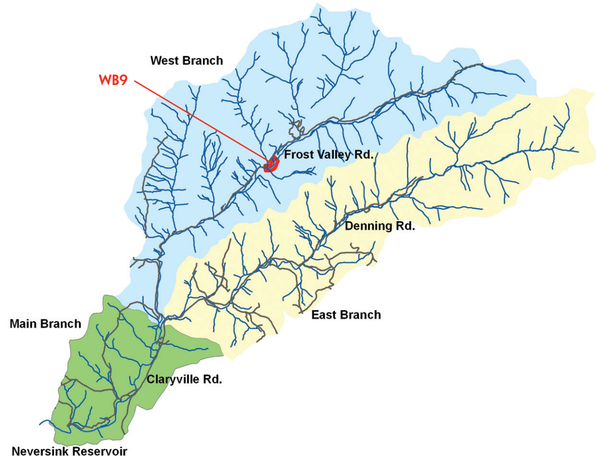
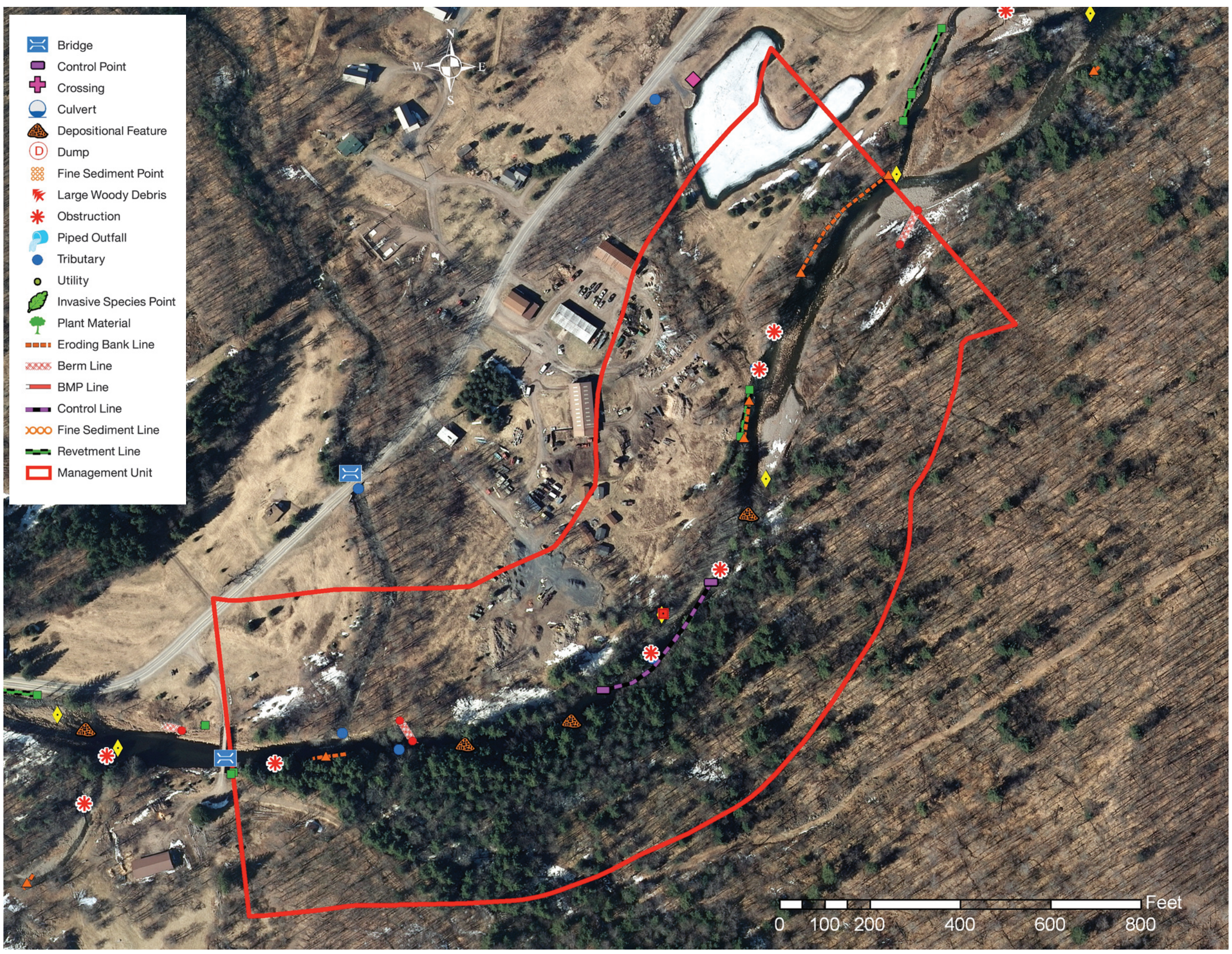
Neversink River West Branch

