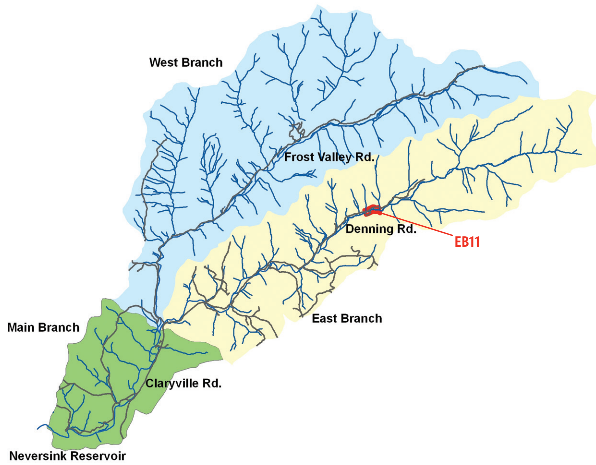
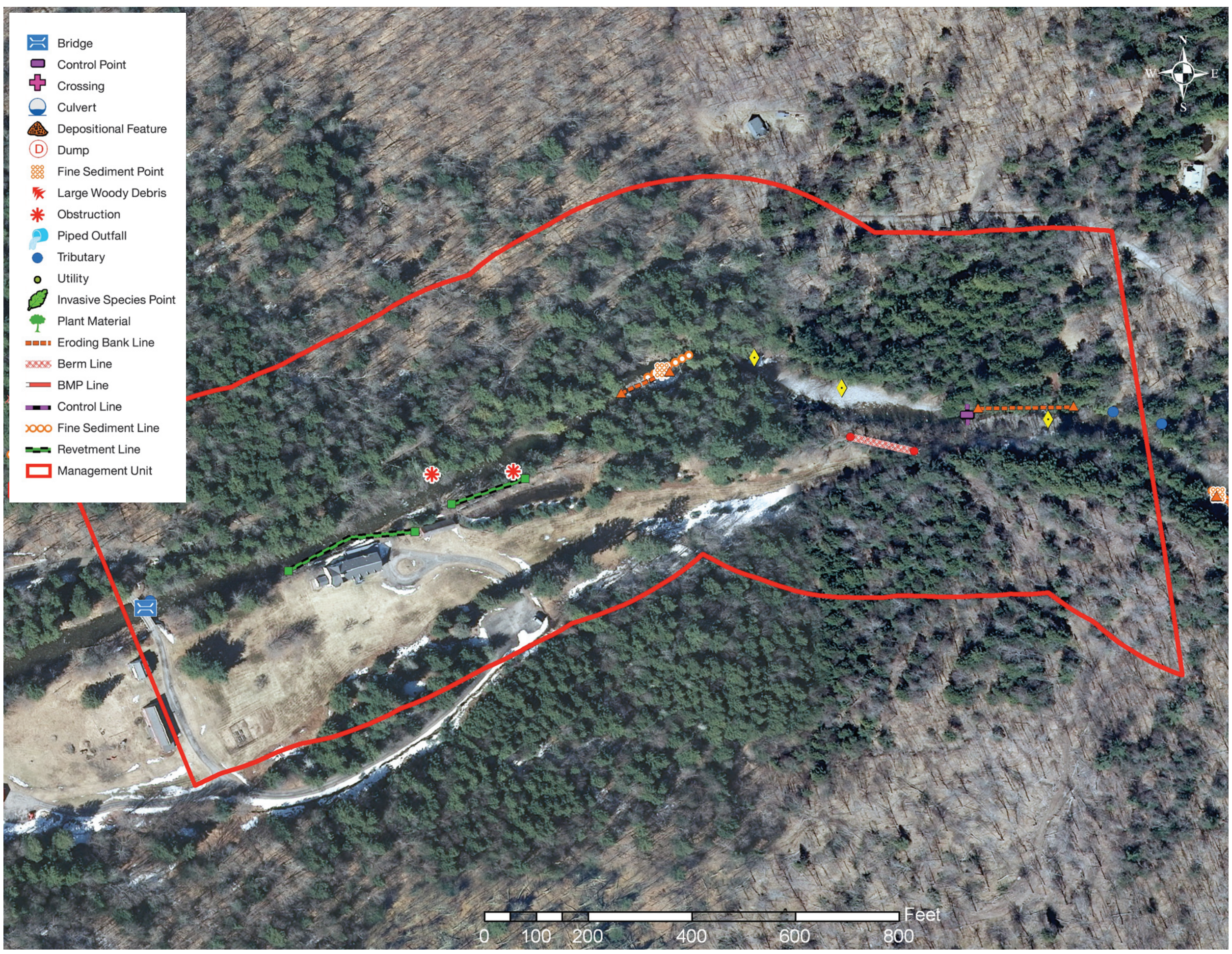
Neversink River East Branch

