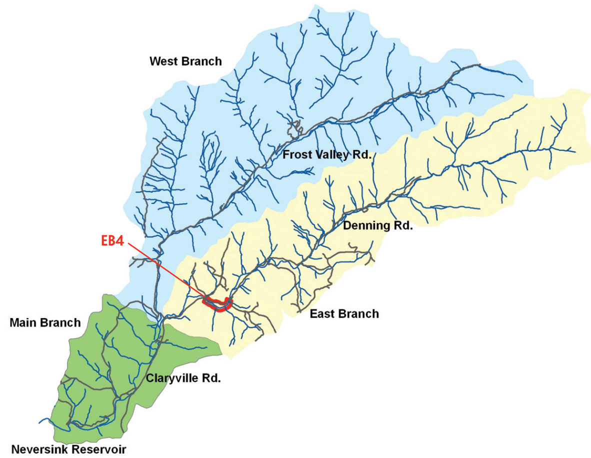
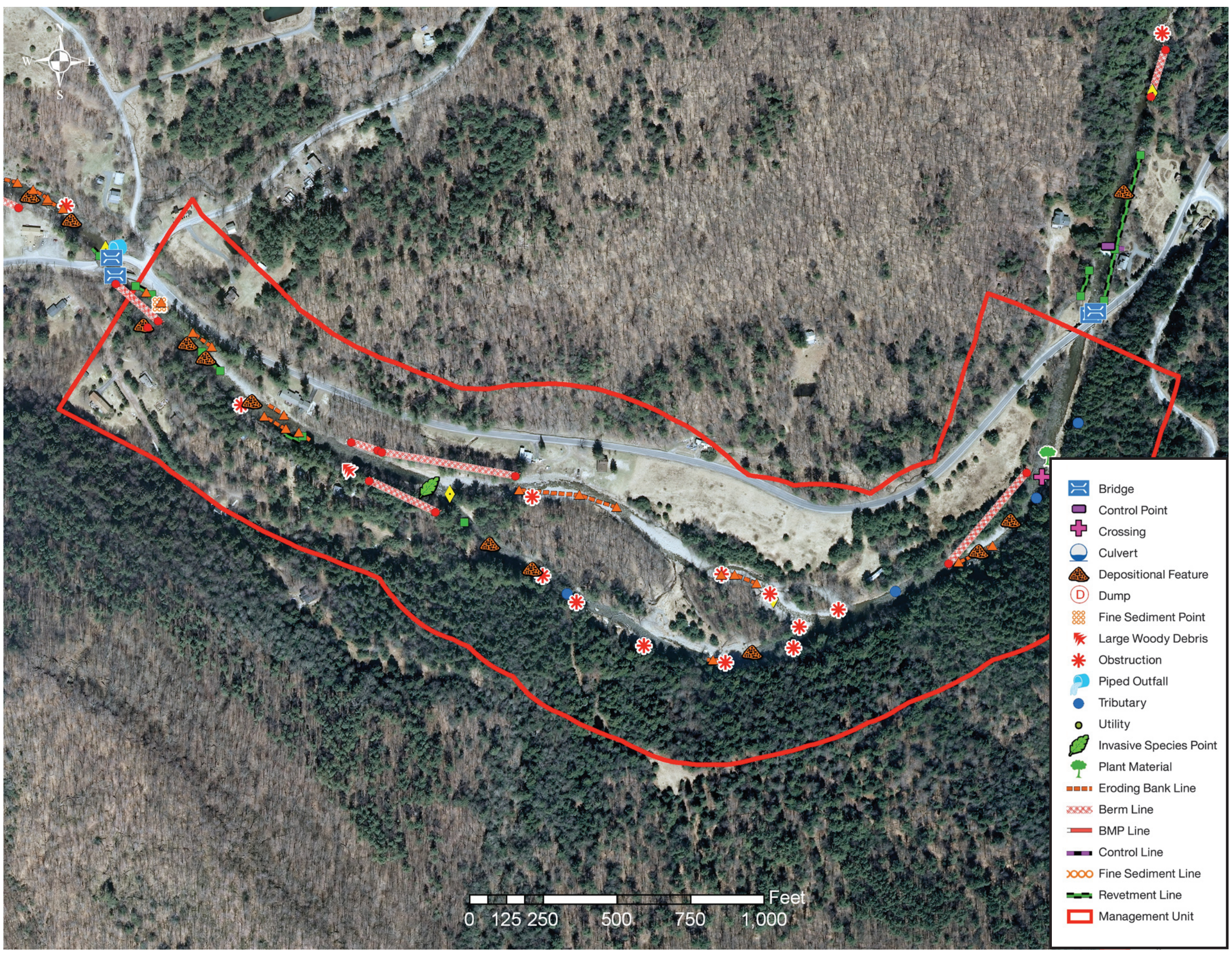
Neversink River East Branch

MANAGEMENT UNIT 4

STREAM FEATURE STATISTICS

- 12% of stream length is experiencing erosion
- 2.66% of stream length has been stabilized
- 18.74 acres of inadequate vegetation within the riparian buffer
- 350 ft. of the stream length is within 50 ft. of the road
- 5 structures are located within the 100-year floodplain boundary





Stream Feature Inventory 2010 (Figure 1)

Management Unit Description

This management unit begins at a bridge crossing of Denning Road, continuing approximately 4,211 ft. before the stream is again crossed by a bridge on Denning Road. The drainage area ranges from 23.0 mi^2 at the top of the management unit to 25.20 mi^2 at the bottom of the unit. The valley slope is 0.92%. The average valley width is 657.87 ft.

