Management Unit 2

Greene County - Town of Hunter
Notch Inn Bridge to Cross Section 34

Management Unit Description

This management unit begins at the Notch Inn Bridge and continues approximately 2,166 ft. to Cross Section 34. The drainage area ranges from 2.2 mi^2 at the top of the management unit to 3.7 mi^2 at the bottom of the unit. The valley slope is extremely steep at 5% and water surface slope is also steep at 4%.

Stream conditions in this management unit are fairly stable due to a generally well-vegetated floodplain, bedrock grade control at the top and bottom of the reach, and stacked rock revetment along one stream bank. The stream is entrenched at several locations, confining flows and increasing potential for bed and bank erosion during large storm events. The rock wall is failing in several locations, perhaps due to the entrenched conditions, and requires repair. Near the downstream end of the unit, a potential bank erosion site should be addressed through riparian zone plantings. Aquatic habitat quality is generally excellent.

Summary of Recommendations Management Unit 2	
Intervention Level	Preservation of stable reaches Assisted Self-Recovery of riparian zone at selected sites
Stream Morphology	None
Riparian Vegetation	Riparian plantings at four identified sites (PS #1-4) Design vegetative bank protection measures to reduce erosion threat to right stream bank at planting site #4
Infrastructure	Repair of stacked rock wall revetment; key-in or buttress toe of wall.
Aquatic Habitat	Preservation of healthy riparian vegetation and canopy cover
Flood Related Threats	Resurvey National Flood Insurance Program (NFIP) maps to more accurately reflect the active stream channel
Water Quality	None
Further Assessment	Ongoing monitoring of bank erosion monitoring sites #2,3,4 Stream feature inventory of unnamed tributary at Notch Inn

Historic Conditions

As in management unit #1, the stream parallels NYS Route 214 fairly closely throughout most of management unit #2. Historically, NYS Route 214 ran between Notch Inn and the creek here, with the road embankment protected by a stacked rock wall. This wall evidently encroached on the stream to the northwest, and it seems likely that the railroad bed and embankment on the southeast side of the creek would have done the same here after its construction in 1883. This would have confined the stream even more than it naturally was in this valley notch.