MANAGEMENT UNIT 11

- 7 % of stream length is experiencing erosion
- 9.63 % of stream length has been stabilized
- 7.28 acres of inadequate vegetation within the 100 ft. buffer
- None of the stream length is within 50 ft. of the road
- Two structures are located within the 100-year floodplain boundary





Stream Feature Inventory 2010 (Figure 1)

Management Unit Description

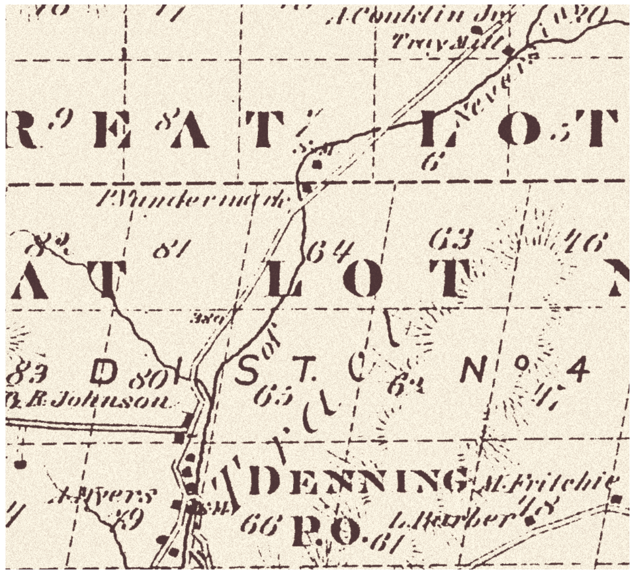
This management unit begins at a private bridge at Frost Valley YMCA, continuing approximately 2,117 ft. to a confluence with Riley Brook. The drainage area ranges from 12.60 mi^2 at the top of the management unit to 13.30 mi^2 at the bottom of the unit. The valley slope is 2.26%. The average valley width is 593.52 ft.

Summary of Recommendations East Branch Management Unit 11

Intervention Level	Assisted restoration of the bank erosion site between Station 42170 and Station 41990. (BEMS NEB11_41800) Assisted restoration of the bank erosion site between Station 41280 and Station 41170. (BEMS NEB11_41100)
Stream Morphology	Baseline survey of channel morphology and sediment transport analysis.
Riparian Vegetation	Improve riparian buffer along the revetment area between Station 40900 and Station 40730. Improve riparian buffer downstream of the bridge at Station 400080.
Infrastructure	Assess flood threats to Frost Valley YMCA private roads and bridge.
Aquatic Habitat	Fish population and habitat survey.
Flood Related Threats	Assess inundation threat to buildings just outside of 100-year floodplain boundary. Floodproofing as appropriate. http://www.fema.gov/library/viewRecord.do?id=1420
Water Quality	None
Further Assessment	Long-term monitoring of erosion sites.