Summary of Recommendations East Branch Management Unit 4

Intervention Level	Passive Restoration of the bank erosion site between Station 12600 and Station 12475 (BEMS ID# NEB4_12500). Full Restoration of the bank erosion site between Station 11600 and Station 11475 (BEMS ID # NEB4_11500. Assisted Restoration of the bank erosion site between Station 11040 and Station 10700 (BEMS ID # NEB4_10700). Passive Restoration of the bank erosion site between Station 11510 and Station 11470 (BEMS ID # NEB4_11500). Assisted Restoration of the bank erosion site between Station 10020 and Station 9975 (BEMS ID # NEB4_9900). Assisted Restoration of the bank erosion site between Station 9940 and Station 9855 (BEMS ID # NEB4_9800). Assisted Restoration of the bank erosion site between Station 9550 and Station 9470 (BEMS ID# NEB_9400). Assisted Restoration of the bank erosion site between Station 9340 and Station 9280 (BEMS ID# NEB4_9300).
Stream Morphology	Assess sediment deposition from the accumulation of large woody debris supplied by the watershed upstream. Conduct baseline survey of channel morphology.
Riparian Vegetation	Improve riparian buffer between Station 13200 and Station 10600. Assess and monitor invasive population of Japanese Barberry at Station 10450.
Infrastructure	Investigate flood threats to Denning Road. Assess ability of Denning Road bridges to effectively convey flood flows.
Aquatic Habitat	Fish population and habitat survey.
Flood Related Threats	Assess threats to building structures in 100-year floodplain.
Water Quality	None
Further Assessment	Long-term monitoring of erosion sites.

