landslide Events
- Limited Boring Data
- Potential Landslide Vulnerable Areas in Town Designated Growth Areas
- Presumpscot Clay detected along Presumpscot River

# Case Study from a Neighbor

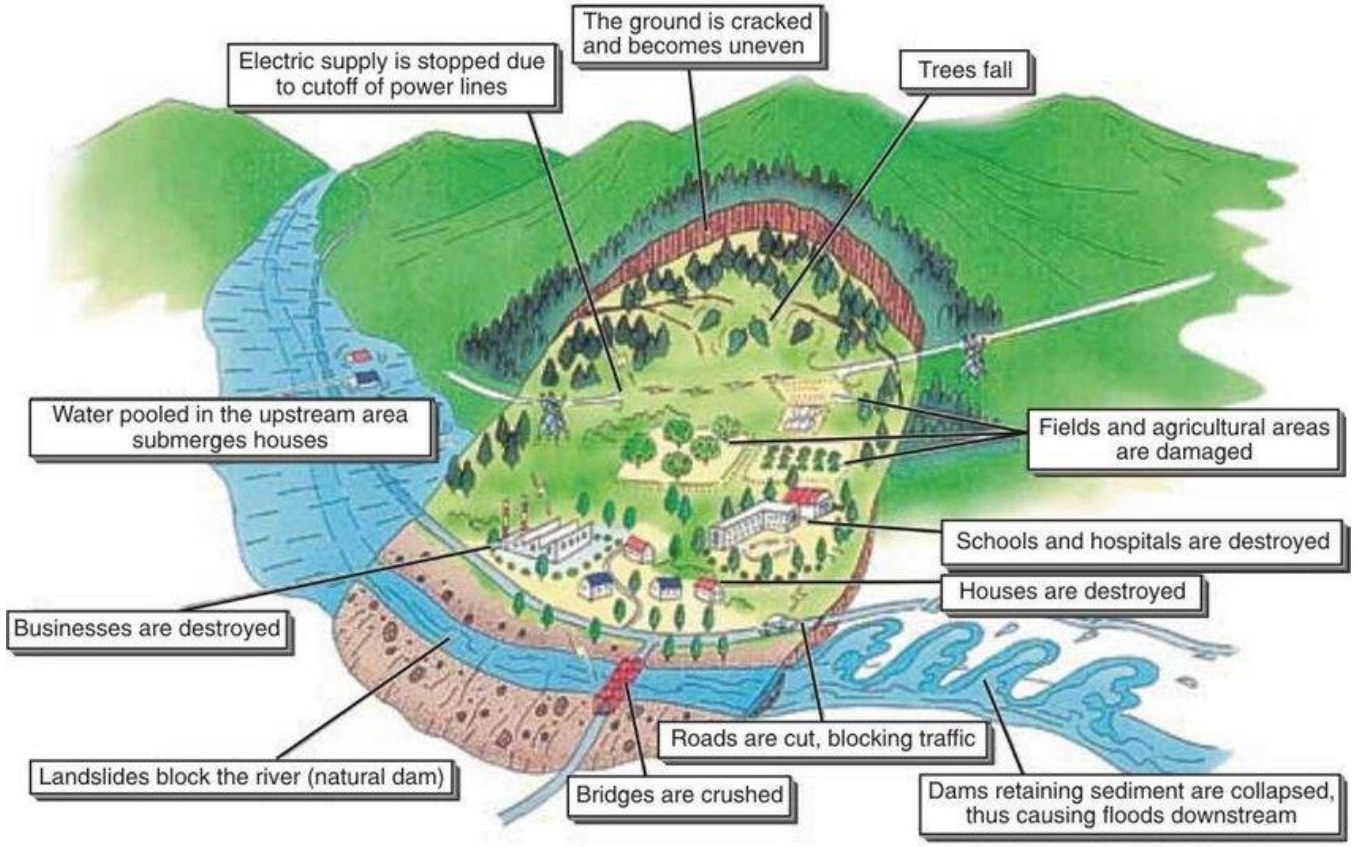


Saint Jean Vianney Landslide, St. Lawrence Waterway, Quebec

# Effects of Landslides on Rivers

ENVIRONMENTAL

- River Blockage and Natural Dams
- Alteration of River Courses
- Impact on Water Quality
- Flooding
- Sediment Load and River Morphology

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# Effects of Landslides on Rivers