Historic Conditions

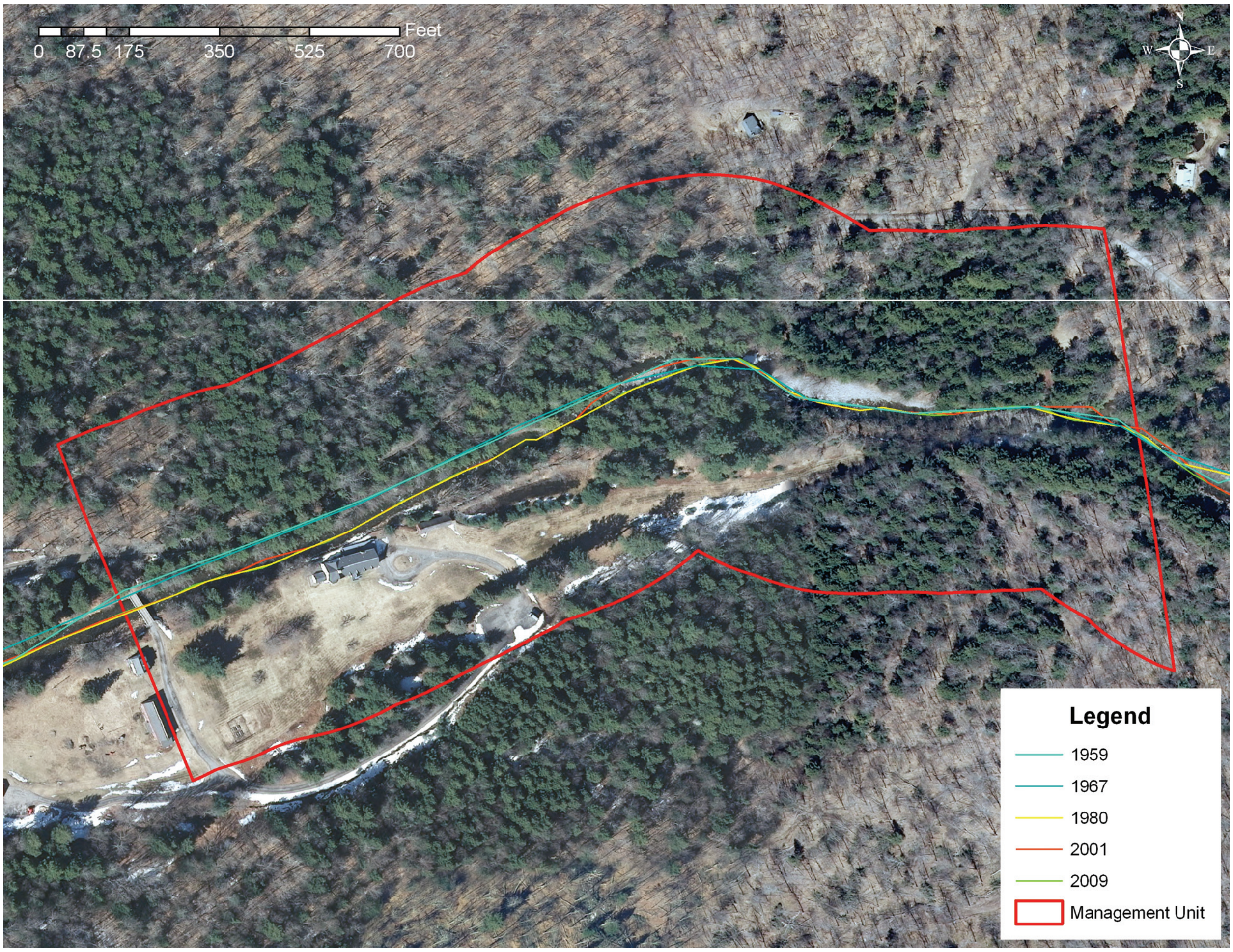
As the glaciers retreated about 12,000 years ago, they left their "tracks" in the Catskills. See Section 2.4 *Geology of Upper Neversink River,* for a description of these deposits. These deposits make up the soils in the high banks along the valley walls on the Neversink mainstem and its tributaries. 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, following page)* and in-stream observations made during a stream feature inventory in 2010 *(Figure 1, page 1)* indicate little lateral channel instability, and only 1 NYS Article 15 stream disturbance permit has been issued in this management unit, according to records available from the NYSDEC DART database (**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.