MANAGEMENT UNIT 9

STREAM FEATURE STATISTICS

- 10.00% of stream length is experiencing erosion
- 2.38% of stream length has been stabilized
- 7.10 acres of inadequate vegetation within the 100 ft. buffer
- None of stream is within 50 ft. of the road
- There are two building structures located within the 100-year floodplain boundary





Stream Feature Inventory 2010 (Figure 1)

Management Unit Description

This management unit begins at the confluence of the outlet from Cole Lake on the Frost Valley YMCA Campus at Station 34300, continuing approximately 2,200 ft. past the confluence of High Falls Brook to a private bridge near the downstream extent of Frost Valley YMCA property at Station 32100. The drainage area ranges from 17.40 mi^2 at the top of the management unit to 21.20 mi^2 at the bottom of the unit. The valley slope is close to 1.08%. The average valley width is 824.45 ft.

Summary of Recommendations West Branch Management Unit 9

Intervention Level	Full restoration of the failed revetment from Station 33700 to 33600 (BEMS NWB9_33600) Passive restoration of the bank erosion between Station 34275 and Station 33975 (BEMS NWB9_33975). Further investigation and evaluation of the bank erosion site between Station 32275 and Station 32200 (BEMS NWB9_32200)
Stream Morphology	Protect and maintain sediment storage capacity and floodplain connectivity. Conduct baseline survey of channel morphology.
Riparian Vegetation	Investigate and evaluate 6.04 acres of potential riparian buffer improvement areas for future buffer restoration. Potential riparian buffer improvement sites between Station 34200 and Station 32700, as well as Station 32300 and Station 32000 (Fig. 7)
Infrastructure	Investigation of cut branch structure near Station 33100; possible replacement with a more effective bank stability technique.
Aquatic Habitat	Fish population and habitat survey.
Flood Related Threats	Floodproofing as appropriate. http://www.fema.gov/library/viewRecord.do?id=1420
Water Quality	Maintain household septic systems.
Further Assessment	Include MU9 in comprehensive Local Flood Hazard Mitigation Analysis of Claryville MUs.