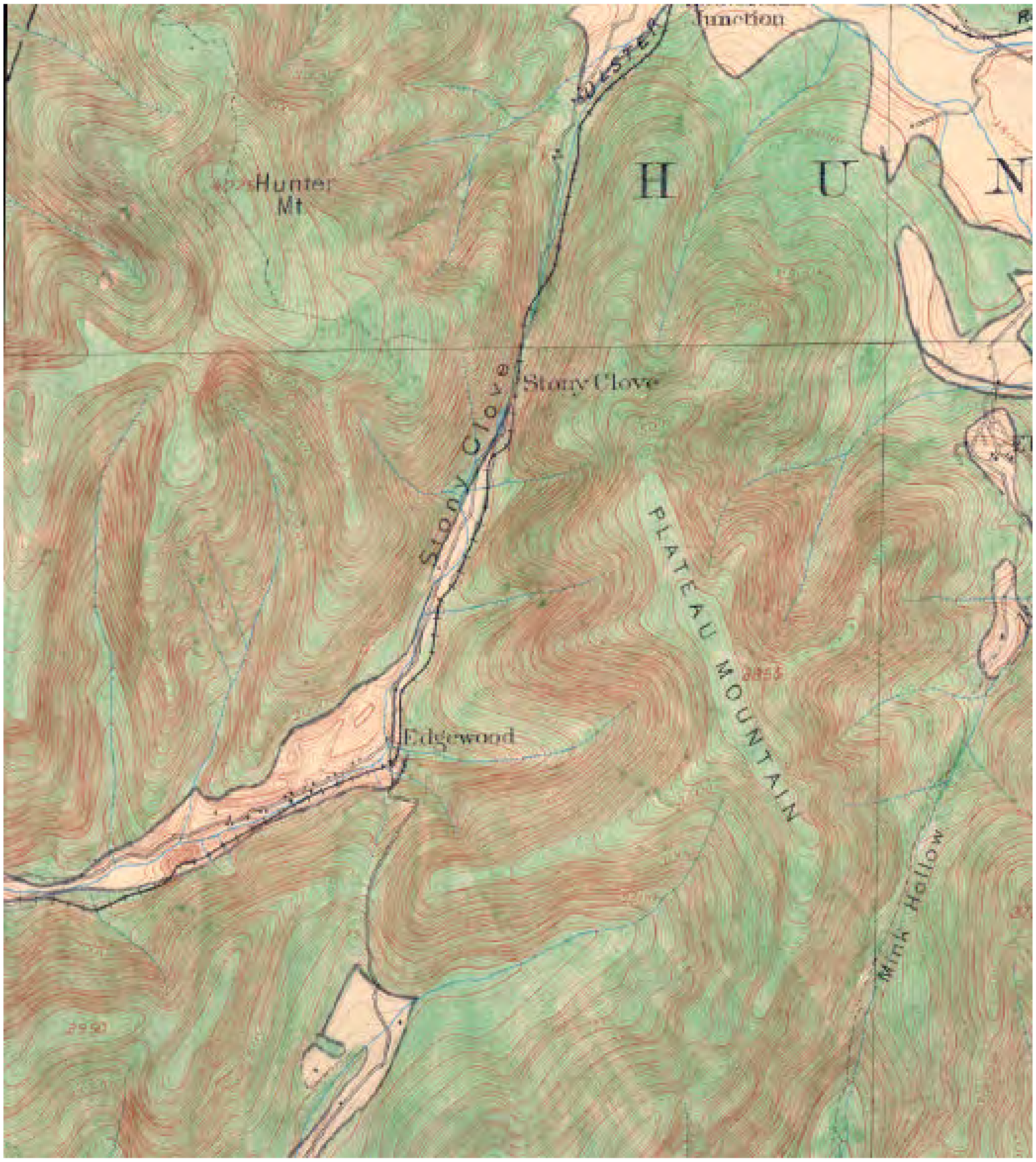


Figure 2 Excerpt of 1903 USGS topographic map

Historical stream channel alignments are not available for this management unit. The unit is located near the top of the watershed where the stream is smaller and covered by tree canopy, making its channel difficult to distinguish on aerial photographs. According to available NYS DEC records there have been no stream disturbance permits issued in this management unit area.

Stream Channel and Floodplain Current Conditions

Revetment, Berms and Erosion

The 2001 stream feature inventory revealed that only 1% (49ft.) of the stream banks exhibited signs of active erosion along 2,166 ft. of total channel length (Fig. 1). Revetment has been installed on 11% (495 ft.) of the stream banks. No berms were identified in this management unit at the time of the stream feature inventory.

Stream Morphology

The following description of stream morphology references insets in foldout Figure 24 "Left" and "right" references are oriented looking downstream, photos are also oriented looking downstream unless otherwise noted. Italicized terms are defined in the glossary. This characterization is the result of a survey conducted in 2001.

Stream morphology, or shape (i.e., slope, width and depth) changes frequently in this unit (Fig. 3), creating small reaches with differing morphologic characteristics, which are classified as different *stream types* (See Section 3.1 for stream type descriptions).

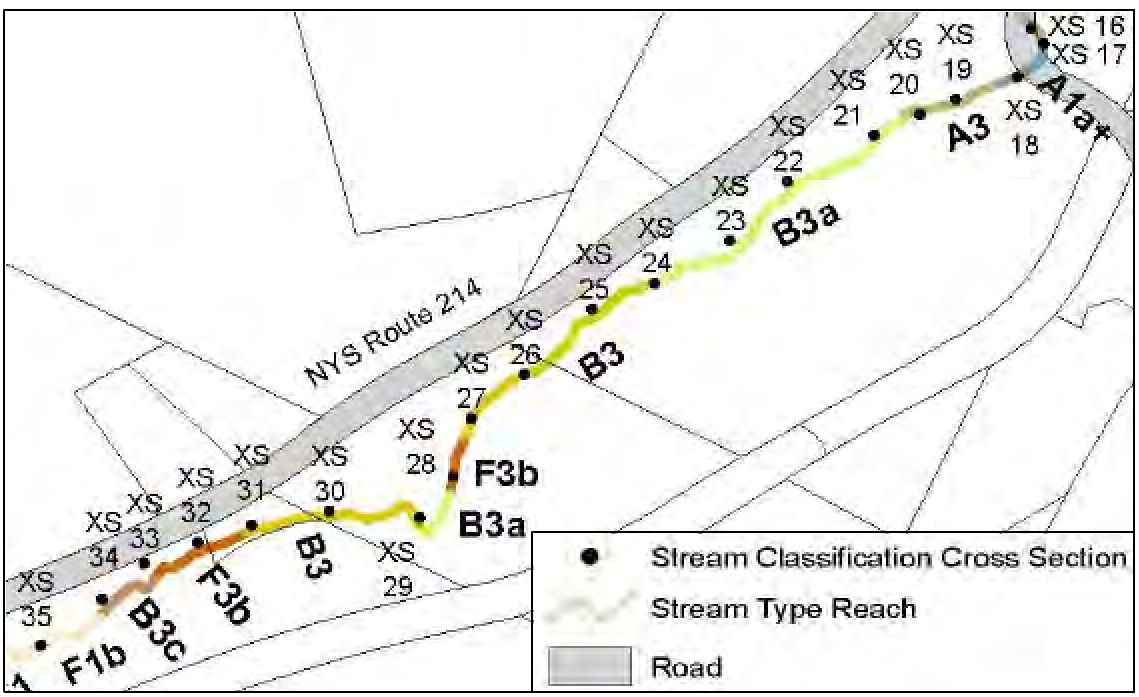


Figure 3 Cross-sections and Rosgen stream types for Management Unit 2

Management unit #2 begins at the Notch Inn Bridge. As the stream emerges from underneath this bridge, it plunges down a 10 ft. waterfall. The first 85 ft. of this section is classified as A1a+ stream (Fig. 4 & 5). This reach has a bedrock bed and an extremely steep slope of 12%.

