

Overview of Landslides in Southern Maine and the September 16, 2020 Westbrook Landslide



Lindsay Theis
Senior Geologist
Maine Geological Survey
lindsay.theis@maine.gov

A Few Modern Landslide Examples



1983



1996



2005

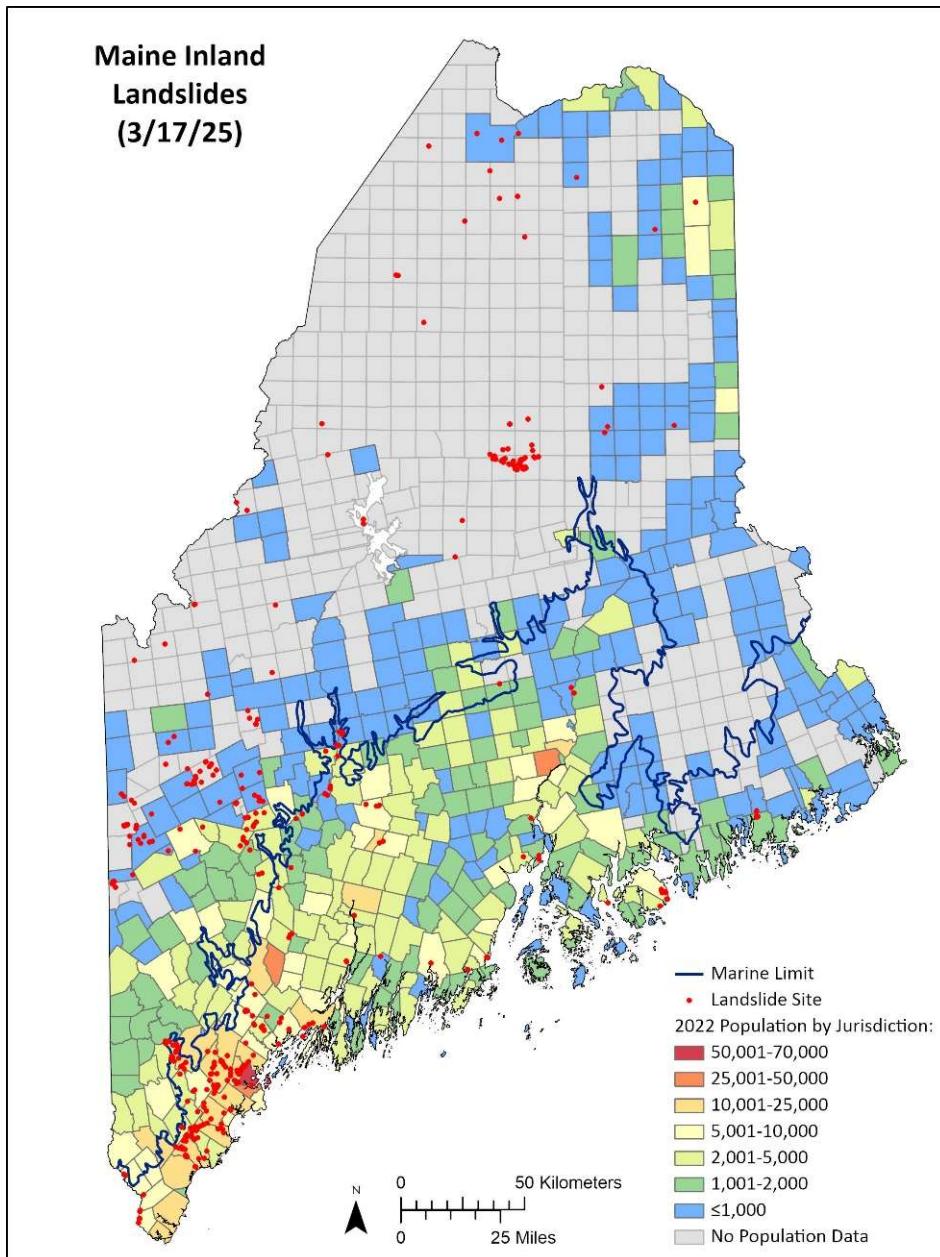


2006

Lidar and Landslides



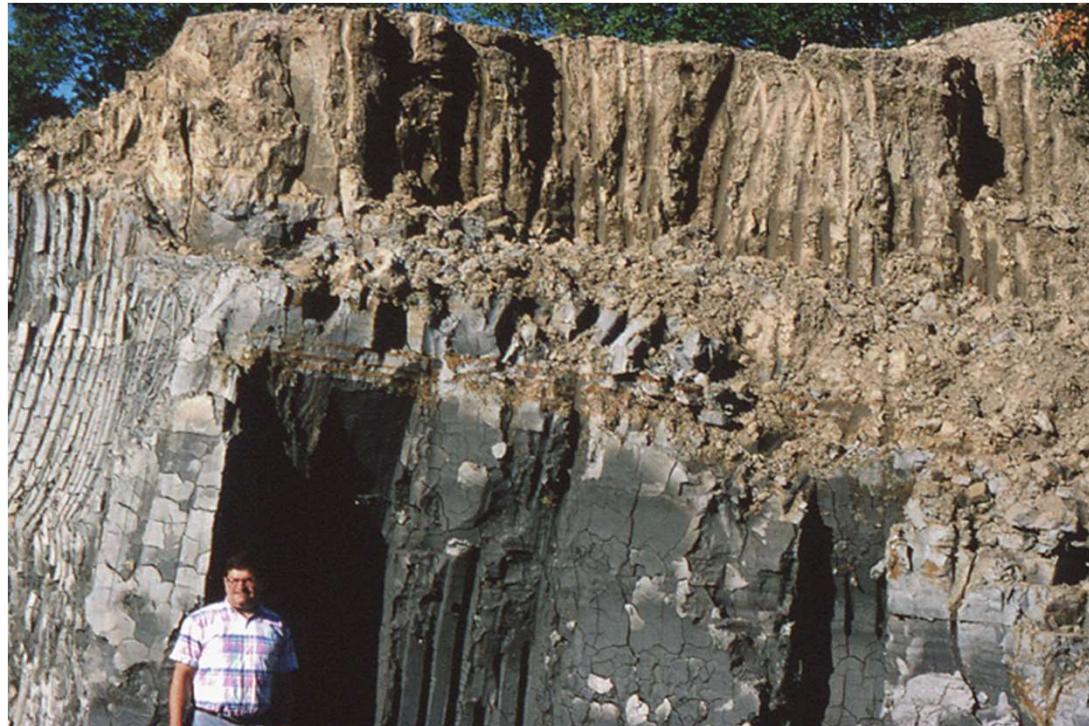
Current Inland Landslide Inventory



- **447** inland landslides:
 - **238** below marine limit (most related to Presumpscot Formation).