SAFETY / ECONOMIC

- Projected Increased Frequency of Landslides with Increased Storm Frequency and Intensity
- Unknown Landslide Vulnerabilities = Increased Safety Risk
- Increasing Population Densities = Increased Future Safety Risk
- High Cost Associated w/ Damage to Existing Infrastructure & Property
- Costs for Rehabilitation / Mitigation will only Get Higher in the Future (Maine Disaster Relief Fund)


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# Overall Goals of this Project

1. Identify triggers of the 2020 landslide (and other vulnerable areas)
2. Explore or make improvements to policy to minimize future losses from landslide action
3. Develop list of mitigation sites

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# Other Goals of this Project

- Facilitate Future Development Safely Along Waterways
- Proactive steps
- Not to cause a panic!

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# Project Partners

- City of Westbrook – Grant Administrator
  - Credere Associates, LLC – Grant Support to Westbrook
- Maine Geologic Service – Mapping Lead
- UMaine College of Engineering – Engineering Evaluation Lead
- Greater Portland Council of Governments
- Portland Water District
- Cumberland County Emergency Management Agency

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# Project Partners

- Partner Municipalities (Emergency Response, Engineering, Planning)
- Maine Department of Environmental Protection (Inf Adaptation Grants and match)
- Technical Advisory Panel – Geotechnical Support (TBD, RFP due in October)
- Planning / Policy Consultant – Update Ordinances(TBD)

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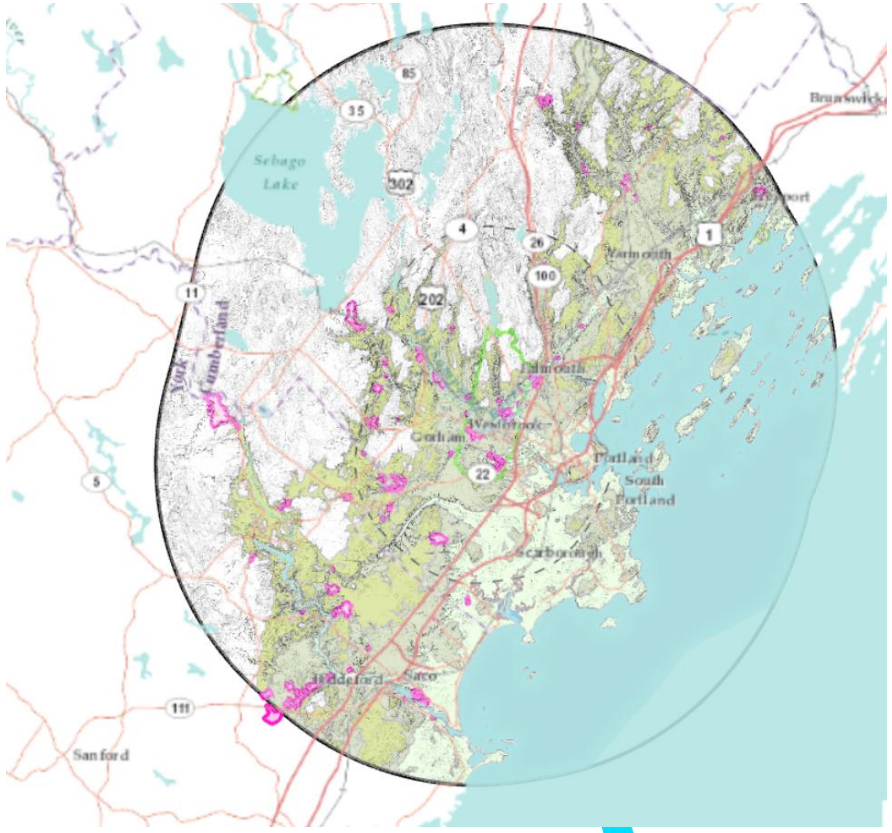
# Overview: Landslides and your Community