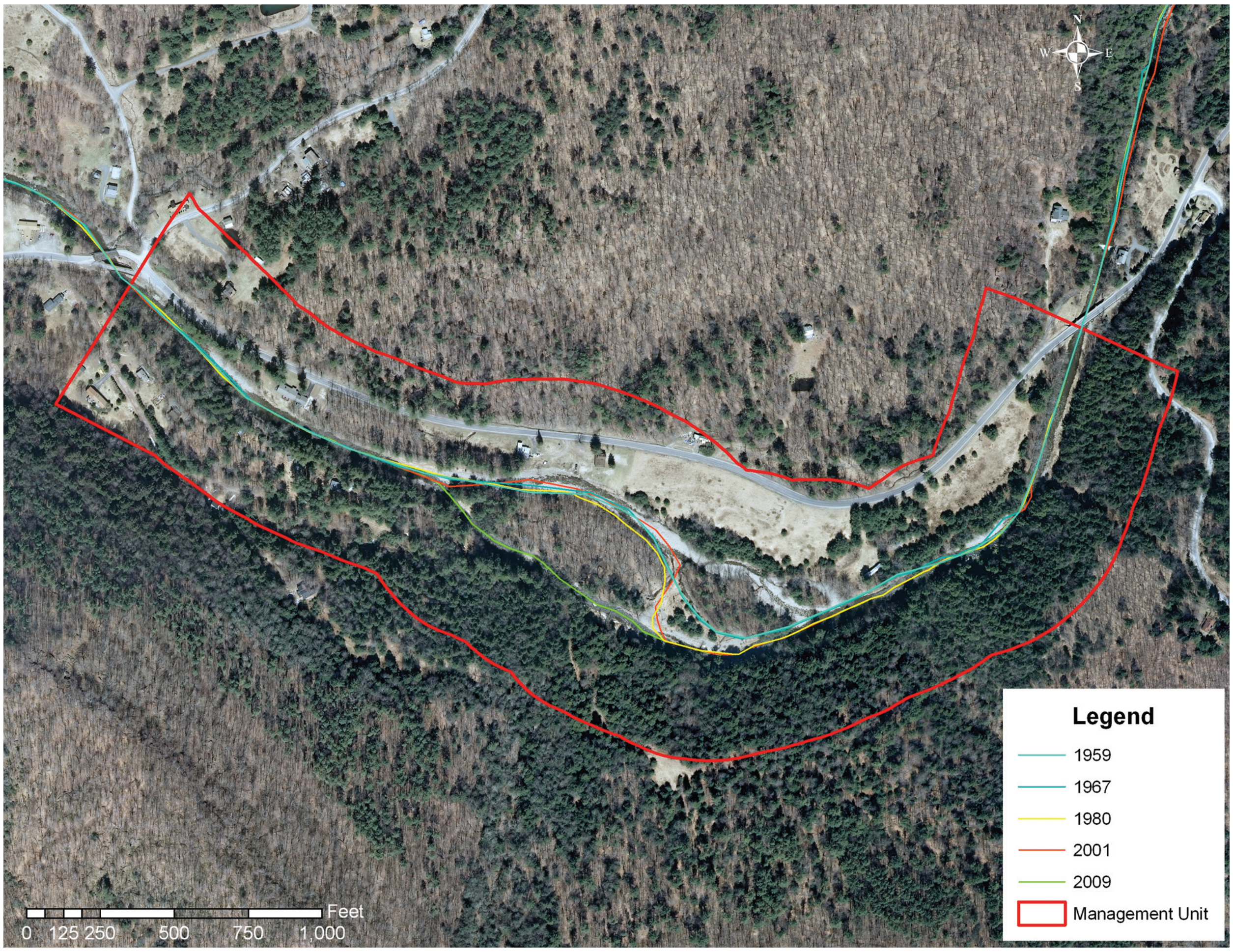
Historic Conditions

As the glaciers retreated about 12,000 years ago, they left their "tracks" in the Catskills. See Section 2.4 *Geology of Upper Neversink River,* for a description of these deposits. These deposits make up the soils in the high banks along the valley walls on the Neversink mainstem and its tributaries. These soils are eroded by moving water, and are then transported downstream by the River. During the periods when the forests of the Neversink watershed were heavily logged for bark, timber, firewood and to make pasture for livestock, the change in cover and the erosion created by timber skidding profoundly affected the Neversink hydrology and drainage patterns.

Excerpt from 1875 Beers Map (Figure 2)

The 1875 Beers Atlas of this area indicates that by that time, the stream had been harnessed for manufacturing, primarily saw mills, woodworking shops and tanneries *(Figure 2).* Raceways were built in the floodplains to divert water to ponds for use as needed. Floodplains were profoundly altered in the process, as these watercourses also became areas of preferential channelized flow when floodwaters inundated the floodplains. When woody debris jams blocked the primary channels, these raceways sometimes eroded out to become major secondary channels, or even took over the full flow to become a new primary watercourse.

During large runoff events, floodplains adjacent to the confluence of major tributaries receive large slugs of material eroded out of the steep streams draining the valley walls. overwhelmed the Neversink's ability to transport it, creating an alluvial fan. Like changes in the floodplains made by humans, these episodes can result in catastrophic shifts in channel alignment. In the roughly one hundred and twenty centuries since the retreat of the glaciers, the position of Neversink River has moved back and forth across its floodplain numerous times in many locations. A comparison of historical channel alignments (Figure 3, above) and in-stream observations made during a stream feature inventory in 2010 (see below) indicate some lateral channel instability. According to records available from the NYSDEC DART database 1 NYS Article 15 stream disturbance permits have been issued in this management unit. These permits pertain to activities which have the potential to significantly impact stream function, such as bank stabilization, stream crossings, habitat enhancement, and logging practices. **(http://www.dec.ny.gov/cfmx/extapps/envapps/).**



Historical channel alignments from five selected years (Figure 3)

Stream Channel and Floodplain Current Conditions

The following description of stream morphology references stationing in the foldout Figure 4. "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. This characterization is the result of surveys conducted in 2010.

The East Branch of the Neversink River enters EBMU4 flowing in close proximity to Denning Road which is located in the right floodplain. The riparian area between the road and the stream is dominated by herbaceous vegetation with an inadequate amount of mature woody vegetation. A riparian buffer including woody vegetation can strengthen the stream bank and slow erosive forces, as well as mitigate

Tributary entering through exposed bedrock on left valley wall (B201)

Willow trees on left side of stream (B203)

flood risks to the adjacent road. It is recommended that the riparian buffer along the right side of the stream between Station 13200 and Station 10600 be further assessed for potential riparian restoration using planting techniques.

The left valley wall begins to control the stream at the top of this management unit, restricting lateral channel migration to the left until approximately Station 10900. Various small unnamed tributaries enter the main channel through this valley wall. The first drainage comes in through exposed bedrock at Station 13150. *(B201)* Small feeder streams such as this often play an integral role in ecosystem integrity, as they are a source of the cold and well oxygenated water that is necessary to support a diversity of aquatic life. Just downstream of this tributary, a large cluster of willow trees has populated a sediment depositional area along the left side of the stream at Station 13000. *(B203)* Willows from this location could potentially be harvested and planted at stream restoration sites.