Historic Conditions

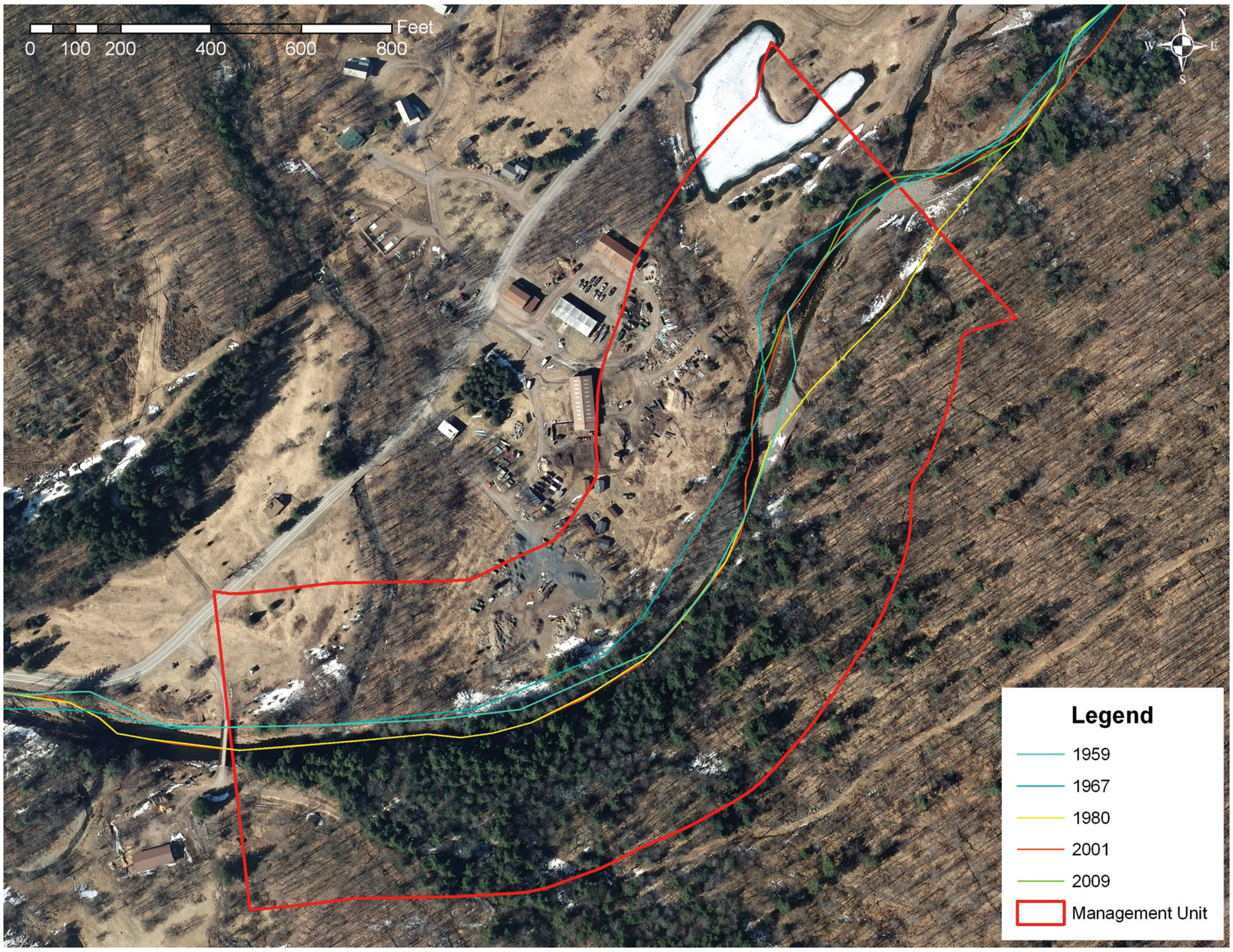
As the glaciers retreated about 12,000 years ago, they left their "tracks" in the Catskills. See Section 2.4 *Geology of Upper Neversink River,* for a description of these deposits. These deposits make up the soils in the high banks along the valley walls on the Neversink mainstem and its tributaries. 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.

According to the map of Forest Industries in the Catskills and the associated descriptions included in *The Catskill Forest: A History* by Michael Kudish (Purple Mountain Press, 2000), Mr. William G. Satterlee and David H. Benton owned two sawmills that were formerly located near the border of WBMU9 and WBMU8. These sawmills, the furthest upstream known industry on the West Branch Neversink, were located near High Falls Brook. According to Beers' 1875 Atlas, one was located along High Falls Brook while the second was on the main channel slightly downstream of the confluence. Reports vary, but these mills were believed to be operational through at least 1870.