- Presented in alphabetical order
- A brief look at your communities

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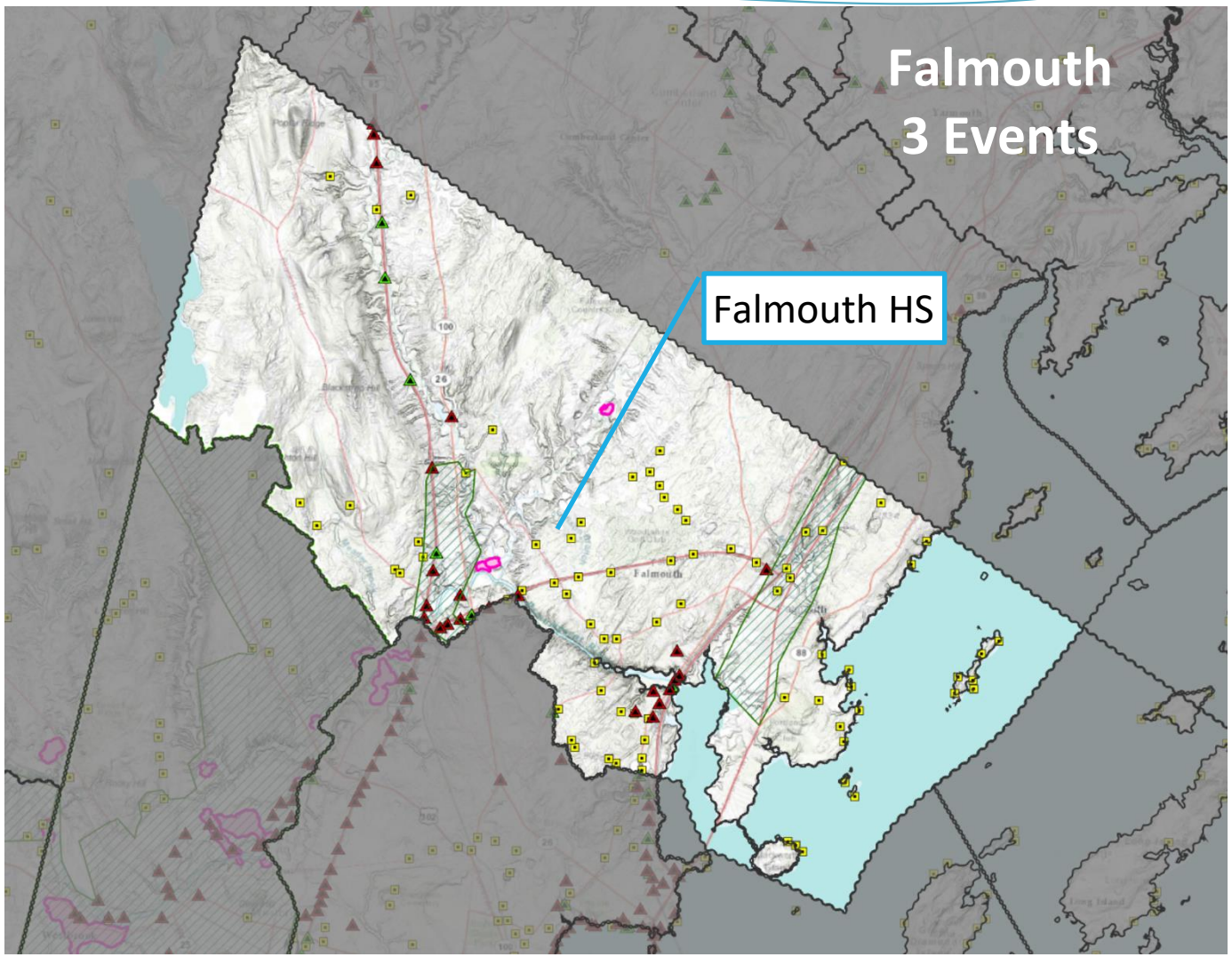
# Falmouth