Berm on right bank (B209)

An old berm begins along the right bank at Station 12900, continuing approximately 400-feet to Station 12500. *(B209)* This berm consists of old sidecast stream and earthen materials, including cobble sized stones. It appears to be unmaintained and overgrown, and was most likely installed to prevent high flows from reaching Denning Road. Power lines cross the channel just upstream of the

Power line clearing on left valley wall (B205)

Naturally repaired left bank failure (A210-215)

berm and continue in a cleared path over the left valley wall. *(B205)* A small tributary enters from the left at Station 12850, contributing a perennial flow.

Depositional area in front on berm (B206)

A sediment depositional area is located along the right bank directly in front of the berm beginning at Station 12750 and continuing downstream until Station 12500. This side bar consists of cobble sized materials and appears to be frequently inundated during higher flows, as evidenced by the lack of vegetation or debris on it. *(B206)* A naturally repaired bank failure was documented along the left bank beginning at Station 12600, continuing approximately 125-feet until Station 12475 (BEMS ID# NEB4_12500. *(Stitched 210-215)* Large boulders and sedges have accumulated at the toe of this once failing slope, allowing it the stabilization necessary to re-vegetate. Therefore, it is anticipated that this site will remain stable without assistance (passive restoration) but should be monitored for future changes in condition.

Tributary entering on right (B211)

Continuing downstream, another tributary enters from the right side at Station 12200. *(B211)* Excessive large woody debris accumulation becomes evident within the channel beginning at Station 12100. A woody debris obstruction causes flow to split into two separate channels at Station 11900. This division of flow has effectively reduced the power of the stream in this reach, as is evidenced by the excessive sediment deposition present here. *(B216)* The channel that diverges to the right flows very close to Denning Road and various building structures with little to no riparian vegetation present. These


Woody debris causing diversion (B216)


Obstructions and aggradated channel (A222)

structures are very high risk of inundation and subsequent property damage during large events. This right channel is heavily aggraded, forcing the flow to braid through and around depositional areas. Large woody debris has deposited at Station 11800 and Station 11600, most likely obstructing any significant flows. *(A222)* Hydraulic erosion is evident along the right bank in two locations in the right channel.

The first begins at Station 11600, continuing approximately 125-feet until Station 11475 (BEMS ID # NEB4_11500). *(Stitched A224-229)* The glacial till that makes up this bank is exposed and entrained during high flows. Historical aerial imagery indicates that during the time period that the stream was stable it stayed in the left channel and did not flow past this eroding bank. Remediation of this bank may be part of a potential full channel restoration which would move all of the flow back into the historic channel (full restoration) and prevent any flows from reaching this unstable bank. Large woody debris obstructions are evident at the upstream and downstream ends of this site and are contributing to the erosion problems. *(A232)*

The second erosion site in the right channel begins at Station 11040 and continues downstream for 340-feet until Station 10700 (BEMS ID # NEB4_10700). *(A234)* Sedges have established at the toe of this bank which have aided in stabilization, allowing the site to re-vegetate without assistance. However, because there is no mature woody vegetation present, this bank is still at risk for further erosion during large events. Flood damage to the building structures along this bank is very likely.


Hydraulic erosion along right bank (A224-229)

(A232) Obstructions contributing to erosion

(A234) Looking downstream of right channel

A riparian buffer including woody vegetation can strengthen the stream bank and slow erosive forces of higher flows during flood events. Therefore, recommendations for this site include assisted restoration with planting and possibly bioengineering techniques to stabilize the bank.

Large woody debris obstructions and sediment deposition were also documented with frequency in the left channel. Fallen trees are creating obstructions to flow across the stream at Station 11860 and Station 11640. *(B221)* These obstructions are reducing the stream's capacity to transport sediment through this reach, resulting in deposition along the right side of the channel at Station 11740 which is heavily vegetated with sedges and willows. *(B219)* Hydraulic pressure has caused erosion of the toe along the left bank at Station 11510, continuing approximately 40-feet to Station 11470 (BEMS ID # NEB4_11500). *(B224)* Large boulders that were plucked from this bank have deposited at the toe and have provided protection from further scour. Therefore, it is likely that this bank will be able to stabilize without further assistance (passive restoration), but should be monitored for future changes in condition.

(B221) Fallen trees obstructing flow

(B219) Depositional side bar with sedge and willow

(B224) Hydraulic erosion on left bank

(B230) Significant obstructions across channel

Continuing downstream, the next 500-feet of stream is characterized by further large woody debris deposition. Significant channel obstructions caused by woody debris were documented at Stations 11360, 11100, and 10950. *(B230)* A small tributary drains into the main channel in the midst of these obstructions at Station 11050. This is also the approximate location that the stream begins to pull away from the left valley wall, maintaining a narrow floodplain on both sides for the remainder of the management unit. *(B232)* Sediment is frequently deposited downstream of the series of obstructions, beginning as a lateral bar at Station 10900 and continuing into aggradation of the full channel by Station 10720. *(B243)* A crumbled portion of an old bridge abutment is now serving as a revetment along the left bank at Station 10610, indicating where a stream crossing was once located. *(B244)*

