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**To:** Logan Perron, District 7 PM  
**From:** Callie Ewald, P.E., Geotechnical Engineer  
**Date:** December 22<sup>nd</sup>, 2023  
**Subject:** St. Johnsbury – VT 2 MM 7.0 Slope Instability

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As requested, Geotechnical staff have performed a site assessment of the slope instability adjacent to the eastbound lane on the south side of Route 2 at approximately MM 7.0 in St. Johnsbury, VT. The landslide occurred on December 18<sup>th</sup> during a heavy rain event and included several large trees, shrubby debris, and overburden material sliding down slope and into Route 2 requiring a full road closure. Maintenance forces were able to clean up the debris, re-establish the ditch, and cut the larger trees still on the slope to open the road to the travelling public. The site assessment took place on December 21<sup>st</sup> approximately two days of dry weather post failure.

The slope appears to be approximately 50 feet in height and about 60 feet in width at the ditch line as shown in Figure 1. The apparent mechanism of failure is gully erosion, where the soil is eroded by large water flows. This particular site was likely a combination of gully erosion and saturated overburden soils sliding on the harder glacial till material beneath it. An incised narrow channel can be seen in the upper half of the slope. Several factors contribute to a slopes susceptibility to gully erosion, including topography, land use, soil types, and surface run-off velocity and volume. Several of these factors were identified and are discussed herein.



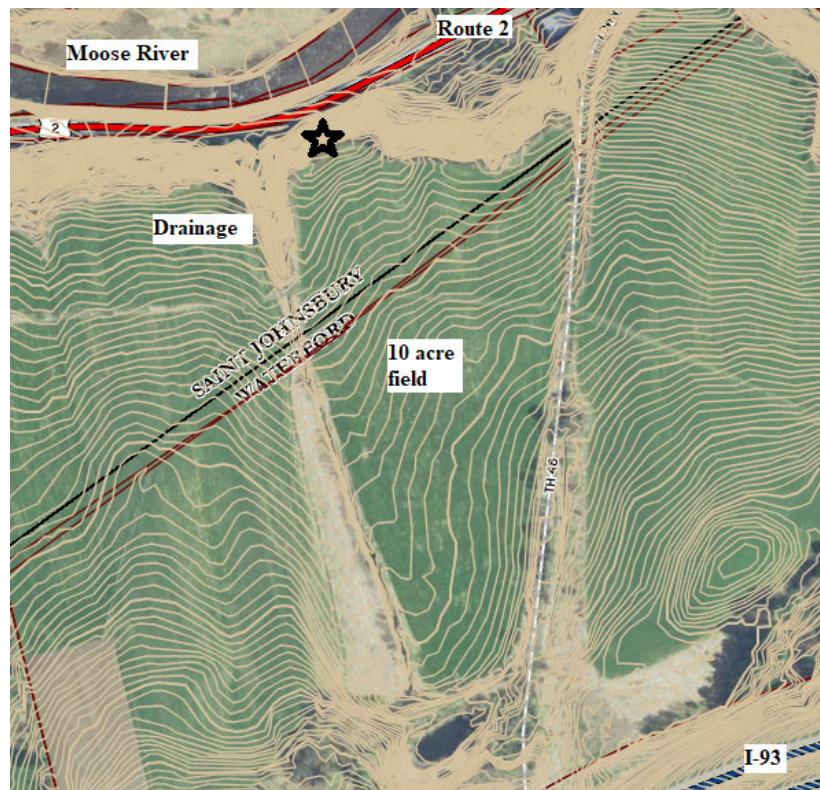
**Figure 1.** Slope looking South, gully erosion characteristics present in upper half of slope

A review of historical google street views show that this general vicinity has been experiencing similar distress dating back approximately 10 years. Figure 2 below shows an area directly east of this current slide which exhibited a slope failure before the summer of 2014. It appears a surficial slide occurred removing the slope of heavy vegetation and stone fill was placed on the lower half to provide some erosion control and confinement to the exposed soils. A few other gully type features and drainages can be seen along this stretch of slope adjacent to Route 2.



**Figure 2. July 2014 Google Street View (left) December 2023 Photo (right)**

The exposed soils in the failure area appear to consist of a hard glacial till, composed of various grain sizes of sands, clays/silts, and cobbles intermixed. This aligns with the 1970 surficial map that shows the area as Till. The topography of the area is illustrated in Figure 3 below. There is an approximately 10 acre grass field on top of the slope with the grade of the field sloping toward the northwest, directly above the slide area. Upon inspection of the crest of slope and field, remnants of sediment transported and left from large water flows could be seen in the grass just inside the grassy field from the crest of slope (Figure 4). It is apparent that during the heavy rain event, the saturated soils were not able to absorb excess water, and the water was likely funneled toward the low point of the field and onto the slope in a concentrated manner.



**Figure 3. Plan view showing large field, star denotes failure area**





**Figure 4.** Looking east, note sediment deposited during heavy rain

It is our opinion that based on the failure mechanism and the soils present on site, the existing slope is temporarily stable. Rain events will continue to erode the soil and undermine the root/vegetation mat, but the trees have been removed and any sloughing should be managed by the ditch. In terms of a more permanent solution to this site, we recommend that a hydraulics/hydrology analysis be conducted to understand the surface run-off that this slope is experiencing and strategies to disperse the water. Any solution here should involve diverting the flow of water to a more stabilized drainage pathway and away from the erosion prone gullies.

Once the water run-off issue is dealt with, the existing slope simply requires standard stabilization strategies. The slope will require a survey and a couple borings and/or hand sampling to develop an appropriate mitigation which will likely utilize re-grading and some stone fill and vegetative erosion control techniques to re-establish the slope and promote vegetation. There appears to be some real estate to grade the slope appropriately in this area but the survey will help to understand feasible alternatives.

Once survey is acquired, the Geotechnical Section can design an appropriate investigation to gather information for design and then we can discuss permanent options for stabilization with you.

If you have any questions about this information or would like to discuss it further, please call me at 802-595-4589.