 - Highest density in most populated area of the state.

Presumpscot Formation

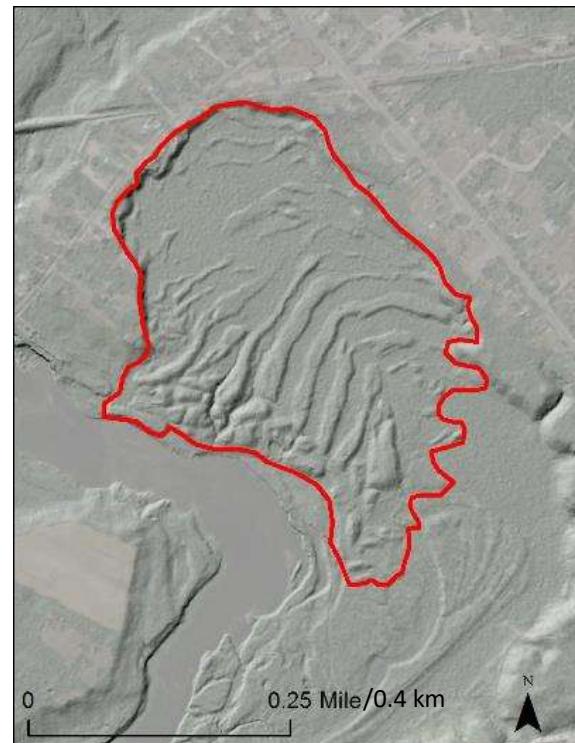
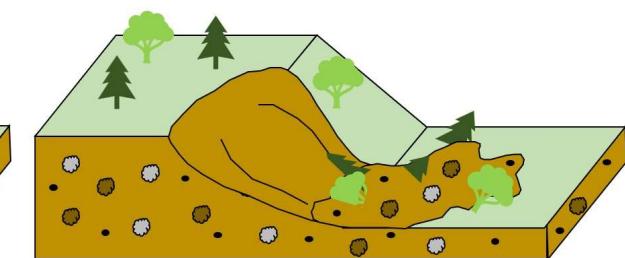
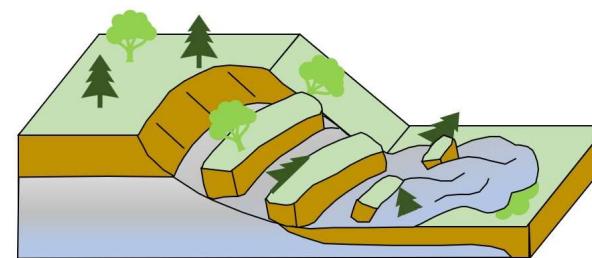
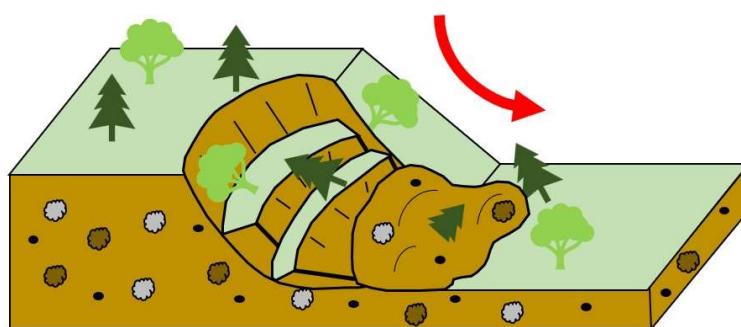
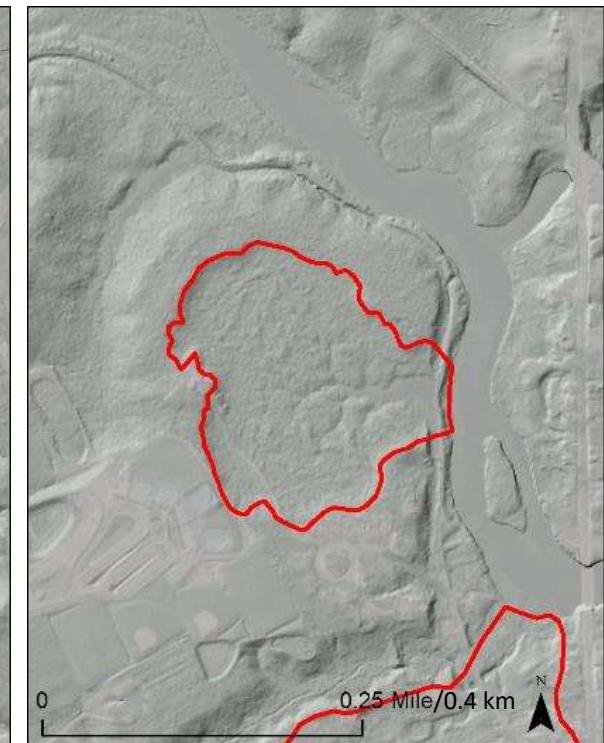
- Sensitive glaciomarine mud deposit found at lower elevations in portions of southern Maine.
- Significant contributing landslide factor in southern Maine.
- Can liquefy and flow when disturbed or left unsupported.



