Neversink River East Branch

MANAGEMENT UNIT 3

Summary of Post-Flood Recommendations

Intervention Level	Assisted Restoration of the bank erosion site between Station 8900 and station 8560 (BEMS ID # NEB3_8800, BEMS ID # NEB3_8700, and BEMS ID# NEB3_8500). Passive Restoration of the bank erosion site between Station 8220 and Station 8195 (BEMS ID # NEB3_8200). Full Restoration of the bank erosion site between Station 7050 and 6790 (BEMS ID # NEB3_6800). Passive Restoration of the bank erosion site between Station 6200 and Station 6040 (BEMS ID# NEB3_6000). Full Restoration of split channel section impacted by emergency restoration efforts from Station 5700 to Station 4500 in EBMU2.
Stream Morphology	No change.
Riparian Vegetation	No change.
Infrastructure	No change.
Aquatic Habitat	No change.
Flood Related Threats	No change.
Water Quality	None.
Further Assessment	Include EBMU3 in comprehensive Local Flood Hazard Mitigation Analysis of Claryville MUs.

Stream Channel and Floodplain Current Conditions

The following description of stream morphology is the result of a survey conducted in December, 2011. "Left" and "right" references are oriented looking downstream, photos are also oriented looking downstream unless otherwise noted. Stationing references, however, proceed upstream, in feet, from an origin (Station 0) at the confluence with the Neversink Reservoir. Italicized terms are defined in the glossary.

As the stream flows close to the right valley wall for this entire management unit, the valley floor on the left side of the stream continues to widen throughout EBMU3, maintaining a well-connected left floodplain.

A significant amount of infrastructure development exists in this floodplain, with a narrow vegetated riparian buffer in many locations. As a result, the buildings and roads in this area are at a very high risk of inundation during flood events and subsequent property damage. The right valley wall receives relatively high erosive forces during flood events in a number of reaches. This has resulted in several eroding bank segments on the right bank and excess sediment supply in this management unit.

Slope failure on the right bank across from cobble point bar. (IMGP1744)

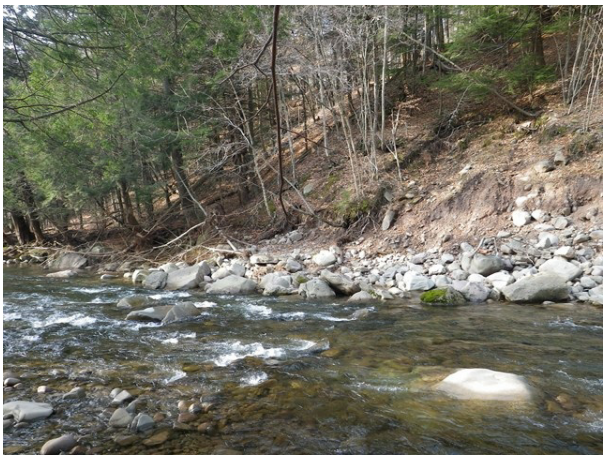
A 440-foot long eroding bank segment with a maximum height of 55 feet from the stream bed was documented extending from Station 9000 to Station 8560 on the right bank across from a cobble point bar. This slope failure was previously documented as three individual eroding bank segments, BEMS ID # NEB3_8800, BEMS ID # NEB3_8700, and BEMS ID# NEB3_8500, which have connected due to hydraulic erosion during flood events since 2010.

Prior to recent flooding, large boulders and sedges had accumulated at the toe of this slope so it was anticipated that this site would remain stable. However, hydraulic erosion due to high near-bank velocities during recent flood events has extended this eroding bank segment and led to slumping from higher elevations on the slope. Therefore, *assisted restoration* is recommended for this site, including installation of a *bankfull stage* bench at the toe of the slope and use of bioengineering techniques to vegetate the exposed slope and reduce erosive forces on the bank during high flow events.

At Station 8220, water that is draining from upland sources through the bank is eroding and washing out finer soil particles (BEMS ID # NEB3_8200). During the initial stream survey in 2010 it was documented that a large percentage of the slope had re-vegetated naturally (See Picture A358 on page 8 for pre-flood condition). However, due to increased surface runoff from upland sources during recent heavy precipitation events and increased hydraulic erosion at the toe of the slope during the resulting flood events, this eroding slope has newly exposed sediments.

