

To: Laurence Becker, Vermont State Geologist

From: George Springston, Research Associate, Norwich University

Date: 9/3/2007

Subject: Erosion along Crosby Brook in Brattleboro

On July 31, 2007 I examined several stream bank erosion sites in Brattleboro with Marie Caduto, Vermont DEC Watershed Coordinator, and Gary King of the Brattleboro Public Works Department. Figures are shown in the Powerpoint presentation that accompanies this memo. Site locations are shown in Figure 1 of the presentation. Sites NF-1A to D are along the main stem of Crosby Brook, a tributary of the Connecticut. The brook shares this part of the valley with Kipling Road and Black Mountain Road. These sites are roughly 0.5 to 1.0 km west of the intersection of U.S. Route 5 and State Route 9 (the rotary). Site NF-2 is a drainage ditch that flows westward into a northern branch of the brook and is located about 1.0 km NNE of the rotary near the Dummerston/Brattleboro town line.

Observations

Site NF-1A is a 40-foot-high landslide on the outside of a bend on the west (right) bank of the brook (Figure 2). The materials consist of 30 feet of pebbly coarse sand, overlying 8 feet of sands, ranging from coarse to very fine, with minor silt and silty clay (Figure 3), overlying 2 feet or more of dense, silt-matrix till. Given the variable bedding orientation and the rapid variations in grain size, it appears that the materials overlying the till have formed in an ice-contact setting (something like an esker or kame terrace deposit). The east (left) bank at this bend is composed of alluvial materials.

Downstream of the slide we observed at least two headcuts, one of which appeared to have cut through recent alluvium and was incising into sands (ice-contact?) below. In order to understand the long-term stability of the slopes at this site it will be important to understand the extent of downstream grade control and whether or not incision is a dominant process at this site. Even a small amount of incision (1 to 2 feet) at site NF-1A may lead to increased landsliding.

Proceeding up the brook, we observed that the gradient of the stream increased and the size of the bed material shifted from sand and fine gravel to coarse pebble and boulder gravels.

Turning west onto Black Mountain Road, we observed a roughly 35-foot-high landslide in dense, silt-matrix till on the south side of the brook at Site NF-1B (Figure 4). A partly healed landslide scar at this site indicates that it was active in earlier years, stabilized, and has now become active again. Note that the weathered upper parts of this till (upper 2 to 4 feet) are more erodible than the lower, less weathered parts. Thus, landslides in this material tend to be fairly shallow.

Bedrock is exposed on the north side of the road just upstream of this site.

Dense till is again exposed at the base of a gully on the south side of the brook (Figure 5).

Bedrock grade control is first observed in the stream roughly 75 feet downstream of a bridge. At the bridge, the stream flows over a bedrock cascade (Site NF-1D). Although the main stream here is not subject to downcutting, we did observe that the roadside ditch flowing into the stream from the north was beginning to headcut (Figure 6).

Site NF-2 is located to the southwest of the Pepsi bottling plant. This is a drainage ditch which flows generally westward to the floodplain of the northern branch of Crosby Brook. It appears that as originally dug, the ditch was shallow and carried water up to the edge of the valley of the brook, where the water would then have dropped over the edge onto the floodplain of the brook. However, the materials that make up the gully walls and floor (and the slope above the floodplain of the brook) are varved lacustrine silt and silty clay with no apparent bedrock exposures (Figures 7 and 8). The edge of the valley was thus a knickpoint in erodible materials. Headcutting back from this knickpoint has created a gully about 15 feet deep and has clearly eroded a large quantity of sediment. Some of the sediment has been deposited on a low alluvial fan that has developed on the former floodplain of the brook (Figure 9), but much appears to have been carried on to the brook.

Recommendations:

The likelihood of incision should be evaluated at NF-1A. Incision would lead to an increase in the effective bank height and further loss of floodplain access and would be very likely to lead to increased landsliding at this site. Although only of moderate severity at the moment, the slide at NF-1A could become much larger.

The slope instability alongside of the brook from NF-1B to D (along Black Mountain Road) is fairly moderate at present. These slides are certainly contributing sediment to the system, but the dense till is about the least erodible surficial material we have and at least it contributes some boulders as well as finer-grained materials. Given the presence of bedrock grade control from about NF-1D upstream, incision is unlikely to be a problem in the higher parts of the stream, although lateral erosion remains a possibility. Although the valley is quite narrow, perhaps some ways can be found to restore some floodplain access. At the very least, further roadway expansion should be avoided and sediment runoff from the road surface and banks should be minimized.

Perhaps the most important long-term action may be to carefully plan any future development in the watershed as any increase in stormwater runoff into these reaches of the brook would be likely to exacerbate the problems.

The incising ditch at NF-2 is clearly a significant source of sediment and should be stabilized as soon as possible.

Please let me know if you have any questions.

cc: Marie Caduto, Vt. DEC Water Quality Division, Watershed Coordinator; Shannon Pytlik, Vt. DEC, Water Quality Division; Fred Nicholson, Vt. DEC Water Quality Division, Stream Alteration Engineer

Figure 2. Site NF-1A. Shallow landslide in ice-contact sands over till on west side of Crosby Brook.



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Figure 3. Highly erodible ice-contact sands at NF-1A.



Figure 4. Site
NF-1B. Shallow
landslide in
dense, silt-matrix
till on south side
of Crosby Brook.



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Figure 5. Site NF-1C. Closeup of dense, silt-matrix till in bed of Crosby Brook.



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Figure 6. Ditch beginning to erode at bridge upstream of NF-1D. Looking west toward road.

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Figure 7. Heavily incised drainage ditch at Site NF-2. Looking east.



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Figure 8. Varved silt and silty clay in drainage ditch at Site NF-2.

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Figure 9. Alluvial fan of sediment from incising ditch at Site NF-2. Looking west toward Crosby Brook.



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