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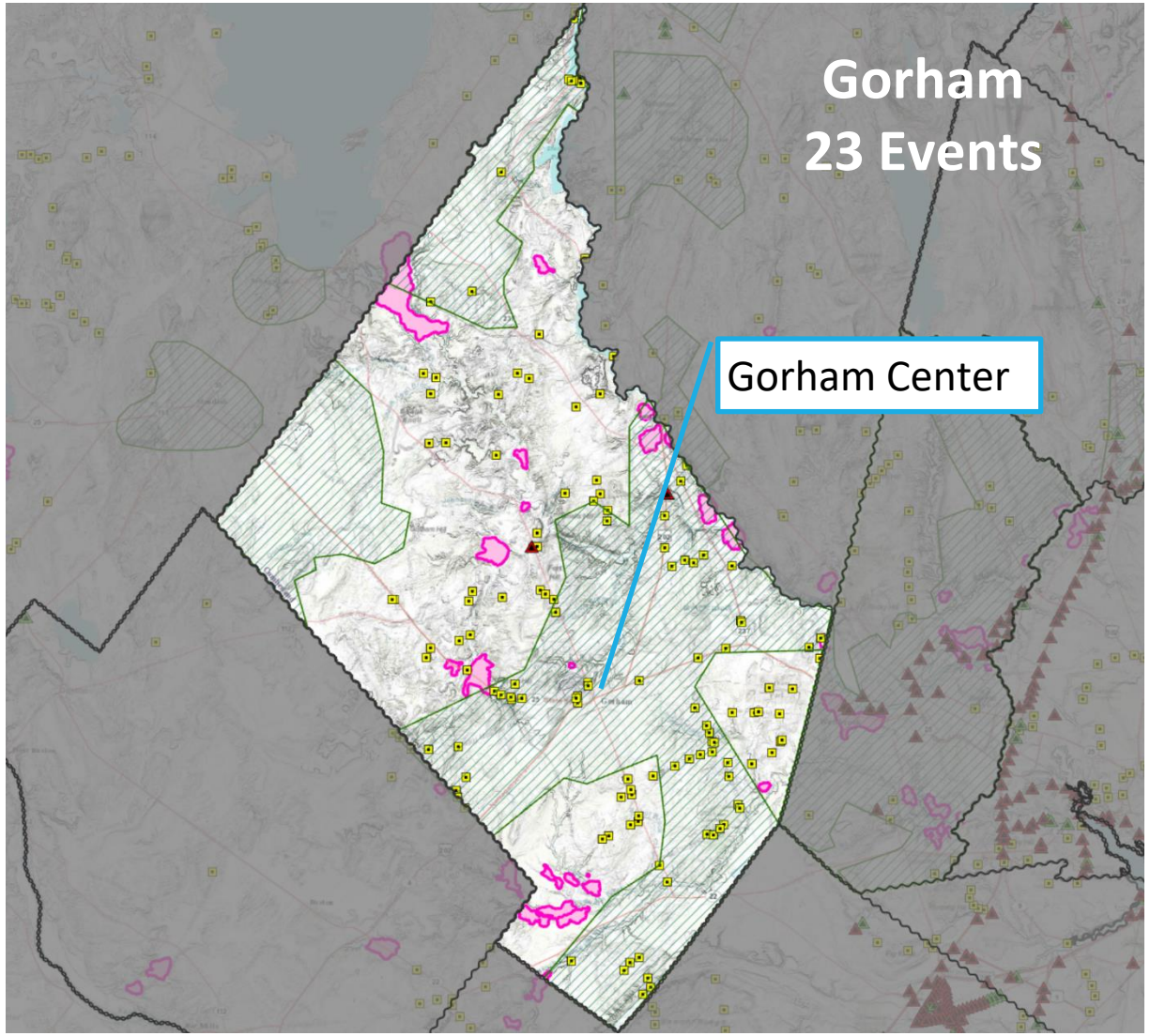
# Gorham