Soft Presumpscot Formation removed from landslide site along Penobscot River.

Presumpscot Formation exposure, south-central Maine.

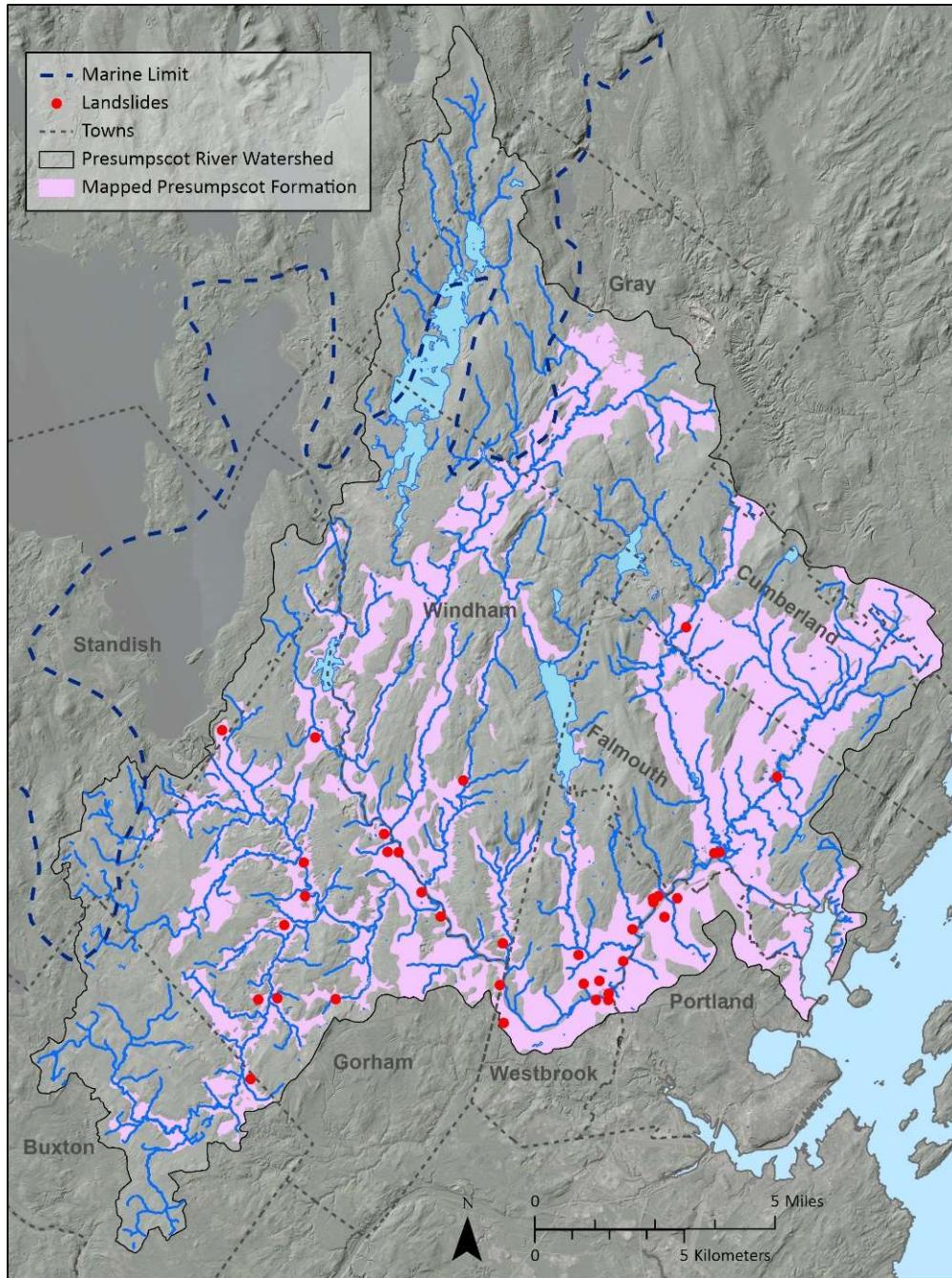
Typical Presumpscot Formation Landslide Morphologies

Rotational**Spread****Flow**

Typical Contributing Factors

- **Water** (reduced shear strength)
- **Steep, unsupported slopes** (freshly eroded riverbanks, excavated areas)
- **Weight** (water, structures, large trees)
- **Vibration -> Presumpscot Formation liquefaction** (earthquakes or humanmade)
- **Combination of above**