(B232) Small tributary entering stream

The right and left channels converge to form one main channel at Station 10500. *(A258)* Both banks were bermed in the vicinity of this convergence in an attempt to mitigate flood risks to surrounding infrastructure. These berms consist of old sidecast stream and earthen materials and appear to be

(B243) Full channel aggradation

(B244) Crumbled bridge abutment serving as revetment

(A258) Looking upstream at convergence of right and left channel

very old, as is evidenced by the mature trees that are growing through them. Along the right bank, a berm begins at Station 10700, continuing approximately 460-feet to Station 10250. There is a brief break in this berm before it again picks up at Station 10240 and continues until Station 10140. *(A267)* The berm along the left bank is located between Station 10500 and Station 10250. *(A262)* This berm is located only 150-feet from a building structure in the left floodplain. Japanese Barberry, which is an invasive plant species to the Catskills region, was documented along the left side of the stream in front of the berm at Station 10450. *(A260)* Invasive species such as this can out-compete native vegetation and have negative effects on the surrounding landscape.

(A267) Old berm on right bank

(A262) Berm along left bank

As the valley floor begins to widen approaching the end of EBMU4, the stream maintains a narrow floodplain on both sides which contains a significant amount of human induced landscape development. Some evidence of the streams interaction with this development was documented during the inventory. A revetment consisting of a combination of cobbles and logs is embedded into the left bank directly in front of a house at Station 9990. This revetment

(A260) Japanese Barberry, Invasive Species

(B248) Cobble and log revetment along left bank

is approximately 60-feet in length, ending near Station 9930. *(B248)* Directly downstream of this structure, the left bank shows signs of hydraulic erosion beginning at Station 10020, continuing downstream for 45-feet until Station 9975 (BEMS ID # NEB4_9900). *(B249)* Although this erosion was not severe at the time of this inventory, it does not appear that it will be able to stabilize without treatment. Therefore, recommendations for this bank erosion site minimally include monitoring for significant changes in condition and possible assisted restoration.

(B249) Hydraulic erosion downstream of revetment

A more severe erosion site begins along the left bank at Station 9940, continuing approximately 85-feet to Station 9855 (BEMS ID # NEB4_9800). *(Stitched B251–253)* Hydraulic pressure put on this 10-foot high bank has exposed cobble sized materials which are entrained during high flows. The erosion of this bank puts nearby building structures at a high risk of damage during flood events. Although some sedges have established at the toe of the bank, it does not appear that it will stabilize without treatment. *Assisted restoration* for banks stabilization is recommended for this site.

At Station 9790 a cobble side bar begins along the right bank, continuing for approximately 200-feet to Station 9590. *(A277)* This bar is well vegetated with sedges and other herbaceous species. Two trees have fallen from the left bank and situated in the channel perpendicular to flow. The obstruction to flow created by these trees is causing minor scour both upstream and downstream.

(B251-253) Severe hydraulic erosion on left bank

(A277) Cobble side bar along right bank

(B257) Cobble stone revetment along right bank

Approaching the downstream end of this management unit, the stream begins to flow in closer proximity to Denning Road. The right bank is revetted with cobble sized stones beginning at Station 9620 and continuing 90-feet downstream until Station 9530. *(B257)* This revetment appears to have been placed in order to prevent flows from further aggravating a hydraulic bank erosion site located higher up on the right embankment adjacent to the road. This bank erosion is approximately 80-feet in length, beginning at Station 9550 and continuing until Station 9470 (BEMS ID# NEB_9400). *(A284)* The site is actively eroding at the upstream end, but appears to be currently inactive at the downstream end. Cobble sized materials are exposed throughout much of this bank, and leaning trees with exposed root structures threaten to fall into the stream and further destabilize the bank. Due to the close proximity of this site to the road, assisted restoration is recommended including the removal of severely leaning trees and techniques to stabilize the bank. This site should also be monitored for future changes in condition.

The downstream end of EBMU4 is characterized by channel instability, most likely contributed to by the presence of the Denning Road bridge crossing. The left bank is bermed beginning at Station 9350 and continuing into the next management unit. *(B267)* Old sidecast stream materials were piled along this bank in an attempt to prevent flood waters from reaching the numerous building and road structures in the left floodplain. These structures are located in a relatively low elevation in the valley which puts them at high risk of inundation during flood events.

(A284) Erosion on right bank

(B267) Berm on left bank

Along the right bank, erosion begins at Station 9340, continuing for approximately 60-feet to Station 9280 (BEMS ID# NEB4_9300). *(A298)* Hydraulic pressure has destabilized this bank exposing alluvial cobbles and silt particles that can be entrained during high flows. The finer silts near the top of the bank are a potential source of fine sediment and turbidity issues. This erosion is located only 20-feet from the road with little to no riparian vegetation, and therefore is not likely to stabilize naturally. Recommendations for this bank erosion site minimally include monitoring for significant changes in condition and possible assisted restoration to stabilize the bank.