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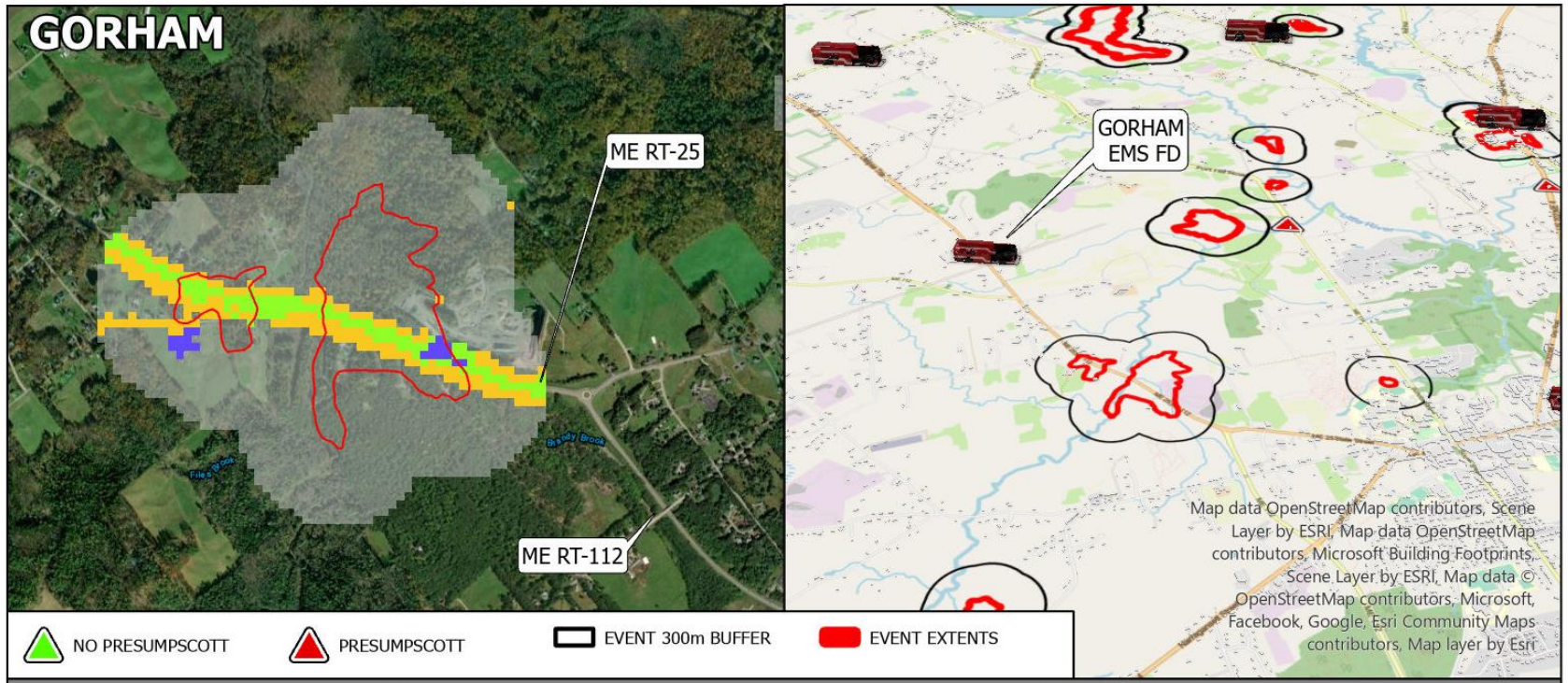