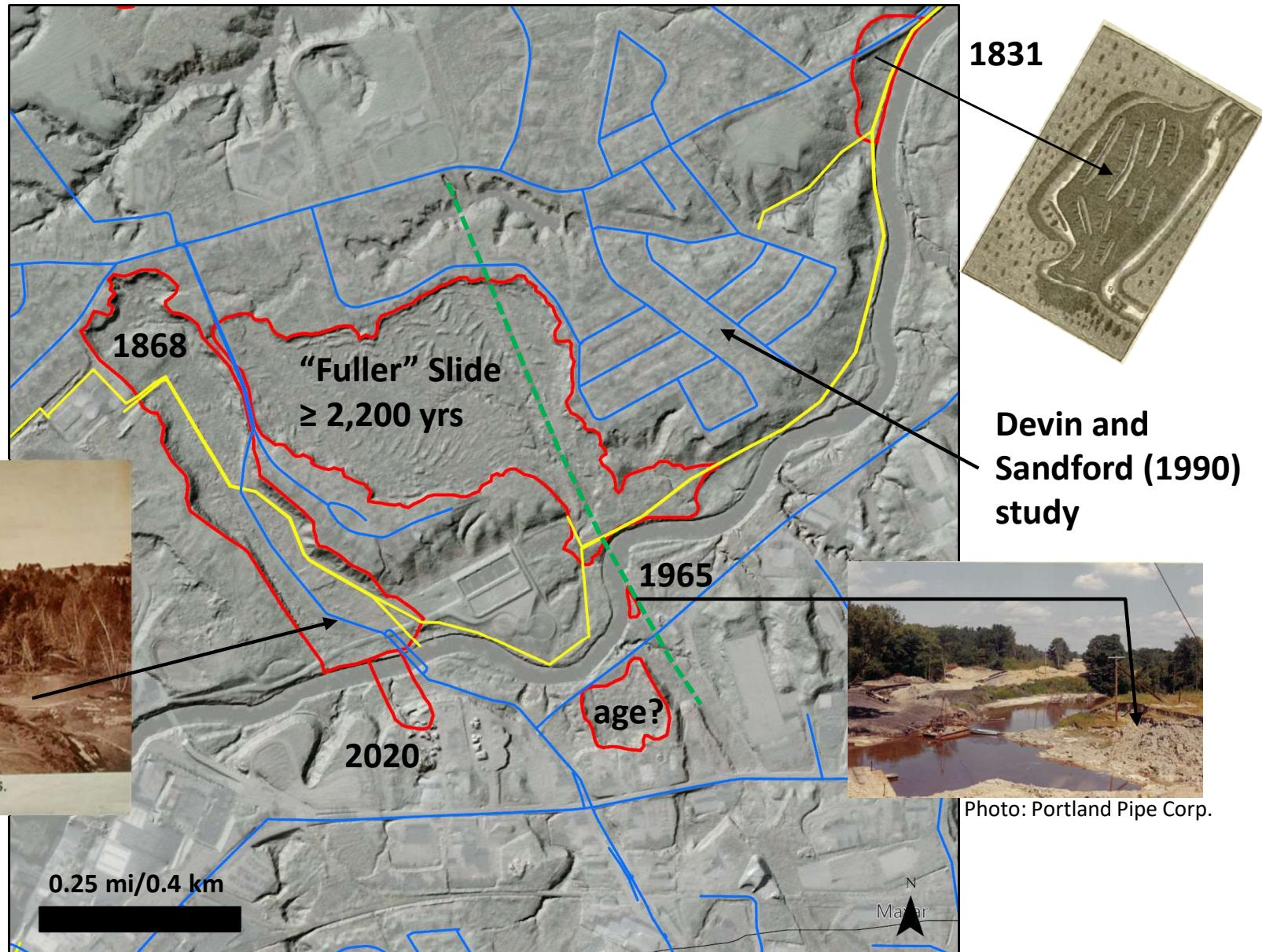


Local Context: Presumpscot River Watershed

- 35 landslides
 - 3 modern
 - 2 historic
 - 4 prehistoric
 - 26 unknown age
- Disturbed area (acres):
 - Mean: 31
 - Max: 321
 - Min: <1
- All related to Presumpscot Formation.
- Mostly along rivers/streams.

Local Context: Westbrook 2020 Event**Line legend:**

- **Red:** Landslide Extents
- **Blue:** Water
- **Yellow:** Sewer
- **Green:** Gas (approx.)