A rip-rap revetment begins along the right bank beginning near the downstream end of the bank erosion at Station 9280, continuing for 60-feet to the bridge abutment. These cobble sized stones were placed to protect the bank from hydraulic pressure during higher flows. *(A315)* Though documented in fair condition at the time of this inventory, it is not likely that over a significant period of time this rip-rap will sufficiently protect the bank or adjacent road from the effects of flooding.

(A298) Erosion along right bank

(A315) Rip rap revetment on right bank

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 on the East Branch, upstream of Sawmill Road through Station 14800 on the Mainstem, downstream of the Halls Mills covered bridge. The purpose of the analysis would be to develop a comprehensive solution for reducing flooding threats to this relatively dense population center of the Neversink Valley.

(A304) Denning Road Bridge

EBMU4 ends near Station 9200 where Denning Road crosses the stream channel. *(A304)* Due to the poor structural and functional condition of the original bridge, it was not in use at the time of this inventory. A more recently installed bridge just downstream is currently being used to allow traffic to pass over the stream channel. Abutments for both of these bridges are encroaching on the wetted channel and are affecting the stream's ability to transport sediment through this reach. A significant amount of sediment aggradation was documented upstream and underneath these structures, typical of bridges with which the abutments are not spaced wide enough to accommodate large flows. Further assessment is recommended to determine potential hazards associated with flood conveyance and sediment transport at these bridges.

Sediment Transport

Streams move sediment as well as water. Channel and floodplain conditions determine whether the reach aggrades, degrades, or remains in balance over time. If more sediment enters than leaves, the reach aggrades. If more leaves than enters, the stream degrades. (See Section 3.1 for more details on Stream Processes).

This management unit is largely dominated by sediment storage reaches and occasionally punctuated by short transport reaches. The channel in EBMU4 is controlled on the left throughout a good portion of the management unit by the valley wall, but does maintain a narrow floodplain corridor on the right side. The densely forested portion of the watershed upstream of this management unit serves as a continuous source of large woody material that is transported downstream and deposited during flood events. This large woody debris often serves as an obstruction to sediment transport, resulting in the aggradation of bed material. Sediment is stored where large woody debris has accumulated in the management unit, and is transported relatively effectively in most other locations. Transport reaches are in a state of *dynamic equilibrium,* effectively conveying sediment supplied from upstream during each flow event. Storage reaches act as a "shock absorber", holding bedload delivered during large flow events in depositional bars and releasing it slowly over time in more moderate flood events. These depositional areas are very dynamic, with frequent lateral channel migration through bank erosion, *avulsions* and woody debris accumulations. This is one process by which floodplains are created and maintained. Sediment storage reaches can result from natural conditions or as the unintended consequence of poor bridge design, check dams or channel overwidening. Infrastructure influenced deposition of sediment is evident in EBMU4 at the two Denning Road bridges at the downstream end of the management unit, which are inadequately designed to effectively transport sediment. This is evidenced by significant channel aggradation in the reach upstream of the bridge. Unpredictable conditions created by changes in channel geomorphology represent risks for nearby property owners during flood events. However, these dynamic disturbance regimes produce unique and diverse habitat patches, attracting equally diverse plant communities and wildlife.

To better understand sediment transport and sediment transport dynamics a baseline survey of channel form and function is recommended for this management unit.

Riparian Vegetation

One of the most cost-effective methods for landowners to protect streamside property is to maintain or replant a healthy buffer of trees and shrubs along the bank, especially within the first 30 to 50 ft. of the stream. A dense mat of roots under trees and shrubs bind the soil together, and makes it much less susceptible to erosion under flood flows. Mowed lawn does not provide adequate erosion protection on stream banks because it typically has a very shallow rooting system. Interplanting with native trees and shrubs can significantly increase the working life of existing rock rip-rap placed on stream banks for erosion protection. Riparian, or streamside, forest can buffer and filter contaminants coming from upland sources or overbank flows. Riparian plantings can include a great variety of flowering trees and shrubs, native to the Catskills, which are adapted to our regional climate and soil conditions and typically require less maintenance following planting and establishment.

Some plant species that are not native can create difficulties for stream management, particularly if they are invasive. Japanese knotweed (Fallopia japonica), for example, has become a widespread problem in recent years. Knotweed shades out other species with it's dense canopy structure (many large, overlapping leaves), but stands are sparse at ground level, with much bare space between narrow stems, and without adequate root structure to hold the soil of stream banks. The result can include rapid stream bank erosion and increase surface runoff impacts.

An analysis of vegetation was conducted using aerial photography from 2009 and field inventories *(Figure 5)*. In this management unit, the predominant vegetation type within the riparian buffer is mixed-closed tree canopy (48.79 %) followed by herbaceous vegetation (18.97 %). *Impervious* area makes up 4.14% of this unit's buffer. No occurrences of Japanese knotweed were documented in this management unit during the 2010 inventory.