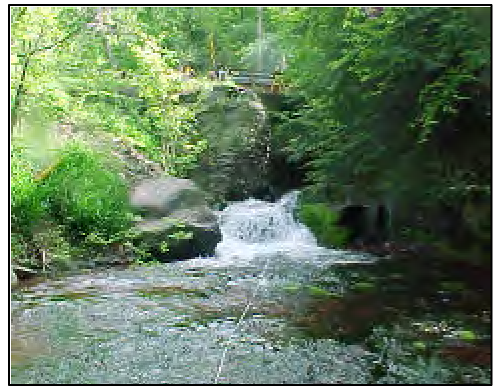


Figure 4 Cross-section 18
Stream Type A1a+ looking upstream

At the bottom of this waterfall a 10 ft. high, 495 ft. long historic stacked rock wall begins on the right bank (Inset D). At the top of the bank, along the length of the stacked rock wall, is a maintained grass corridor. Above this corridor sits the Notch Inn.

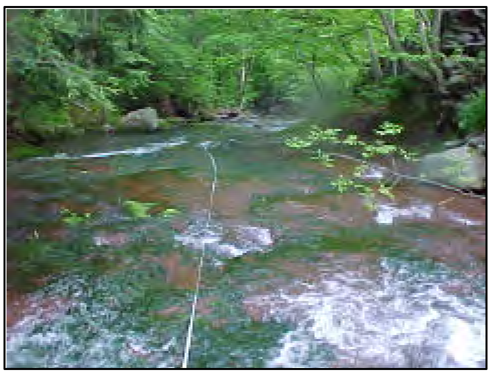


Figure 5 Cross-section 18
Stream Type A1a+, looking downstream

On the left side of the stream a significant unnamed tributary enters Stony Clove Creek (Inset I). This tributary, whose headwaters are on the slopes of Plateau Mountain, is approximately 1.4 miles long. The tributary is rated C(t) under the NYS DEC best usage classification system. This classification indicates the waters support fisheries, is suitable for non-contact activities, and can sustain trout populations.

As the bedrock bed material abruptly changes to cobble and stream slope decreases, stream type changes to A3 for the next 161ft. (Fig. 6). This stream reach is *entrenched* with high stream banks, which limits the stream's access to its floodplain during high flow events. As the bed material changes, the stream drops off the bedrock into a pool. Bank erosion monitoring site #2 is on the right bank where *scour* has eroded away the toe of the stacked rock wall (Inset C). This toe failure, has caused an 11 ft. stretch of the wall to fall into the stream, leaving bare soil exposed. Without treatment, this "crack in the armor" may lead to further failure of the wall along its length. This is the first of three erosion sites along the stacked rock wall.

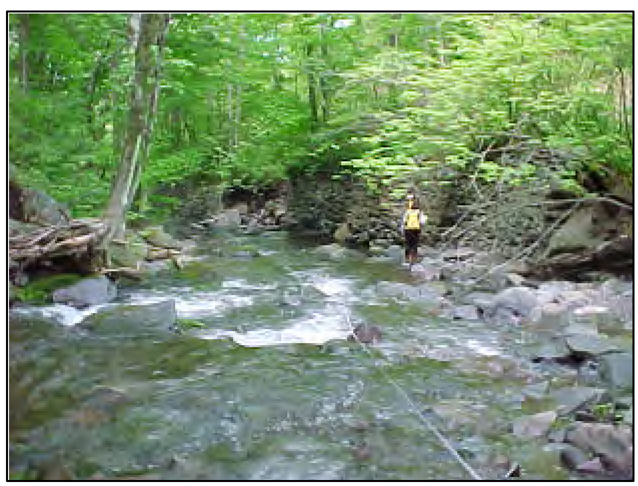


Figure 6 Cross-section 20
Stream Type A3

The Bank Erodibility Hazard Index (*BEHI*) score of site #2 is ranked "High", the third highest prioritization category in terms of its vulnerability to erosion. However, this bank erosion site is considered a low priority for restoration due to its small eroding area (133 ft^2) and its lack of significant threat to infrastructure or water quality. According to Rubin's 1996 stream corridor geology mapping, the stream throughout most of this management unit is cut through unconsolidated deposits (See Section 2.4).

As the stream continues with the stacked rock wall on the right, the left floodplain opens up slightly and entrenchment moderates, changing stream type to B3a for the next 604 ft. (Fig. 7). This reach remains steep with an overall slope of 5%. Approximately 40 ft. into this reach, the *thalweg* is forced, by channel constriction, into the stacked rock wall resulting in bank erosion monitoring site #3 (Inset H). The stress produced the thalweg against this bank has eroded the bank toe causing the bank to fail. Many large cobbles and small boulders remain at the base of this bank providing some erosion protection.