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



Historical channel alignments from five selected years (Figure 3)

floodplain numerous times in many locations. A comparison of historical channel alignments *(Figure 3)* and in-stream observations made during a stream feature inventory in 2010 *(Figure 1, page 1)* indicate significant lateral channel instability. According to records available from the NYSDEC DART database twenty-seven 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. database (**http://www.dec.ny.gov/cfmx/extapps/envapps/**).

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.

WBMU9 begins slightly downstream of the confluence of the outlet from Lake Cole with the main channel near Station 34300. Several sites along the right bank between Station 34200 and Station 32700, as well as between Station 32300 and Station 32000, are potential areas where the riparian buffer could be improved through planting efforts *(Figure 7)*. Similar to channel conditions in WBMU10, the river is semi-confined in this management unit with confinement on the left bank by the left valley wall and some floodplain on the right bank. This valley condition makes the right bank highly susceptible to erosion as the left valley wall and deposition on the left bed force flow in the main channel towards the highly erodible alluvial materials of the right bank.

An eroding bank segment was observed extending 300 feet from Station 34275 to Station 33975 (BEMS NWB9_33975). This site was documented as active; hydraulic erosion during high flow events has led to exposure of alluvial materials in the bank, although some vegetation was observed on the bank in conjunction with hardening at the toe. *(IMPG0276)* It is likely that this bank will revegetate and stabilize without treatment (*passive restoration*). However, it is recommended that this site be monitored for changes in condition.

Active hydraulic erosion of bank (IMPG0276)

Stacked stone berm on left bed (A7)

Fallen trees along right bank (IMPG0277)

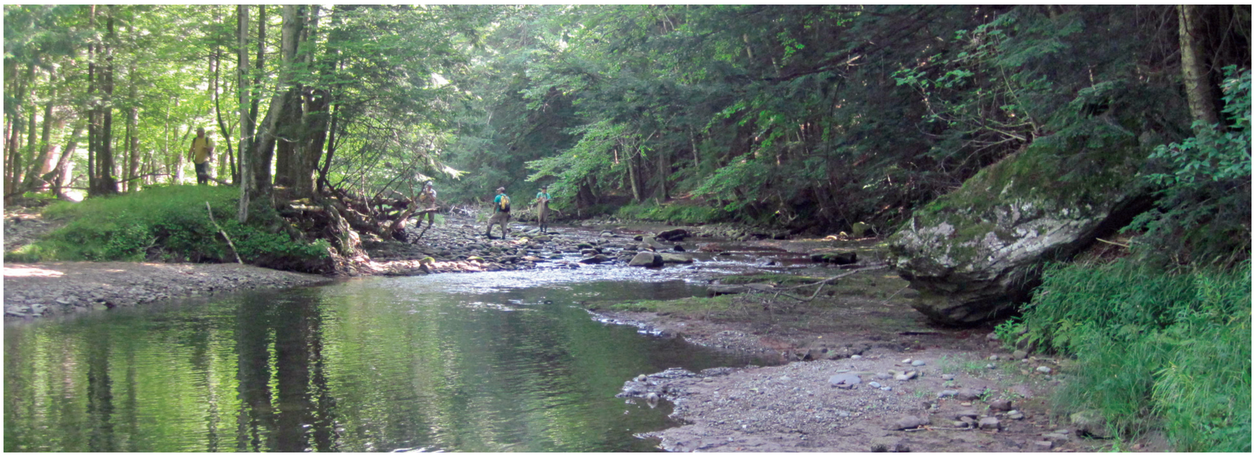
Perennial stream conveying flow around large obstruction (IMPG0281)

Stacked rock revetment (IMPG0286)