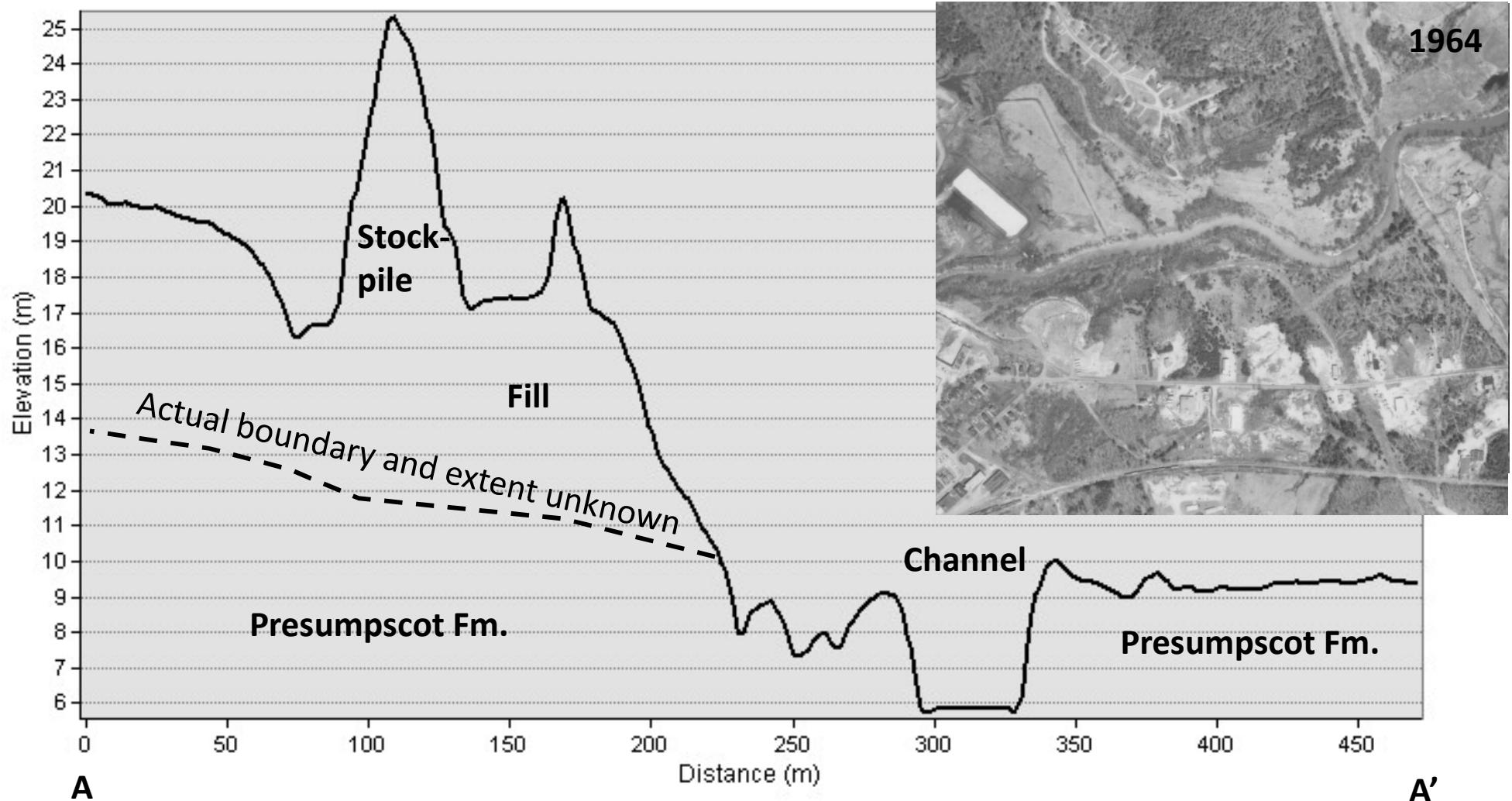


2020 Event Local Geology: Fill over Presumpscot Formation

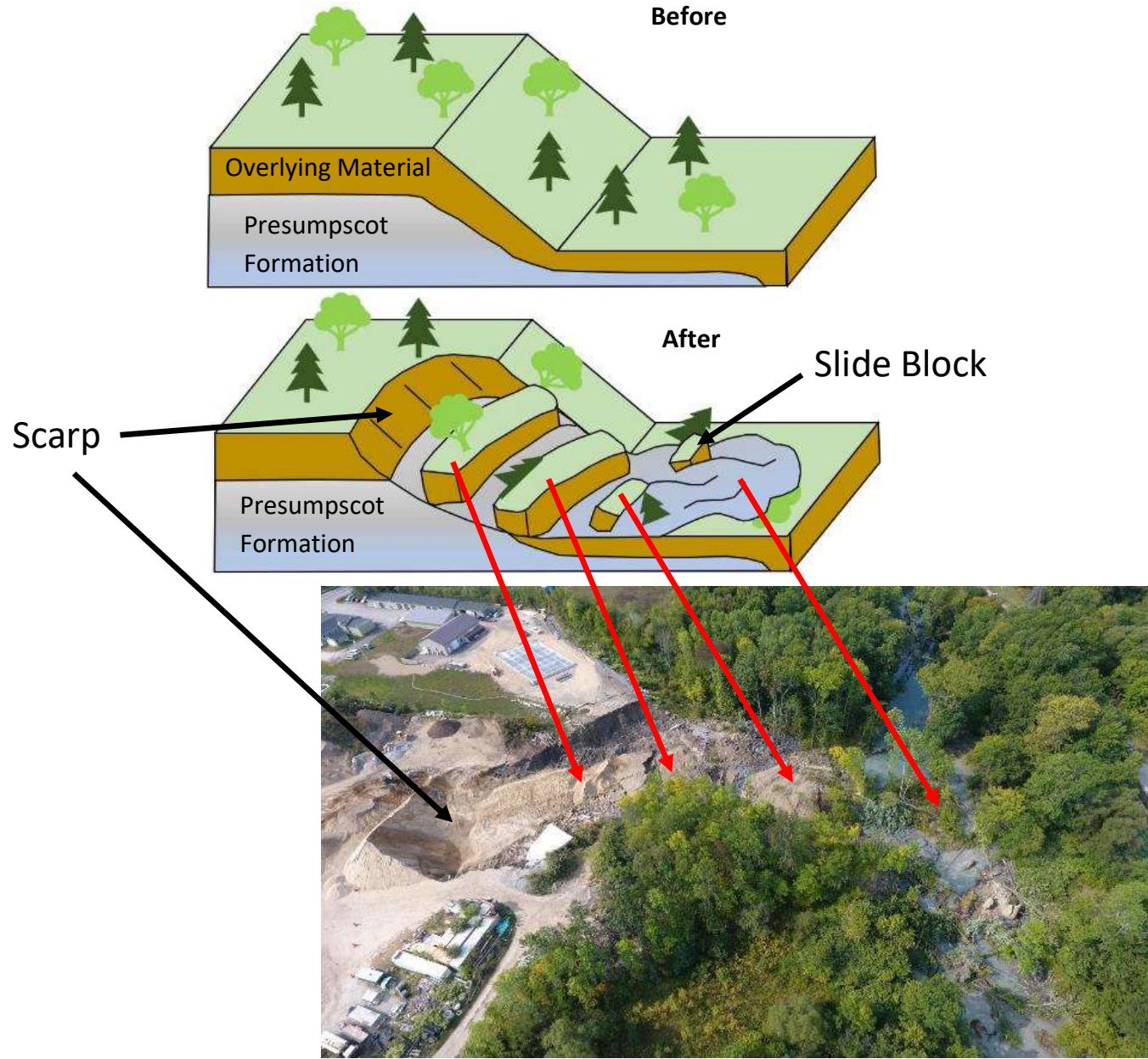


Photo: SAPPI or City of Westbrook

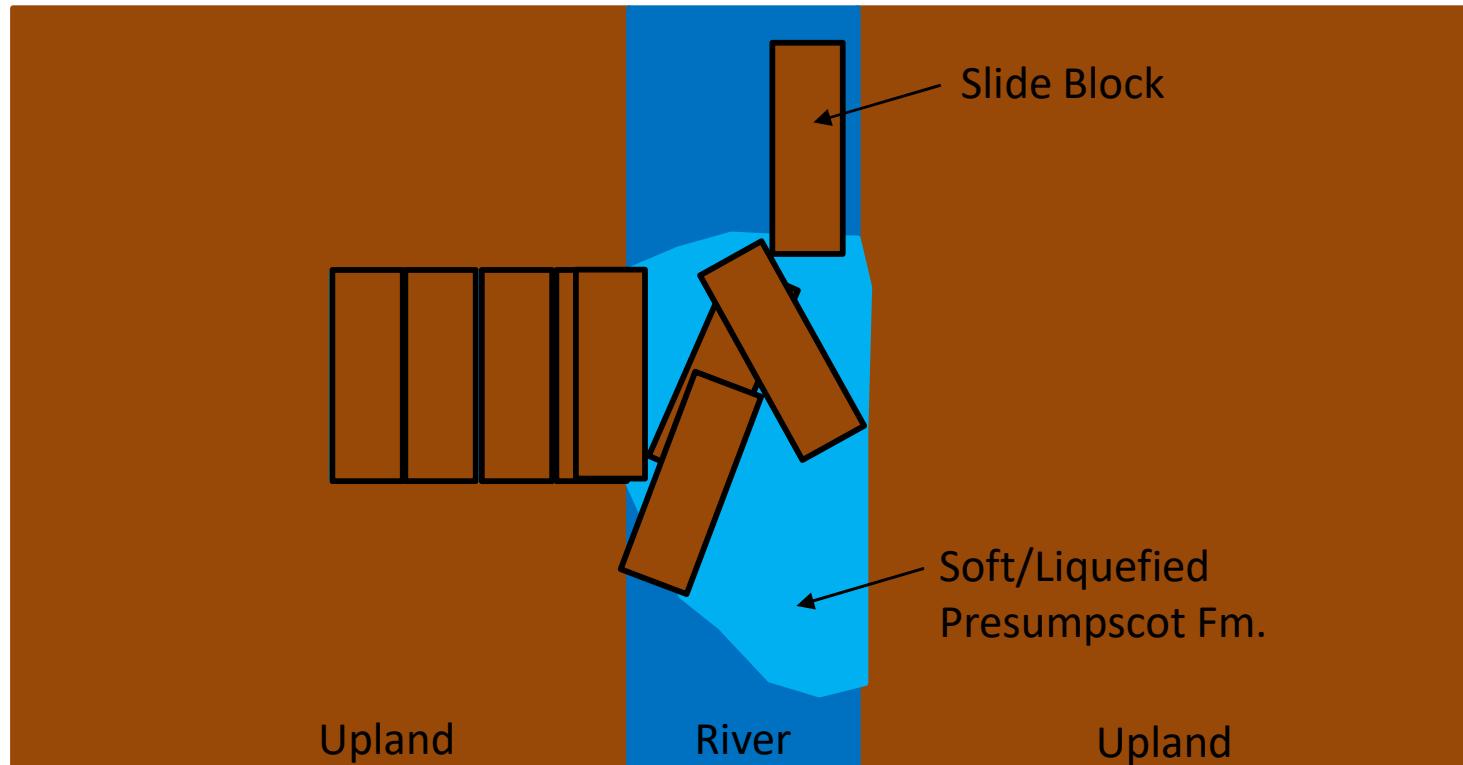
Pre-Landslide Lidar Cross Section