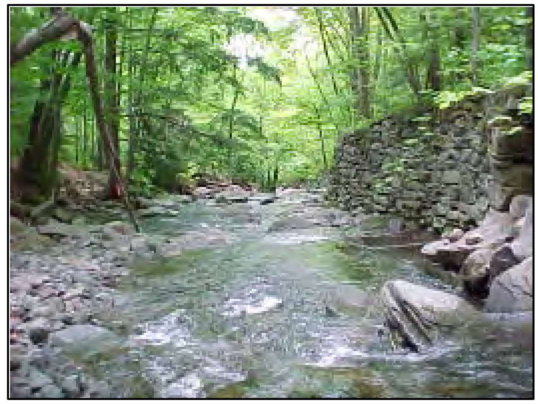


Figure 7 Cross-section 21 Stream Type B3a

The BEHI score of site #3 is ranked "Low", the second lowest prioritization category in terms of its vulnerability to erosion. This bank erosion site is considered a low priority for restoration due to its small eroding area (210 ft^2) and its lack of significant threat to infrastructure or water quality. The stream continues (Inset B) for another 150 ft. until again the thalweg runs against the stacked rock wall at bank erosion monitoring site #4 (Inset A).

The BEHI score of site #4 is ranked "Very Low", the lowest prioritization category in terms of its vulnerability to erosion. This bank erosion site is considered a low priority for restoration due to its small eroding area (201 ft^2) and its lack of significant threat to infrastructure or water quality.

Figure 8 Tributary

The stacked rock wall on the right bank ends approximately 120 ft. downstream from erosion site #4. On the left bank a small unnamed tributary flows into Stony Clove Creek. The confluence is *perched*, but still appears stable. This tributary, shown in the picture at the left, is approximately 0.7 miles long. The tributary is rated D, the lowest classification under the NYS DEC best usage classification system. The best usage for this tributary according to the classification is fishing.

According to landowner accounts from the residential property on the right bank, during heavy rainfalls, water crosses this lawn to enter the creek. This runoff has begun to form small gullies on the lawn and may contribute to streambank erosion (PS#4).

The last 240 ft. of this B3a stream reach is stable and gently meandering (Fig. 9). At the end of this reach there is a stormwater culvert with a concrete headwall on the right stream bank (Inset G). The culvert outlet drops stormwater onto a fairly steep slope before entering Stony Clove Creek. This is normally a cause for concern because it may result in bank erosion, but this drainage way has large bed material providing some protection from erosion.

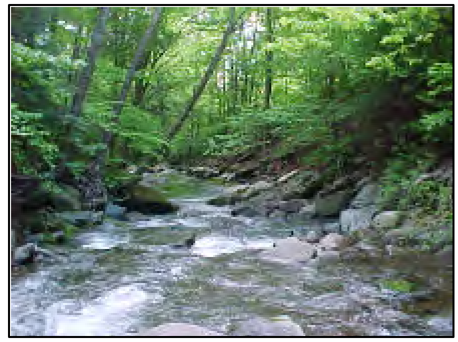


Figure 9 Cross-section 24
Stream Type B3a

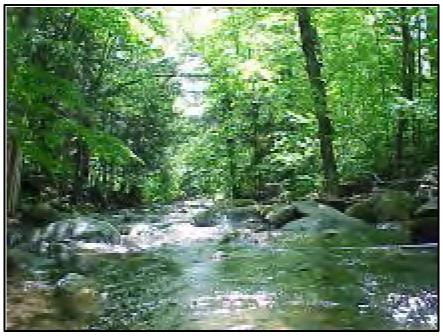


Figure 10 Cross-section 25
Stream Type B3

Continuing downstream, slope decreases to 3.1% as stream type transitions to B3 (Fig. 10). This 426 ft. reach is stable with a meandering *planform*. Approximately 270 ft. downstream from the beginning of this reach, at cross section 26, a tributary enters on the right bank. At the end of this reach is another small unnamed tributary on the left bank (Inset F). Neither of these tributaries is classified by the NYS DEC.

Proceeding downstream, the channel becomes entrenched again and slope decreases to 2.6%, changing the stream type to F3b for 118 ft. (Fig. 11).

As entrenchment moderates and the channel narrows, stream type changes to B3a. The slope of this short 93 ft. reach increases significantly to 4.7%.

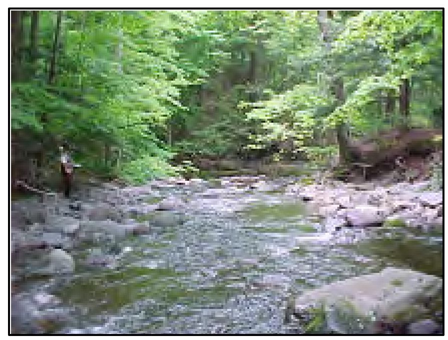


Figure 11 Cross-section 28
Stream Type F3b

Figure 12 Cross-section 30
Stream Type B3

At the end of this reach, there is 100 ft. bedrock outcrop on the left bank, forcing the stream turn sharply to the right. As the stream comes out of this turn the slope decreases to 2.8%, transitioning to B3 stream type for this 316 ft reach (Fig. 12). This moderately entrenched reach poses an erosion threat to the right bank, at the property with the newly renovated red barn. This bank is a prime candidate for plantings to reduce this erosion risk.