A depositional feature was observed on the left bed in this location composed of cobble with some grass and sedge vegetation. On the left bank behind this cobble bar a 4-foot high and 4-foot wide stacked stone berm was observed extending 85 feet between Station 34300 and Station 34215. It appeared that the berm was constructed to block a currently dry side channel that flows adjacent to the left valley wall as the main channel curves slightly right towards Frost Valley Road. This channel converges with the main channel at the end of the meander near Station 33500. The 1980 stream center line shows this dry side channel as conveying the majority of the flow historically. *(A7)*

Downstream of the eroding bank segment on the right bank there is a series of three fallen trees from the right bank across the channel near Station 33800. *(IMPG0277)* Near Station 33700 a perennial stream conveying flow from a cleared field on the right bank joins a short side channel formed around a large wood obstruction. *(IMGP0281)*.

A stacked rock revetment with scour and erosion at the toe was observed for 100 feet on the right bank from Station 33700 to Station 33600. The



Shale bedrock providing grade control on left bed (A16)

revetment was documented in fair structural and functional condition. The erosion into the toe of the failed erosion was documented as active caused by hydraulic erosion (BEMS NWB9_33600). Review of the aerial imagery available for this bank reveals several garages and equipment staging areas on the right bank behind this bank failure site; the revetment was most likely designed to stabilize the bank and protect this property. *(IMGP0286)*

Woody debris jam forming on right bank (IMPG0295)

Recommendations for this site include investigation of past management activities and potentially *full restoration*. This project would require geomorphic and sediment transport analyses of the reach to identify appropriate restoration design and would likely include placement of *flow deflection structures* to reduce erosive forces on the banks as well as *assisted restoration* using *bioengineering* techniques to establish a riparian buffer and stabilize the eroding bank as well as redirection of the main channel in this reach.

Downstream of the failed revetment the main channel flows adjacent to exposed shale bedrock providing grade control on the left bed at the apex of a wide meander bend against the left valley wall. *(A16)*. Across from the apex of the meander bend near Station 33100 cut branches were observed forming a woody debris jam on the right bank. *(IMGP0295)* It appeared that these branches were placed to provide bank stabilization in this location, but the structure was documented in poor structural and functional condition. It is recommended that the purpose and design of this structure be further investigated with consideration of replacement of this structure with a more effective stabilization technique if necessary.

The shale bedrock grade control ended near Station 32900. A series of two transverse bars, natural longitudinal grade adjustment structures in the cobble bed, were observed at Station 3288 and Station 32550. *(A18, A20)*

A stacked stone berm was observed extending 50 feet perpendicular to the main channel at Station 32450. The berm was approximately 4 feet high and 4 feet wide, and appeared to be protecting a recreational trail maintained by Frost Valley YMCA. *(IMGP0300)* Across from the berm an intermittent tributary conveying concentrated runoff joins the main channel. Based on the observed flow contribution it is possible that this tributary drains a surface water storage area up slope, which is further evidenced by a terrace visible in the topography of the otherwise steep left bank in this location. *(A22)*

Slightly downstream, near Station 32300 the High Falls Brook tributary joins the main channel from the right bank conveying drainage from the north side of High Falls Ridge. Old mortar abutments were observed on both bank of High Falls Brook at the convergence. It is possible that these mortar abutments

Transverse bar (A18)

Transverse bar (A20)

Stacked stone berm perpendicular to stream (IMPG0300)

Intermittent tributary conveying concentrated runoff (A22)

High Falls Brook confluence (IMPG0302)

Eroding left bank (A23)

are remnants from the sawmill formerly located on High Falls Brook upstream of the confluence. *(IMGP0302)* A headcut was observed in the main channel slightly upstream of the private bridge.

An eroding bank segment was observed on the left bank across from the High Falls Brook confluence, extending 75 feet from Station 32275 to Station 32200 (BEMS NWB9_32200). Vegetation and hardening was observed at the toe of the erosion site while active undercutting was observed at the crown of the bank failure 20 feet above the bankfull height on the left bank. *(A23)* It is possible that this erosion is caused by piped flow from land uses up slope on the left bank. Recommendations for this site include further investigation of surface runoff to best characterize the bank failure and identify possible restoration efforts.