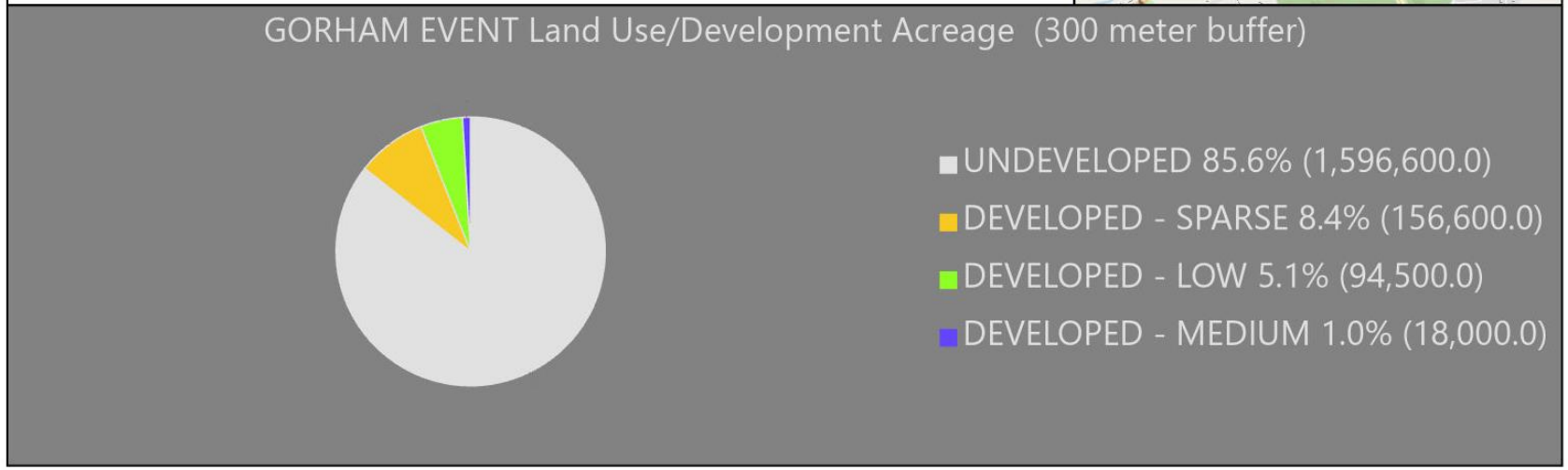


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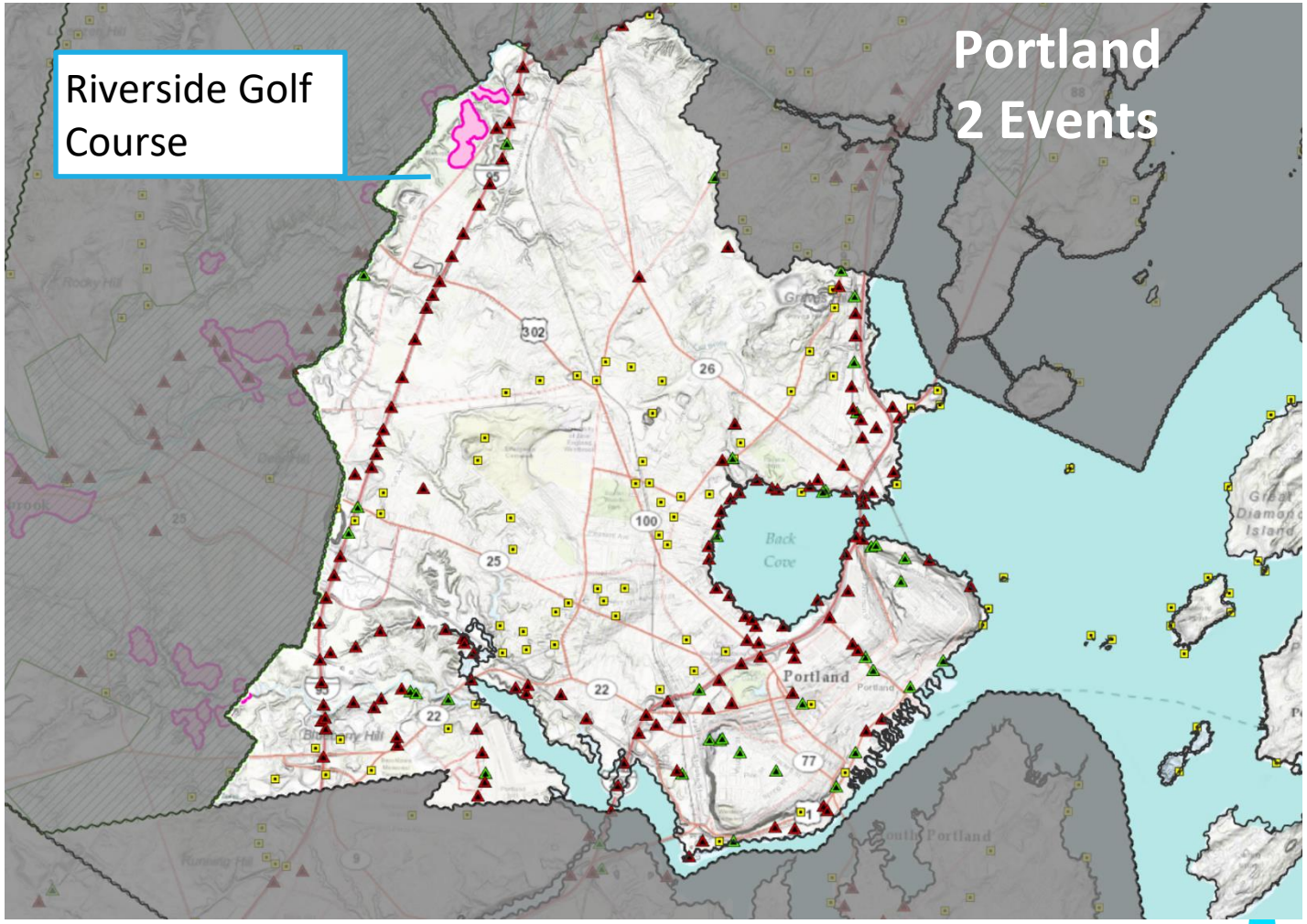
# Portland