There are 4.85 acres of wetland (6.41% of EBMU4 land area) within this management unit mapped in the National Wetland Inventory (see Section 2.5, Wetlands and Floodplains for more information on the National Wetland Inventory and wetlands in the Neversink watershed). Wetlands are important features in the landscape that provide numerous beneficial functions including protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, and maintaining surface water flow during dry periods (See Section 2.5 for wetland type descriptions and regulations).

Freshwater-forested shrub is the largest wetland type in EBMU4, totaling 3.03 acres in size. The other wetland type in this management unit is Riverine (1.82 acres).

Flood Threats

INUNDATION As part of its National Flood Insurance Program (NFIP), the Federal Emergency Management Agency (FEMA) performs hydrologic and hydraulic studies to produce Flood Insurance Rate Maps (FIRM), which identify areas prone to flooding. 5 building structures are located in the 100-year floodplain in EBM4. The upper Neversink River is scheduled to have its FIRMs updated with current surveys and hydrology and hydraulics analysis in the next few years, and the mapped boundaries of the 100-year floodplain are likely to change.

A large portion of Denning Road which runs through this management unit falls within the 100-year floodplain boundary and is at high risk of inundation during flood events. There is also a large section of Denning Road, as well as several building structures that fall just outside of the floodplain boundary, but could still be inundated during large floods. The two bridge structures at the downstream end of EBMU4 have abutments that are encroaching on the stream channel and are not adequately designed to handle large flows. Further assessment is recommended to determine potential hazards associated with flood conveyance and sediment transport at these bridges. FEMA provides guidance to homeowners on floodproofing at: http://www.fema.gov/library/viewRecord.do?id=1420

BANK EROSION Due to a number of conditions, bank erosion was documented at 8 locations in this management unit. These erosion sites are recommended for a restoration category based on their severity and likelihood of stabilizing naturally. The first erosion site is a naturally repaired bank failure documented along the left bank beginning at Station 12600, continuing approximately 125-feet until Station 12475 (BEMS ID# NEB4_12500). It is anticipated that this site will remain stable without assistance (*passive restoration*) but should be monitored for future changes in condition. Hydraulic erosion is evident along the right bank in two locations in the right channel after a divergence. The first begins at Station 11600, continuing approximately 125-feet until Station 11475 (BEMS ID # NEB4_11500). Remediation of this bank may be part of a full channel restoration which moves all of the flow back into the historic channel (*full restoration*), which in turn would prevent any flows from reaching this unstable bank. The second erosion site in the right channel begins at Station 11040 and continues downstream for 340-feet until Station 10700 (BEMS ID # NEB4_10700). Recommendations for this site include *assisted restoration* with planting and possibly bioengineering techniques to stabilize the bank. Passive restoration is recommended for hydraulic erosion of the toe along the left bank at Station 11510 and continuing approximately 40-feet to Station 11470 (BEMS ID # NEB4_11500). The left bank shows signs of hydraulic erosion beginning at Station 10020, continuing downstream for 45-feet until Station 9975 (BEMS ID # NEB4_9900). Assisted restoration is recommended to remediate the erosion at this location. A more severe erosion site begins along the left bank at Station 9940, continuing approximately 85-feet to Station 9855 (BEMS ID # NEB4_9800). *Assisted restoration* with possible bioengineering techniques for bank stabilization is recommended for this site. Bank erosion approximately 80-feet in length, beginning at Station 9550 and continuing until Station 9470 (BEMS ID# NEB_9400) is recommended for assisted restoration. Along the right bank, erosion begins at Station 9340, continuing for approximately 60-feet to Station 9280 (BEMS ID# NEB4_9300). This site is also a candidate for assisted restoration practices.

INFRASTRUCTURE 2.66% (224 ft.) of the stream bank length in this management unit has been stabilized with stacked rock revetments in three different locations. The first revetment is located along the left bank at Station 9990. This revetment is approximately 60-feet in length, ending near Station 9930. The right bank is revetted with cobble sized stones beginning at Station 9620 and continuing 90-feet downstream until Station 9530. A rip-rap revetment begins along the right bank beginning near the downstream end of the bank erosion at Station 9280, continuing for 60-feet to the bridge abutment.

There were 5 berms documented in EBMU5, totaling 15.89 % (1,338.4 ft) of the total length of stream banks. These berms were all constructed from local stones and earthen materials.

Aquatic Habitat

Aquatic habitat is an important aspect of the Neversink River ecosystem, providing recreational, aesthetic, and economic benefits to the community. While ecosystem health includes a broad array of conditions and functions, what constitutes "good habitat" is specific to individual species. When we refer to aquatic habitat, we often mean fish habitat, and specifically trout habitat, as the recreational trout fishery in the Catskills is one of its signature attractions for both residents and visitors. Good trout habitat, then, might be considered one aspect of "good human habitat" in the Neversink River valley.