EBMU11 begins at Station 42200, where Riley Brook enters through the right floodplain. *(A147)* Riley Brook is a perennial tributary which crosses under Denning Road approximately 80-feet prior to its confluence with the East Branch of the Neversink River, making it a potential source for contaminants from road runoff. It is likely that this tributary contributes chlorides (salt) and petroleum by-products from road runoff to the Neversink.

Erosion along the right bank begins just downstream of the tributary confluence at Station 42170, continuing approximately 184-feet before ending at Station 41990 (BEMS NEB11_41800). The toe of the bank is being actively undercut exposing the alluvial cobble sized bank materials. Several mature coniferous trees have had their root structure scoured out and are now leaning towards the stream. *(B78)* There is a log home standing only 20-feet from this eroding bank that is being threatened under higher flows. Due to the proximity of this structure to the bank erosion, assisted restoration is recommended at this site. Bioengineering practices could be used to stabilize the toe of the bank and prevent further undercutting. Large mature trees that are severely leaning toward the stream can be cut at the trunk and removed, leaving the root wads in place to help stabilize the bank materials.

A side bar has formed along the left bank directly across from the erosion at Station 42020. This depositional area consists of primarily cobble sized materials and is approximately 50-feet in length. *(B76)* An abandoned side channel diverges into the left floodplain near the upstream end of the bar. This relict channel is overgrown with herbaceous vegetation and is littered with leaf debris from the previous Fall, suggesting that it has not received significant flow in any recent events.

Continuing downstream, a rock vein runs across the stream creating elevation grade control at Station 41840. *(A153)* It is unclear whether this rock structure is naturally occurring or intentionally placed. A scour pool has formed directly below because the water faces an abrupt vertical drop as it flows over the vein, creating a localized readjustment of channel slope and sediment movement.

Riley Brook entering through right floodplain (A147)

Scour on right bank endangering log home (B78)

Cobble side bar on left bank (B76)

Rock vein running across stream (A153)

Mortar and stone berm on left bank (A154)

Relict sluice gate (A155)

Cobble side bar on right bank (B82)

Looking downstream of main channel at converge with small side channel (B84)

Large failure on right bank (A165)

At Station 41720 an old mortar and stone berm begins on the left bank, continuing approximately 126-feet to Station 41600. *(A154)* This berm is set back from the stream by 15-feet and averages 3-feet in width. A relict sluice gate is incorporated into the upstream end of the berm and still stands in solid structural condition. This gate was once used to divert water from the stream into a millrace that runs into the left floodplain. *(A155)* According to Kudish and the 1875 Beers Maps, this millrace was once used by a sawmill built before 1849 by John W. Smith. At the time when beers plotted his maps in 1875, the mill was run by the Johnson brothers in the hamlet of Denning.

Across from the berm, a cobble side bar begins at Station 41780 and continues 195-feet to Station 41450. *(B82)* This bar has been cleared of any leaf debris and has minimal vegetative growth on it, indicating that it is at a low enough elevation that it becomes inundated under significant flow events. A small side channel diverts to the right side of the bar at Station 41600 and converges back with the main channel at Station 41400. *(B84)* This channel was dry at the time that this stream feature inventory was conducted.

The main channel takes a sharp turn to the left at Station 41420 and continues in a relatively straight alignment for the remainder of EBMU11. A large failure on the right bank begins at Station 41280, continuing downstream over 100-feet downstream until Station 41170 (BEMS NEB11_41100). *(A165, A166)* The cause of this mass failure is a combination of processes, including hydraulic erosion at the toe of the bank and rotational slumping near the top. As the bank has become less stable, large sod mats with trees still rooted in

Large failure on right bank (A166)

Uprooted trees sliding into stream (A162)

Exposed glacial till (A161)

Mortared rock wall revetment on left floodplain (B88)

Herbaceous vegetation not providing adequate stabilization (B87)

Large building close to stream (A175)

Stacked rock revetment protecting building on left bank (A178)

Looking downstream at Frost Valley owned bridge (B92) them have slid or fallen from the top of the 50-foot high bank down to the toe, which in some instances has caused obstructions to stream flow. *(A162)* The exposed glacial till in this bank is a potential source of fine sediment and turbidity when entrained under higher flows. *(A161)* Although some large boulders have begun to accumulate at the toe of the bank it does not appear that this failure has reached an angle of repose, suggesting that it will continue to erode and fail during significant flood events. Therefore, assisted restoration is recommended for this site in order to alleviate hydraulic pressure on the bank and establish stability.