During the 2011 post-flood survey, small boulders were documented extending from the toe of the embankment, which may reduce near bank shear stress and hydraulic erosion at the toe. This rock may serve as a base for the accumulation of additional rock from higher on the slope, which may eventually reach a higher stage than the floodplain on the left bank, effectively hardening the toe of the bank. This natural toe

protection could allow the bank to continue to stabilize without treatment (*passive restoration*). However, it is recommended that this site be monitored for future changes in condition.



Stabilizing slope failure on the right bank. (IMGP1751)

As the channel approaches a hard left turn, there is a relatively severe slope failure that begins at Station 7050 and continues for approximately 260-feet until Station 6790 (BEMS ID # NEB3_6800). The glacial till that makes up this 40-foot high bank is exposed throughout the reach, and represents a source of fine sediment that can be entrained during high flows. The slope failure was most likely initiated by a spring seepage draining through the bank exacerbated by fluvial erosion at the toe of the slope. As the sediment particles become unstable, the bank fails under its own weight and large portions begin to slide down the slope. At the time of the 2010 inventory, several trees had either fallen to the base of the bank or were leaning with their root structures exposed. By the 2011 inventory the trees were gone entirely from the bank. The channel appears to have been overwidened.

Slope failure with exposed glacial till on the right bank. (IMGP1756)

Due to the severe angle of this bank, lack of scour protection at the toe and unstable channel dimensions, it is unlikely that this slope will stabilize without treatment. Therefore, *full restoration* is recommended for this site in order to alleviate hydraulic pressure on the bank and establish stability. This restoration effort could include installation of a *bankfull stage* bench at the toe of the slope, an increased radius of curvature, and removal of mature trees at the top of the bank that could fall and obstruct flow in the main channel. In addition, both in-stream structures like rock vanes and use of bioengineering techniques to vegetate the exposed slope could help reduce erosive forces on the bank during high flow events, until the bench develops mature vegetation.

The left bank begins to erode at Station 6200 and continues downstream for approximately 160-feet until Station 6040 (BEMS ID# NEB3_6000). (See Picture B319 on page 12 for pre-flood condition) Although the location of woods debris jams shifted slightly since 2010, it is likely that this erosion site is

still aggravated by the presence of large woody debris obstructions along the right side of the channel, which divert hydraulic pressure into the bank during high flows. As determined in 2010, the bank angle is not severe enough that it would indicate future failure, and large cobbles that have been exposed through the erosion process are now helping to armor the bank down to the toe. It appears that it is possible for this bank to stabilize without treatment (*passive restoration*). However, it is recommended that this site be monitored for changes in condition.

In 2010 an obstruction along the right bank at Station 5700 had caused a divergence of flow into a side channel in the right forested floodplain. (See picture B327 on Page 12 for pre-flood conditions). The side was mostly dry at the time of the 2010 inventory. This channel flows up against the right valley wall and continues to follow the course of this exposed bedrock before converging back with the main channel further downstream in EBMU2.

Emergency efforts to realign the channel in this stream reach to protect infrastructure following the recent flood events included construction of a berm across the main channel at this location to divert the majority of the flow into this side channel (Photo IMPG1760).

Berm in the main channel diverting flow into a previously dry side channel. (IMGP1760)

Side channel confined at upstream end by sidecast berms. (IMGP1768)

Appropriately sized main channel. Flow is diverted by a berm upstream. (IMGP1769)

This is perceived as a less threatening channel alignment; however, the side channel is undersized and cannot convey all of the flow during high flow events. As a result, sediment cannot be passed through the reach effectively, and is accumulates in the reach. This leads to channel shifting toward the left bank. Similar conditions occur just downstream opposite Claryville Post Office (Photo IMPG 1768).

Full restoration is recommended for this stream reach which extends to the convergence of the main channel and side channel near Station 4500 in EBMU2. The restoration should include removal of all berms in this stream reach to restore floodplain connectivity and re-establish an appropriate cross-sectional area for effective sediment transport. The majority of the flow should be returned to the appropriately sized left channel to prevent accumulation of bedload and channel shifting in the future. Flow deflection structures could be considered to prevent erosion of left bank.

As a part of the restoration designs for this management unit, it is recommended that this entire MU be included in a comprehensive Local Flood Hazard Mitigation Analysis to investigate hydraulics and sediment transport in the stream corridor, from Station 10500 through the Halls Mills covered bridge on the mainstem of the Neversink River, to develop options for reducing flooding threats to this relatively dense population center of the Neversink Valley.

EBMU3 ends in the middle of this stream reach at Station 5270 at the border between Ulster and Sullivan Counties.