2020 Event Landslide Morphology: Retrogressive Spread



Retrogressive Landslide: Map View



Rafted Slide Blocks -> Islands



Photo: SAPPI or City of Westbrook

Rafted Slide Blocks -> Islands



Known Factor: PRESUMPSCOT FORMATION



Possible Factor: Overburden Weight

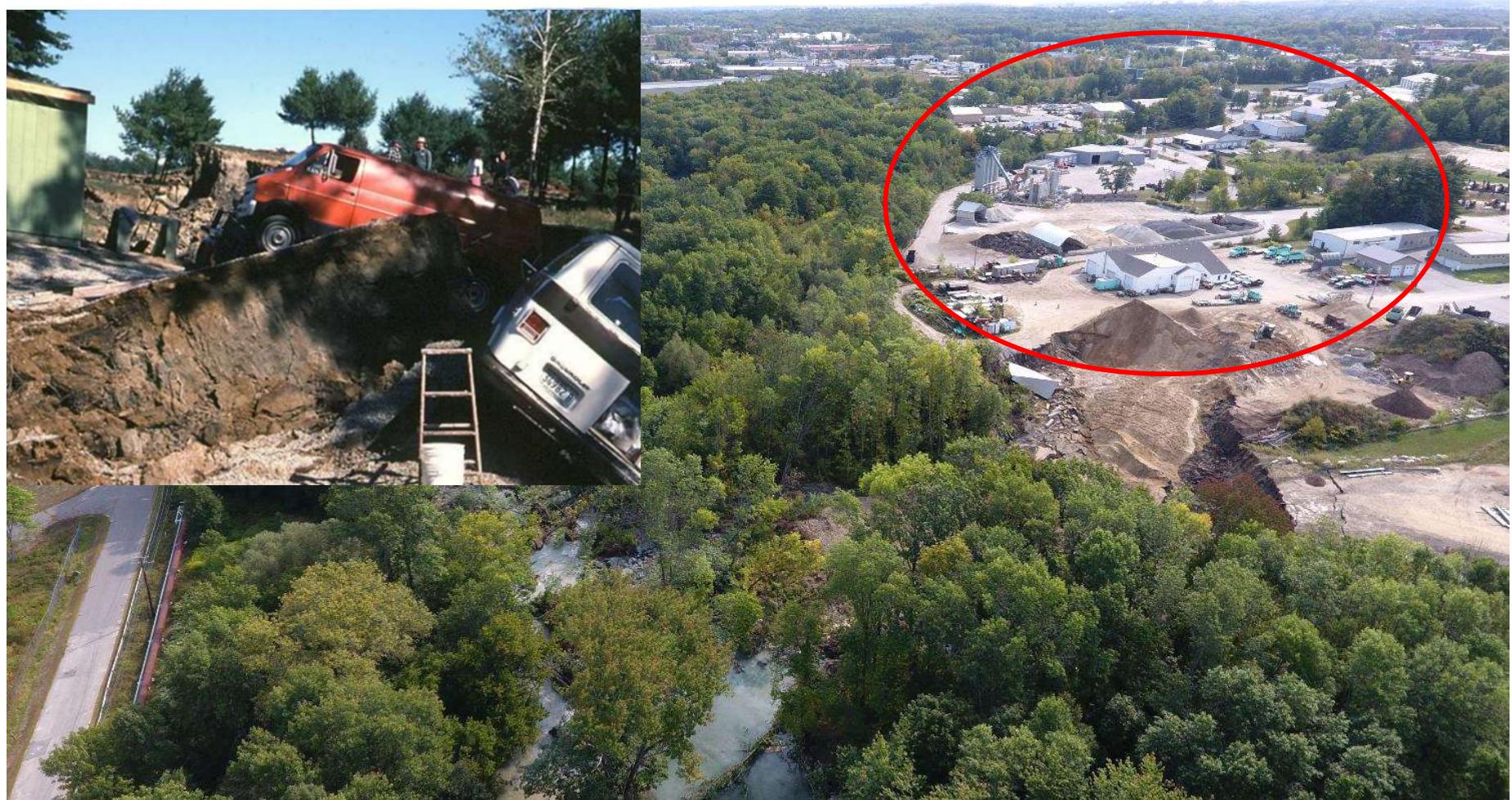


Photo: SAPPI or City of Westbrook

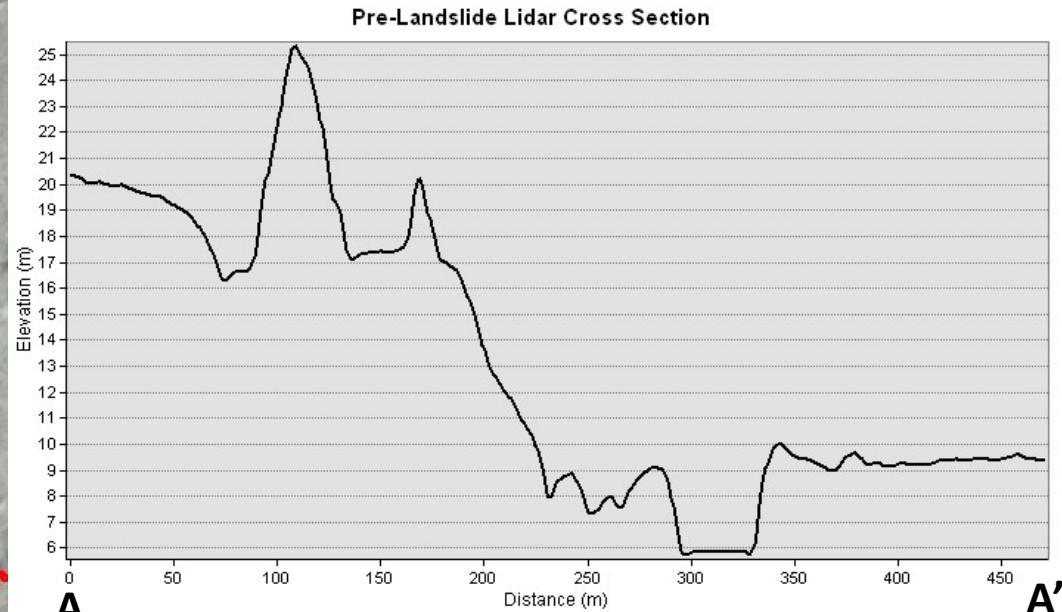
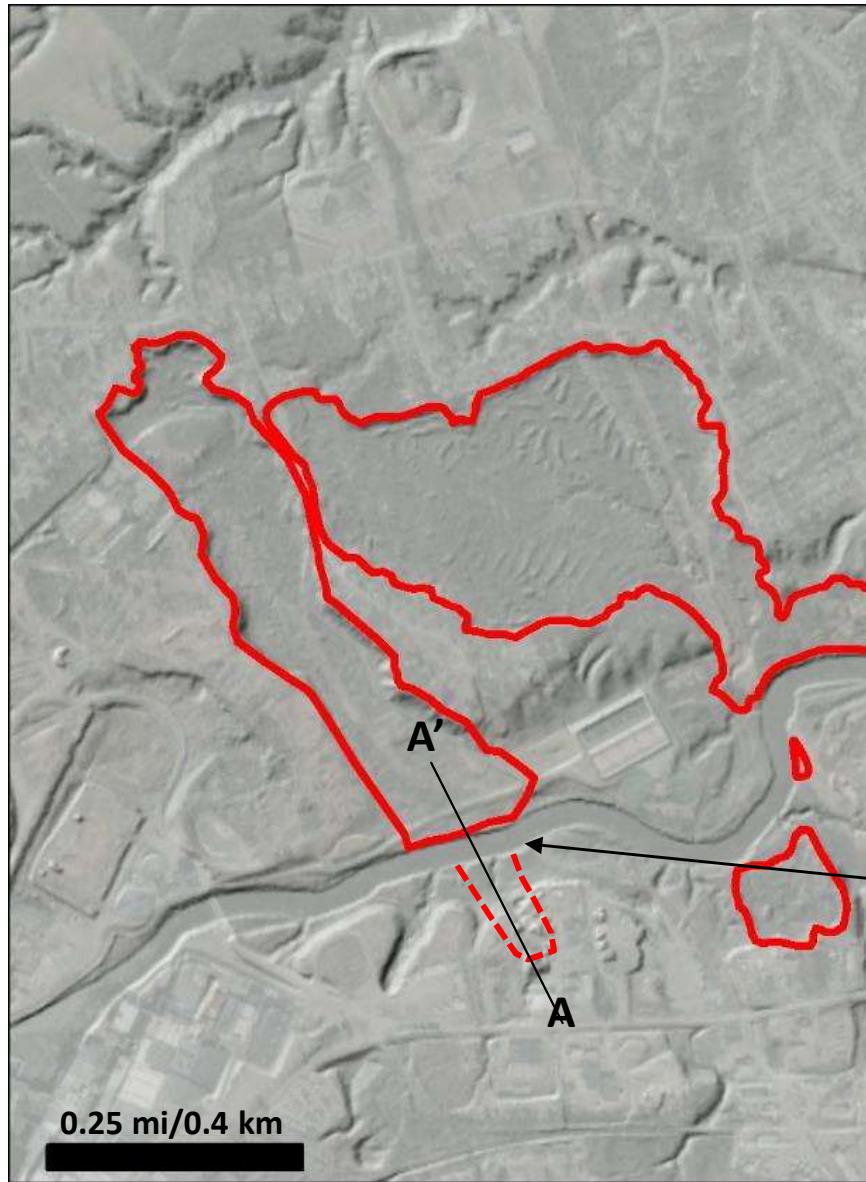
Possible Factor: Overburden Weight