As we continue downstream the channel begins to come in close contact with infrastructure on the left bank and floodplain owned by Frost Valley YMCA. Due to flood threats to buildings and access roads, a mortared rock wall revetment has been constructed beginning at Station 40900, continuing downstream until Station 40730. *(B88)* This revetment is set back from the stream approximately 30-feet and runs adjacent to a retention pond. The area between the wall and the stream consists of primarily herbaceous vegetation which does not provide adequate stability to the stream bank under high flows. *(B87)* A riparian buffer including woody vegetation could be established here using planting techniques, which could strengthen the stream bank and slow erosive forces of higher flows during flood events.

A second revetment has been placed directly downstream along the left bank between Station 40650 and Station 40400 in an attempt to protect a large building that is situated less than 15-feet from the edge of the bank. *(A175, A178)* This stacked rock wall is an attempt to alleviate the high risk of hydraulic erosion and failure under significant flows. Although this revetment appears to be in relatively fair condition, under increased flood magnitudes and frequency it will do little to mitigate flood risk to this structure.

EBMU11 ends at Station 40080, just downstream of where a private bridge owned by Frost Valley YMCA crosses the stream channel *(B92)*. This bridge is in good functional and structural condition, however the stacked rock abutments encroach on the bankfull channel on both sides of the stream which may contribute to difficulties in conveying flow and sediment during larger flood events. Both the right and left banks on the downstream end of the bridge consist of primarily herbaceous vegetation and should be considered for riparian buffer improvement using planting techniques. *(B94)*

Herbaceous vegetation on right and left banks downstream of bridge (B94)

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 represents the continuation of a series of sediment storage reaches occasionally punctuated by short transport reaches from the upstream end of the East Branch. Relatively good floodplain connectivity is maintained throughout EBMU11. 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. While such unpredictable conditions represent risks for nearby property owners, 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 (30.40%) followed by evergreen-closed tree canopy (25.76%). *Impervious* area makes up 4.02% of the total land cover in this unit's buffer. No occurrences of Japanese knotweed were documented in this management unit during the 2010 inventory.

There are no documented wetlands in EBMU11.

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. Two building structures are located in the 100-year floodplain in EBMU11. 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.

The stream channel maintains good floodplain connectivity throughout this management unit. A private access road and bridge near the downstream end of EBMU11 is the only infrastructure that falls within the 100-year floodplain boundary. This road, along with the two building structures are at a very high risk during flood events. Denning Road falls just outside of this boundary in the right floodplain and could also be at risk during floods. 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 in EBMU11, stream banks at two locations within this management unit are actively eroding. The first is caused by hydraulic erosion and begins along the right bank at Station 42170, continuing approximately 184-feet in stream length before ending near

Station 41990. Assisted restoration is recommended for this site. The second bank erosion site is a mass failure that is a potential source of fine sediment along the right stream bank between Station 42180 and 41170. Full restoration is recommended for this site in order to alleviate hydraulic pressure on the bank and establish stability.

INFRASTRUCTURE 9.63% (418 ft.) of the stream bank length in this management unit has been treated with some form of stabilization. There are two revetments in EBMU11, both of which are intended to protect infrastructure in the left floodplain belonging to Frost Valley YMCA. The first is a mortared rock wall between Station 40900 and Station 40730. The second is a stacked rock wall offering bank stabilization between Station 40650 and Station 40400. One mortar and stone berm was documented in this management unit between Station 41720 and Station 41600, totaling 2.98% (126.1 ft.) of the total length of stream bank. This berm included a sluice gate that once diverted water to a millrace in the left floodplain.

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 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 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 are no piped outfalls or road drainages 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 are two bank erosion sites in EBMU11 that are a potential 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**.