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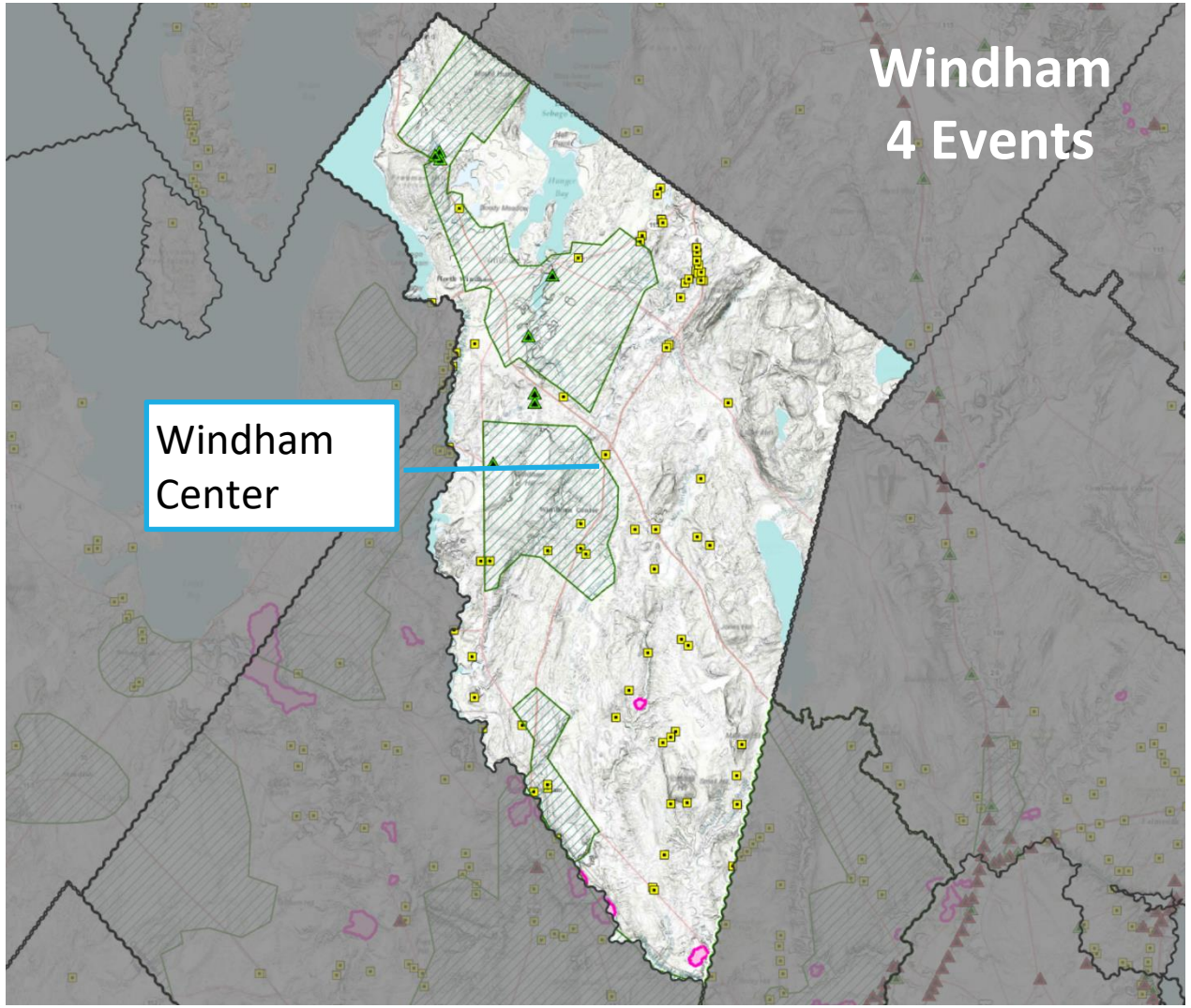
# Windham


Windham
4 Events
Windham
Center
TEST BORING- NO PRESUMPSCOT
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# Standish