A small unnamed tributary enters the creek from the right stream bank at the end of this reach (Fig. 13). This tributary is not classified under the NYS DEC best usage classification system. According to landowner accounts, during heavy rainfalls, water crosses their lawn to enter the creek. This overland flow has begun to form gullies and contributes to streambank erosion.

Figure 13 Tributary

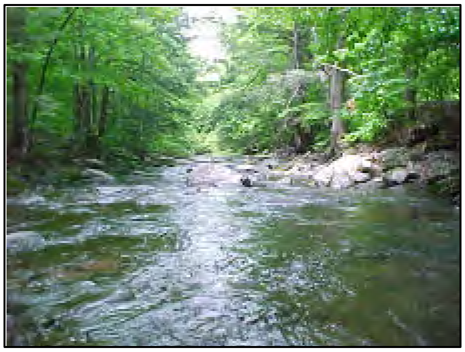


Figure 14 Cross-section 32 Stream Type F3b

Continuing downstream the channel widens and becomes entrenched, as stream type changes to F3b for this 248 ft. reach. The slope decreases slightly to 2.4%.

As the management unit comes to an end, the stream type changes to B3c (Fig. 15). Entrenchment moderates and slope decreases dramatically to 0.9% through the final 115 ft. of this unit.

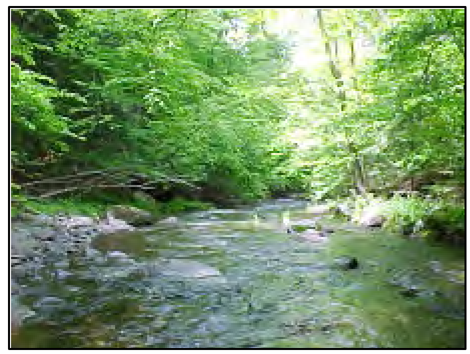


Figure 15 Cross-section 34 Stream Type B3c

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).

There is some evidence of *sediment transport discontinuity* in this unit. Bed degradation associated with frequent fluctuations in entrenchment, however, is moderated to a large degree by a generally well-vegetated riparian zone.

<u>Riparian Vegetation</u>

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. Grass does not provide adequate erosion protection on stream banks because it 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 streambanks 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. Native species are adapted to regional climate and soil conditions and typically require little maintenance following installation and establishment.

Plant species that are not native can create difficulties for stream management, particularly if they are invasive. Japanese knotweed (*Polygonum cuspidatum*), 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 streambanks. The result can include rapid streambank erosion and increased surface runoff impacts.

An analysis of vegetation was conducted using aerial photography from 2001 and field inventories (Fig. 16, Appendix A). Japanese knotweed occurrences were documented as part of the MesoHABSIM aquatic habitat inventory conducted during the summer of 2002 (Appendix B).