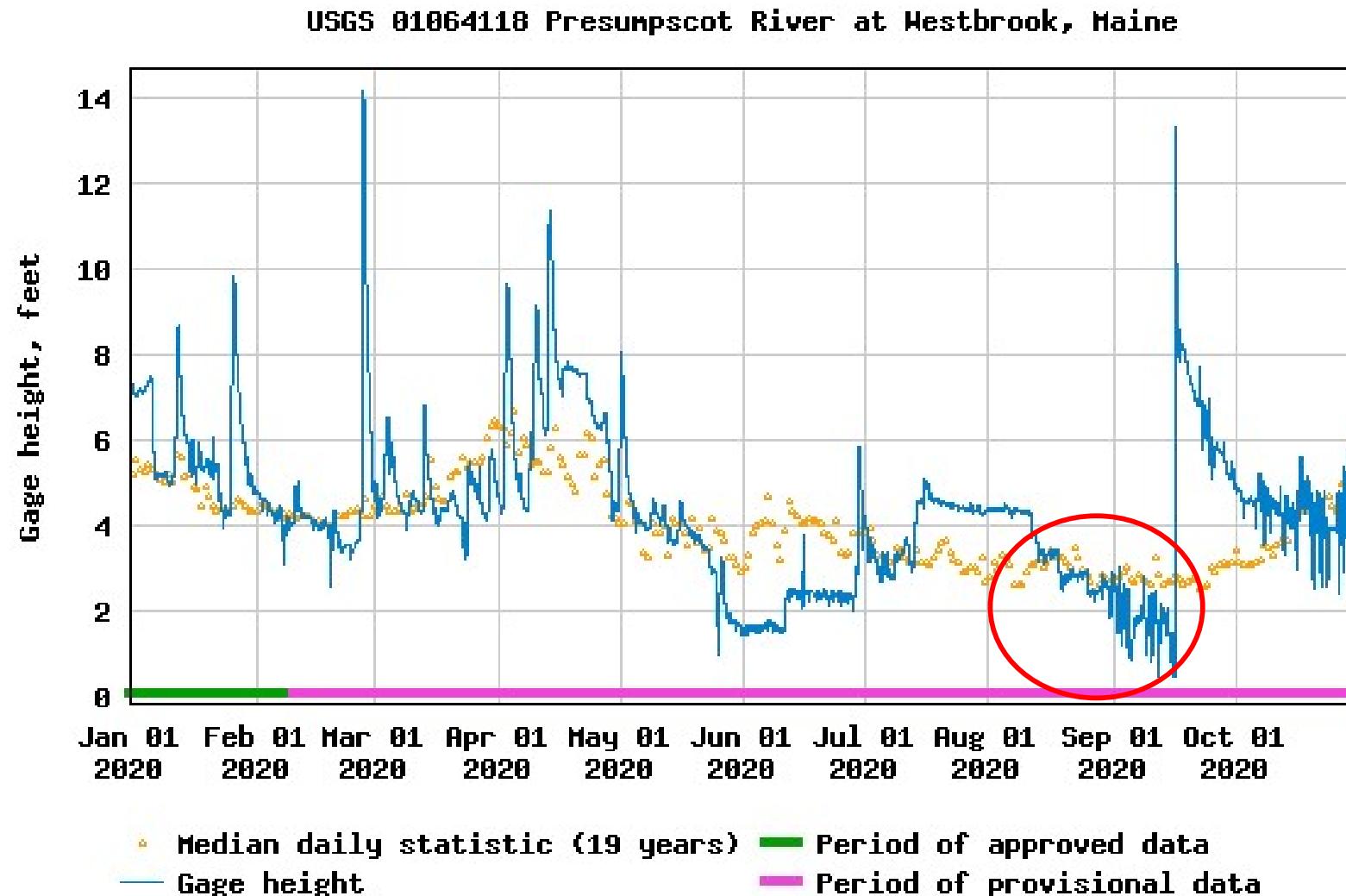
Possible Factor: Vibration



Possible Factor: Exposed Banks



Possible Factor: Exposed Banks



More Information:

- Maine Geological Survey Landslide Page:
 - <https://www.mainegov/dacf/mgs/hazards/landslides/index.shtml>
- Maine Geological Survey Webmap (easily browse lidar and popular datasets):
 - <https://experience.arcgis.com/experience/cfbc9177649b466795c1f0d3f18f1f40>