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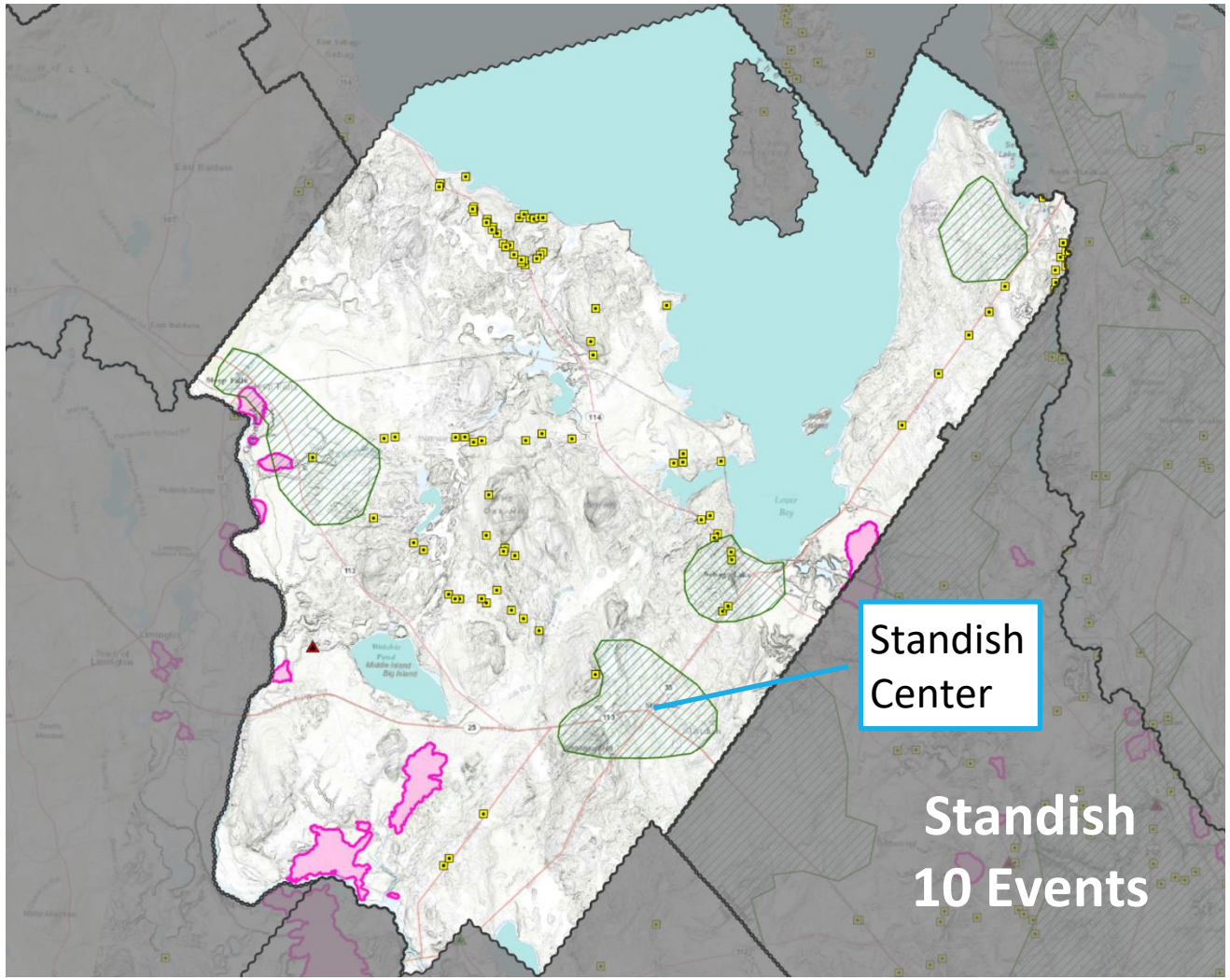

# Summary of Risks to Communities

- Impacts to Land = Up to 750 acre landslide in Hollis
- Impacts to Water Quality / Recreation
- Safety – Loss of Property / Risk of Injury / Potential Loss of Life
- Town/Private Costs of Response and Rebuilding Infrastructure
- Potential Adverse Impacts to Designated Growth Areas

# Proposed Scope of Work

- 1. Collect / Aggregate Existing Boring Data (Summer / Fall 2024)
- 2. Evaluate Existing Available Data (Fall / Winter 2024)
- 3. Identify Data Gaps (Winter Spring 2025)
- 4. Conduct Field Efforts to Fill Data Gaps (Spring/ Summer 2025)
- 5. Evaluate Additional Data (Fall/Winter 2025)
- 6. Develop Vulnerable Area Maps (Winter 2026)
- 7. Develop Model Ordinance and Tool Box for Addressing Vulnerable Areas (Winter/Spring/ Summer 2026)
- 8. Identify Mitigation Projects for FEMA Funding (Spring/Summer 2026)

# Outcomes

- Identification of Vulnerable Areas within Area Communities
- Policy for Addressing Growth within Vulnerable Areas
- List of Mitigation Projects for Future Funding

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# What we need from you

- Please fill out data request form
- Provide municipal contact for further outreach
- Time tracking for any municipal staffer that participates in this work (Please keep track of your hours worked on this with name, position title, hours spent, date, and task worked on!) (Ongoing)

# Questions?