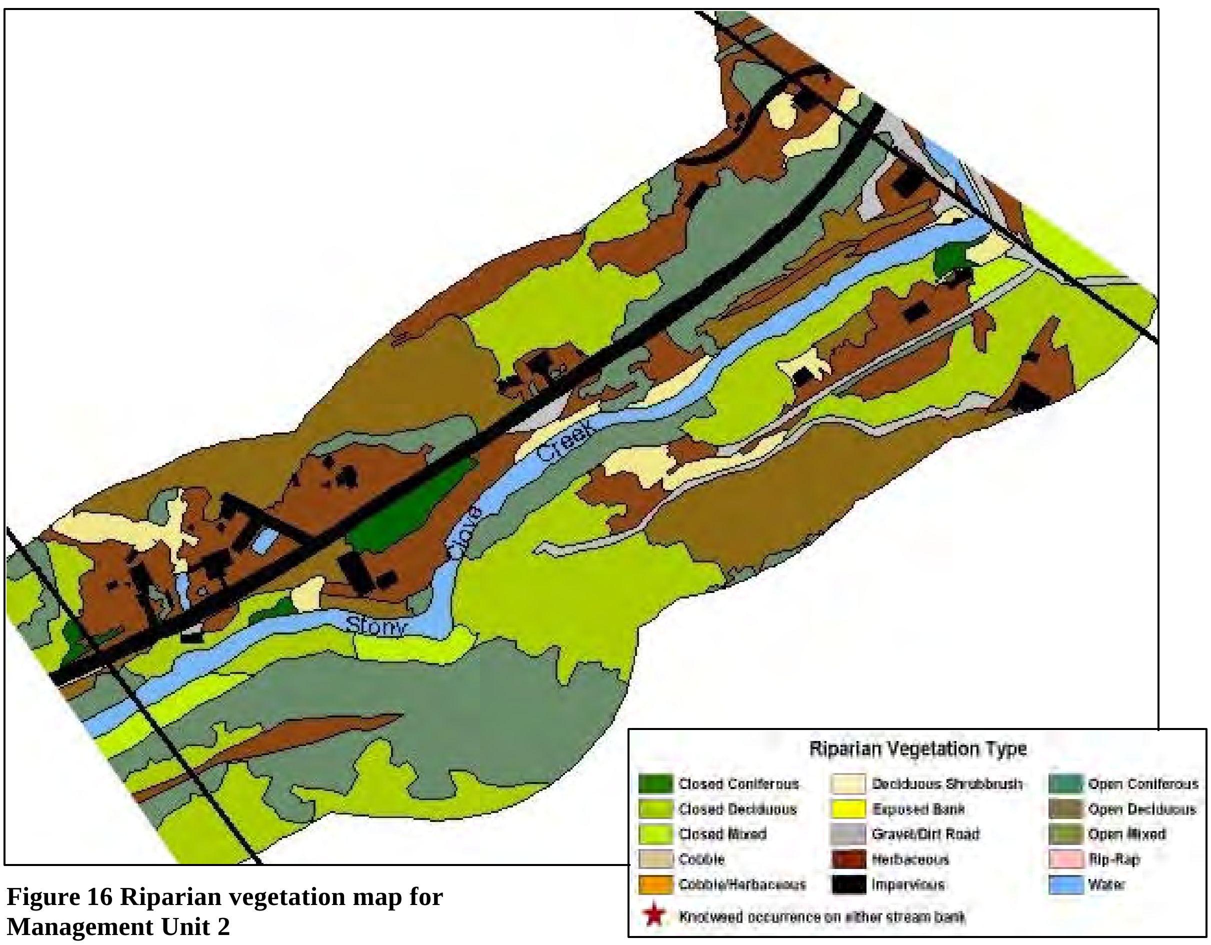


Figure 16 Riparian vegetation map for Management Unit 2

The predominant vegetation type within the 300 ft. buffer is forested (67%) followed by herbaceous (20%). Areas of herbaceous (non-woody) cover present opportunities to improve the riparian buffer with plantings of more flood-resistant species. *Impervious* area (6%) within this unit's buffer is primarily the NYS Route 214 roadway and private residences.

In June 2003, suitable riparian improvement planting sites were identified through a watershed-wide field evaluation of current riparian buffer conditions and existing stream channel morphology (Fig. 17). These locations indicate where plantings of trees and shrubs on and near stream banks can help reduce the threat of serious bank erosion, and can help improve aquatic habitat as well. In some cases, eligible locations include stream banks where rock rip-rap has already been placed, but where additional plantings could significantly improve stream channel stability in the long-term, as well as biological integrity of the stream and floodplain. Areas with serious erosion problems where the stream channel requires extensive reconstruction to restore long-term stability have been eliminated from this effort. In most cases, these sites can not be effectively treated with riparian enhancement alone, and full restoration efforts would include re-vegetation components. Four appropriate planting sites were documented within this management unit.

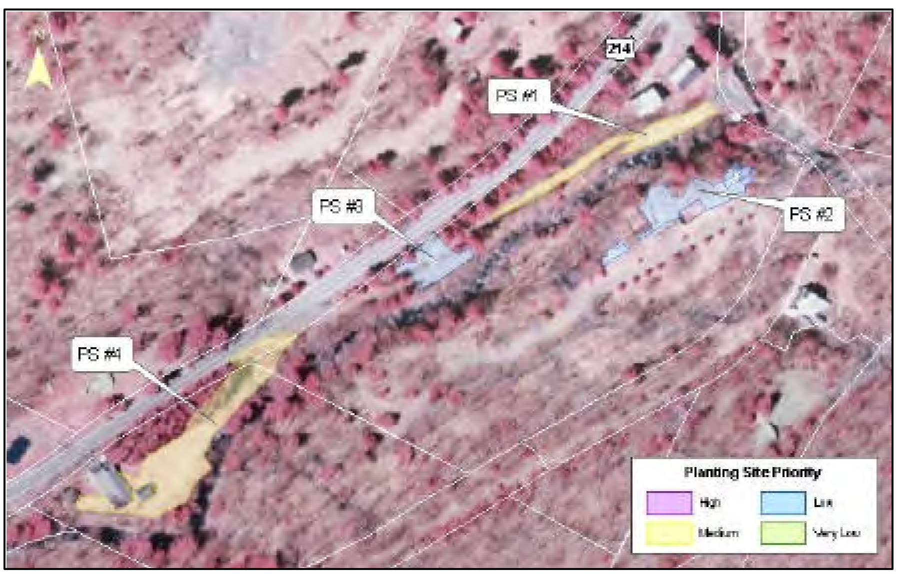


Figure 17 Planting sites location map for Management Unit 2

Planting site #1 is located at the top of the management unit on the right bank at Notch Inn (Fig. 18). At the top of the stacked rock wall is a narrow swath of trees and shrubs, along which runs a relic alignment of NYS Route 214, which is currently mowed. To improve buffer function of the riparian zone here, it is recommended to plant this mowed area with native trees and shrubs.

Figure 18 Planting Site #1

Figure 19 Planting Site #2

Planting site #2 (Fig. 19) is also located at the top of the management unit, at an old campground which is no longer is use, at the top of the left bank. A large mowed grass area still exists at this campground. To improve the buffer function of this area, it is recommended to plant this mowed area with native trees and shrubs.

