

To Laurence Becker, Vermont State Geologist
From: George Springston, Research Associate, Norwich University
Date: August 15, 2012
Subject: Slope Stability Issues in Barre City, May, 2011

Heavy rainfall on the evening of May 26, 2011 resulted in extreme flooding in parts of central Vermont. Coming on top of an extremely wet spring, this rain appears to have been the trigger for several slope failures in Barre City. After your initial response on May 29 and 30, I went out to several sites with you and Dave Gladding from the Barre City Fire Department. The sites we visited are described below. I returned on June 3 and visited these and additional sites with John Lens of Geodesign. John made a number of recommendations to the city that are not included in this memorandum.

Hilltop Avenue

We examined three properties on Hilltop Avenue (Numbers 15, 17, and 21). Active, shallow, translational sliding has occurred at the top of slope, severe ground fracturing is visible behind each of these houses. The ground is pulling away and dropping down from the back sides of foundations and some foundation cracks are visible. This slope instability is threatening the stability of the houses and associated outbuildings. See the photos below.



Landsliding behind houses at Hilltop Avenue Three fresh fault scarps are visible, indicating recent and ongoing slope failure.



Another view of the active slope failures at Hilltop Avenue.



Soil pulling away from the rear of a foundation at Hilltop Avenue.



A fracture in soil in the woods below Hilltop Terrace.



View from below looking up at cracked foundation of garage, Hilltop Avenue.



Slope instability behind houses at top of slope behind houses on Hilltop Avenue. Note landslide scarp to left of stone foundation.

Kirk Street

We examined the entire slope below Hilltop Avenue in order to evaluate risks to houses below on Kirk Street. At the time of our examination, the City had emergency evacuation orders in effect for houses close to the base of the slope. These were subsequently lifted.

13 Foster Street

A translational landslide approximately 41 feet high has developed on the back side of Number 13, Foster Street. River Street runs along the base of this slope. Note that the base of the slope is reinforced with a retaining wall, indicating that slope stability has been a problem here in the past. The foundation of the house did not, however, appear to be immediately threatened. To the east of this house the soil shows indications of cracking, and further evaluations should be undertaken. A house on River Street below this site could possibly be at risk. Surface water runoff from Bassett Street could be adding to the wetness of the main slope failure at this site.



Cracks in soil behind #13 Foster Street. Main scarp is to the left.



Top of main scarp at #13 Foster Street.



Looking down onto River Street at the main translational slide at #13 Foster St.



View from River Street of the retaining wall at the base of the slide behind #13 Foster Street.

Recreation Path Site Near Park Street School

Fresh fractures in the paved recreation path indicate active subsidence. Water appears to be piping around the culvert below this spot, thus removing soil and leading to collapse. The site may actually be in Barre Town rather than Barre City.



Fractures in Recreation Path. These appear to be resulting from subsidence due to piping of water around the culvert under the site.



Outlet to the culvert on the recreation path.

21 Queen Street

We examined a report of slope instability behind #21 Queen Street, but saw no clear signs of slope failure. Minor settlement of a propane tank and tilting of a fence has occurred at the site and the residents were going to keep the Fire Department informed if any changes occurred at the site.

House on West Patterson Street

Severe bank erosion was observed behind a house on West Patterson Street (I did not get the house number). This site is on a steep bank above Gunner Brook. The bank is about 23 feet high, with an angle of 48 degrees from horizontal. An episode of stream erosion several years ago resulted in slope failure at the site. In the week since the May26 storm, renewed fracturing of the soil at the top of the slope has occurred. The fractures are within 7 feet of the house and pose a severe risk to the future stability of the building.



Fracturing of soil behind the West Patterson Street house. Gunner Brook in the background.



The top of the slope at the West Patterson Street house. Note that the bank at the fence is failing.



Fractures at the top of the slope at the West Patterson Street house. The house is immediately to the left. Looking upstream on Gunner Brook.

Landslide on West Patterson Street

An active rotational slump-flow type of landslide is located on West Patterson Street. A crack in the soil was observed about 6 feet behind the existing scarp, indicating a strong likelihood of future movement.



Rotational slump landslide above West Patterson Street. Looking up at scarp (in shadow).



West Patterson Street landslide viewed from above.

Retaining Wall on Merchant Street

We observed some undermining of stones at the outer edge of the pavement, but no sediment washing out from the base of the wall below. This appears to be a road maintenance issue rather than a significant slope failure.

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