WBMU9 ends at a private bridge crossing maintained by Frost Valley YMCA at Station 32100.

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 contains both sediment storage reaches and sediment transport reaches. The 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. The densely forested portion of the watershed within 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 storage reaches can result from natural conditions, like the widening valley floor and decreased channel slope as is the case in this management unit or as the unintended consequence of poor bridge design, check dams or channel overwidening. This is one process by which floodplains are created and maintained.

In some locations in WBMU9 the river is confined by the left valley wall and high banks on the right bank, leaving little accessible floodplain for sediment deposition and storage. These sections of the river act as transport reaches. Transport reaches, like the areas in WBMU9 with boulder and bedrock grade and planform control, are in a state of *dynamic equilibrium,* effectively conveying sediment supplied from upstream during each flow event. However, the densely forested floodplain still serves as a source of large woody material that that can be introduced into the channel during flood events. This large woody debris often serves as a local obstruction to sediment transport, resulting in the aggradation of bed material and the development of floodplains over the long-term. Healthy, undeveloped floodplains throughout the Neversink watershed like those in WBMU9 reduce the velocity of higher flows, thereby mitigating the threat of stream bank erosion and property damage during flood events.

To better understand sediment transport dynamics of this section of the Neversink, 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. There were no occurrences of Japanese knotweed documented in this management unit during the 2010 inventory.

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 (26.20 %) followed by deciduous closed tree canopy (23.20%) and evergreen closed tree canopy (15.54%). *Impervious* area makes up 0.37% of this unit's buffer. There are 6.0 acres of potential buffer improvement area in this management unit (see Fig. 7). No occurrences of Japanese knotweed were documented in this management unit during the 2010 inventory.

There are 3.49 acres of wetland (9.69% of WBMU9 land area) within this management unit mapped in the National Wetland Inventory as two distinct classifications (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 A type descriptions and regulations). The wetland classified as Riverine is 2.74 acres in size and the wetland classified as Freshwater Pond is 0.75 acres in size.

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. 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. There are two building structures in WBMU9 within the 100-year floodplain as identified on the FIRM maps. FEMA provides guidance to homeowners on floodproofing at: **http://www.fema.gov/library/viewRecord.do?id=1420.**

BANK EROSION Due to the semi-confined channel conditions in WBMU10, the right stream bank within the management unit are at a relatively high risk of erosion as the main channel is frequently forced into the easily erodible alluvial materials on the right bank. Three areas of erosion were documented in the management unit during the stream feature inventory.

An eroding bank segment was observed extending 300 feet from Station 34275 to Station 33975 (BEMS NWB9_33975). This site was documented as active; hydraulic erosion during high flow events has led to exposure of alluvial materials in the bank, although some vegetation was observed on the bank in conjunction with hardening at the toe. It is likely that these banks will revegetate and stabilize without treatment (*passive restoration*). However, it is recommended that this site be monitored for changes in condition.

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Aquatic Habitat

Aquatic habitat is one aspect of the Neversink River ecosystem. 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 usses 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 mainstem and tributaries in WBMU9 are classified as "C(T)" connoting best usage for 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 are no piped outfalls that convey storm water runoff directly into the Neversink River in this management unit.

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 is one bank erosion site in WBMU9 that is a potential minor source of fine sediment. None of the sites represent a significant source of turbidity.

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

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

"Floodplain management issues"

It was noted that Hemlock Brook Gorge at Station 32200 has continued to erode at a significant rate. During the 2010 walkover the tributary was perched at the confluence and is now at the same level. A steel culvert, under a logging road, was blown out approximately 400 feet up Hemlock Gorge Brook either after Irene or the September 18, 2012 flood, resulting in a severe headcut moving up through the brook. The tributary has become more incised and is contributing significant bank material to the system.