Planting site #3 is a gravel and grass pullout area on NYS Route 214 (Fig. 20). There are currently a few trees on this steep right bank. To improve buffer function, it is recommended to plant this mowed area with native trees and shrubs. Shrub plantings may be preferred at this site as there is a telephone line above the site. Depending of landowner use of this area, the gravel pullout area or a portion of this area should also be considered for similar plantings.

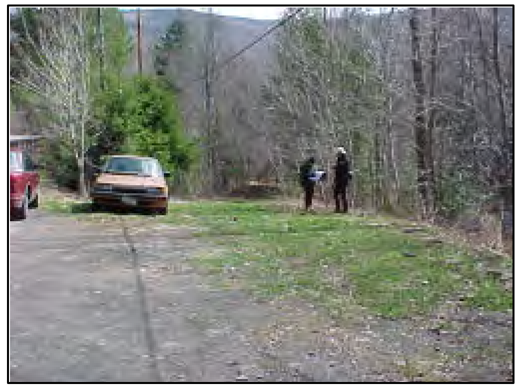


Figure 20 Planting Site #3

Figure 21 Planting Site #4

Planting site #4 is located at the newly renovated red barn on the right side of NYS Route 214 (Fig. 21). The right stream bank located on this property is fairly steep with scattered trees and shrubs. This stream bank is slightly eroded and is susceptible erosion in the future. To reduce this risk the stream bank should be planted with trees and shrubs. Due to the steepness of this bank, use of a *geotextile* may be necessary to ensure planting success. To improve buffer function in this area, it is recommended to plant the mowed area with native trees and shrubs. If this option is disagreeable to the landowner, increasing the buffer width by at least 20 ft. beyond the stone wall could increase buffer functionality while still allowing a significant lawn area.

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.

Initial identification for these maps was completed in 1976. Some areas of these maps may contain errors due to stream channel migration or infrastructure changes over time.

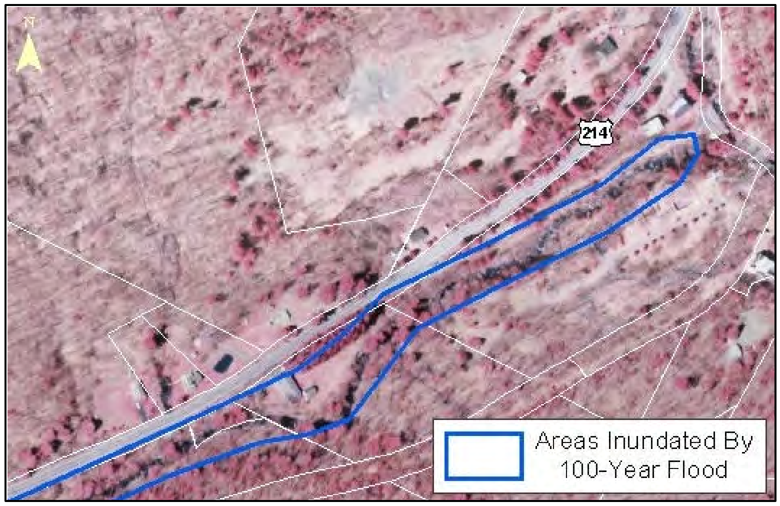


Figure 22 100-year floodplain boundary in Management Unit 2

To address the dated NFIP maps, the NYS DEC Bureau of Flood Protection is currently developing floodplain maps, using a new methodology called Light Detection And Ranging (LIDAR). LIDAR produces extremely detailed and accurate maps, which will indicate the depth of water across the floodplain under 100-year and other flood conditions. These maps should be completed for the Stony Clove Watershed in 2004.

According to the NFIP maps, there are two houses located within the 100-year flood boundary in this management unit (Fig. 22). The current NFIP maps are available for study at the Greene and Ulster County Soil & Water Conservation District offices.

Bank Erosion

Most stream banks within this management unit are stable. The 1% of stream banks currently experiencing erosion is located along sections of the stacked rock wall, which begins on the right bank at the top of the management unit. This section of stream is vulnerable to erosion because the stream is entrenched. Stream entrenchment prevents high flows from spilling into the floodplain, resulting in higher velocity of in-channel flood waters and erosion. A threat of future erosion exists at Planting Site #4; improvement of streamside vegetation is recommended to address this threat.