Even characterizing trout habitat is not a simple matter. Habitat characteristics include the physical structure of the stream, water quality, food supply, competition from other species, and the flow regime. The particular kind of habitat needed varies not only from species to species, but between the different ages, or life stages, of a particular species, from eggs just spawned to juveniles to adults.

New York State Department of Environmental Conservation (DEC) classifies the surface waters in New York according to their designated uses in accordance with the Clean Water Act. The following list summarizes those classifications applicable to the Neversink River.

1. The classifications A, AA, A-S and AA-S indicate a best usage for a source of drinking water, swimming and other recreation, and fishing.
2. Classification B indicates a best usage for swimming and other recreation, and fishing.
3. Classification C indicates a best usage for fishing.
4. Classification D indicates a best usage of fishing, but these waters will not support fish propagation.

Waters with classifications AA, A, B and C may be designated as trout waters (T) or suitable for trout spawning (TS). These designations are important in regards to the standards of quality and purity established for all classifications. See the DEC Rules & Regulations and the Water Quality Standards and Classifications page on the NYSDEC web site for information about standards of quality and purity.

In general, trout habitat is of a high quality in the Neversink River. The flow regime above the reservoir is unregulated, the water quality is generally high (with a few exceptions, most notably low pH as a result of acid rain; see Section 3.1, *Water Quality*), the food chain is healthy, and the evidence is that competition between the three trout species is moderated by some *partitioning* of available habitat among the species. The East Branch of the Neversink River been given a "C(T)" class designation, supporting fishing and indicating the presence of trout. Trout spawning likely occurs in this management unit, but has not yet been documented in the DEC classification.

Channel and floodplain management can modify the physical structure of the stream in some locations, resulting in the filling of pools, the loss of stream side cover and the homogenization of structure and hydraulics. As physical structure is compromised, inter-species competition is increased. Fish habitat in this management unit appears to be relatively diverse.

It is recommended that a population and habitat study be conducted on the Neversink River, with particular attention paid to temperature, salinity, riffle/pool ratios and quality and in-stream and canopy cover.

Water Quality

The primary potential water quality concerns in the Neversink as a whole are the contaminants contributed by atmospheric deposition (nitrogen, sulfur, mercury), those coming from human uses (nutrients and pathogens from septic systems, chlorides (salt) and petroleum by-products from road runoff, and suspended sediment from bank and bed erosion. Little can be done by stream managers to mitigate atmospheric deposition of contaminants, but good management of streams and floodplains can effectively reduce the potential for water quality impairments from other sources.

Storm water runoff can have a considerable impact on water quality. When it rains, water falls on roadways and flows untreated directly into the Neversink River. The cumulative impact of oil, grease, sediment, salt, litter and other unseen pollutants found in road runoff can significantly degrade water quality. There were no piped outfalls documented during this stream feature inventory.

Sediment from stream bank and channel erosion pose a potential threat to water quality in the Neversink River. Clay and sediment inputs into a stream may increase *turbidity* and act as a carrier for other pollutants and pathogens. There are currently 8 documented bank erosion sites in EBMU4 that could be sources of fine sediment.

Nutrient loading from failing septic systems is another potential source of water pollution. Leaking septic systems can contaminate water making it unhealthy for swimming or wading. Four structures are located in relatively close proximity to the stream channel in this management unit. These homeowners should inspect their septic systems annually to make sure they are functioning properly. Each household should be on a regular septic service schedule to prevent over-accumulation of solids in their system. Servicing frequency varies per household and is determined by the following factors: household size, tank size, and presence of a garbage disposal. Pumping the septic system out every three to five years is recommended for a three-bedroom house with a 1,000-gallon tank; smaller tanks should be pumped out more often.

The New York City Watershed Memorandum of Agreement (MOA) allocated 13.6 million dollars for residential septic system repair and replacement in the West-of-Hudson Watershed through 2002, and the program was refunded in 2007. Systems eligible included those that are less than 1,000-gallon capacity serving one-or-two family residences, or home and business combinations, less than 200 feet from a watercourse. Permanent residents are eligible for 100% reimbursement of eligible costs; second homeowners are eligible for 60% reimbursement. For more information, call the Catskill Watershed Corporation at 845–586–1400, or see **http://www.cwconline.org/programs/septic/septic_article_2a.pdf**.

Community Comments
Fall 2012

Station 9000-8100 *"Along road is an old race"*

Station 10000-9800 (Leudemann & Charlick) *"Low spot"*

Station 12200 (Englese) & Station 11500 (Zuliani) *"Sediment increased in back channel"*

"Interested in stream bank protection, elevating my residence, new FEMA flood maps and relocating my residence."

"Interested in stream bank protection, elevating my residence, channel maintenance and new FEMA flood maps"