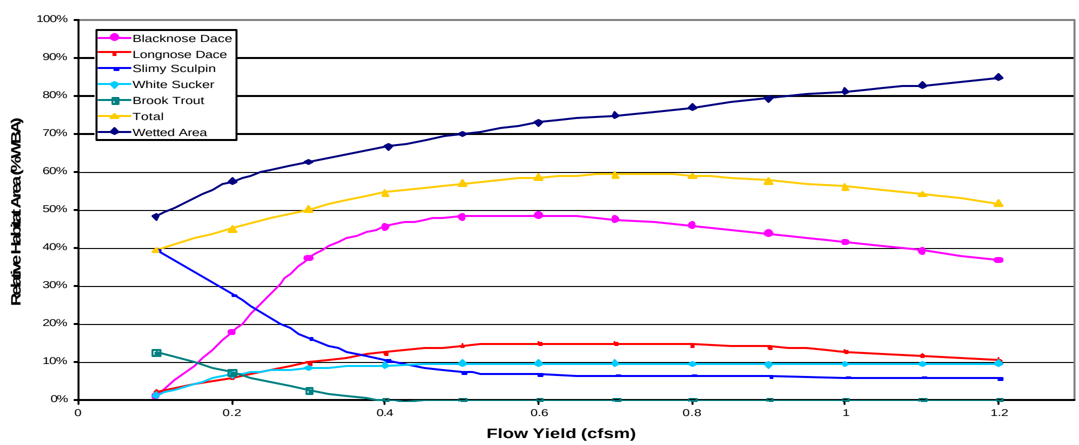
Infrastructure

Although approximately 252 ft. of this roadway is within 50ft. of the stream, there are no apparent flood threats to this roadway. There are no stream crossings within this management unit.

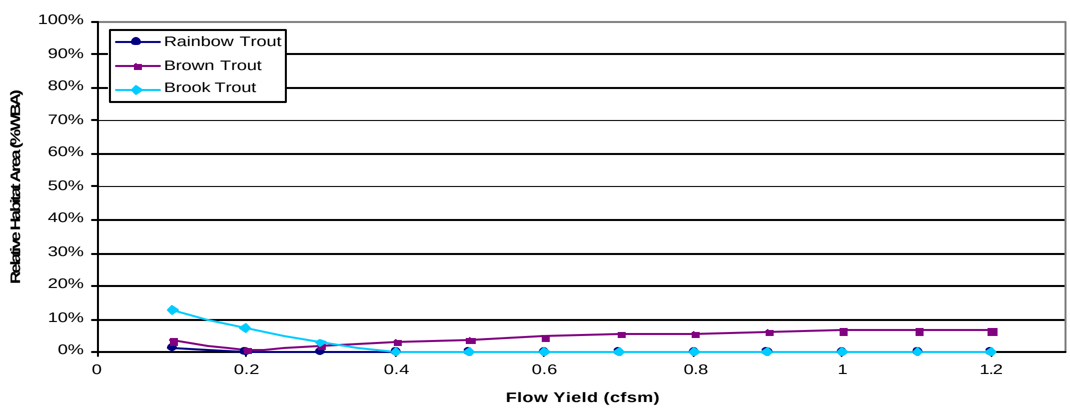
Aquatic Habitat

Aquatic habitat was analyzed for each management unit using Cornell University Instream Habitat Program's model called MesoHABSIM. This approach attempts to characterize the suitability of instream habitat for a *target community* of native fish, at the scale of individual stream features (the "meso" scale), such as riffles and pools. Habitat is mapped at this scale for a range of flows. Then the suitability of each type of habitat, for each species in the target community, is assessed through electrofishing. These are combined to predict the amount of habitat available in the management unit as a whole. The habitat rating curves in the figure below depict the amount of suitable habitat available at different flows. See Appendix B for a more detailed explanation of methods.

This management unit is comprised largely of cascades and has some rip-rap, woody debris, and canopy cover. It is a shallow area with relatively fast, but varying velocities. At very low flows, wetted area is half the size of bankfull wetted area and increases steadily to 90% of bankfull wetted area at 1.5 cfsm. At the highest measured flows, the size of the management unit increases only laterally, not lengthwise. Overall habitat increases gradually until mid-flows, when it then declines. The largest amount of habitat is available for blacknose dace, whose rating curve increases steeply at low flows and then gradually declines. The amount of habitat considered to be excellent for slimy sculpin declines sharply with flow. White sucker and longnose dace have relatively stable, moderate levels of habitat available. With the exception of lowest flows, no habitat is available for brook trout. Rainbow and brown trout have only low levels of habitat available.



Rating curve for relative habitat area versus flow for Management Unit 2



Rating curve for trout relative habitat area versus flow for Management Unit 2

Figure 23 MesoHABSIM habitat rating curves for Management Unit 2

Water Quality

Clay exposures and sediment from stream bank and channel erosion pose a significant threat to water quality in Stony Clove Creek. Clay and sediment inputs into a stream may increase *turbidity* and act as a carrier for other pollutants and pathogens. No clay exposures were identified in this management unit at the time of the stream feature inventory. The absence of glacial lake silts/clays and/or clay-rich lodgement till means this unit is not likely to contribute significantly to suspended sediment loading.

Stormwater runoff can also have a considerable impact on water quality. When it rains, water falls on roadways and flows untreated directly into Stony Clove Creek. The cumulative impact of oil, grease, sediment, salt, litter and other unseen pollutants found in road runoff can significantly impact water quality. There is one stormwater culvert in this management unit, which drains some road runoff.

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. There are many houses located in 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 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. Eligible systems included those that were less than 1,000-gallon capacity serving one- or two-family residences, or home and business combinations (CWC, 2003). No homeowners in this management unit made use of this program to replace or repair a septic system.