Management Unit 19

Ulster County - Town of Shandaken
Chichester Bridge to Between Cross Section 186 & 187

Management Unit Description

This management unit begins at the Chichester Bridge, and continues approximately 3,997 ft., ending between cross section 186 and 187. The drainage area ranges from 27.0 mi^2 at the top of the management unit to 31.8 mi^2 at the bottom of the unit. Both the valley slope and stream water surface slope are 1.7%.

Stream conditions in this confined management unit are relatively unstable, with infrastructure encroachment that contributes to bank erosion at several sites. Management efforts in this unit should focus on reestablishing a stable toe at two bank failures, and plantings at several revetment sites to improve longevity and increase overhead cover.

Summary of Recommendations Management Unit 19	
Intervention Level	Full Restoration / Assisted Self-Recovery
Stream Morphology	Conduct feasibility study on full restoration of bank erosion monitoring site #25
Riparian Vegetation	Riparian plantings at identified planting sites (PS #50-52)
Infrastructure	Assisted restoration at erosion monitoring site #26
Aquatic Habitat	Enhance overhead cover by joint planting of rip-rap at identified planting sites (PS #50 & #52)
Flood Related Threats	Resurvey National Flood Insurance Program (NFIP) map to more accurately reflect the active stream channel
Water Quality	Bioengineered treatment of hillslope at erosion site #25 Restoration of vegetated low bench erosion site #26
Further Assessment	Ongoing monitoring of bank erosion monitoring sites #25 & #26

Historic Conditions

As the glaciers retreated about 12,000 years ago, they left their “tracks’ in the Catskills. Rubin (1996) mapped the presence of lodgement till from the Chichester bridge downstream to the approximate location of cross-section 181 (See Section 2.4, Geology of the Stony Clove Creek, for a description of these deposits). This glacial deposit is extensively exposed along the right bank across from Fitchner Road (Inset C). Stream channels incised into lodgement till tend to have unstable stream banks that are often over-steepened and fail by episodic mass wasting. According to Rubin’s mapping the glacial lake silt/clay deposits are exposed or near the surface along the remainder of this Management Unit (Inset B). Where streams are incised into the glacial lake deposits there is strong potential for channel instability by excessive scour in the stream bed or rotational failures (slumping) along adjacent hillslopes. There is also a significant amount of bedrock control along the right bank which limits channel migration but increases erosion potential along the left bank that is confined by NYS Route 214.

The view in Figure 2 is approximately from the hard turn that the Stony Clove Creek takes when it hits the bedrock valley wall at the base of Sheridan Mountain. The southeast floodplain of the creek here was not settled until sometime between 1900 and 1960.

Figure 2 Looking upstream under the NYS Route 214 bridge at Chichester, Courtesy of the Gale Collection

Assuming accuracy for the 1903 USGS 15-minute topographic map of Phoenicia, the location of the confluence of Ox Clove has changed, and the bend in the Stony Clove Creek mainstem has moved northwest (Fig. 3). A pool has been created across NYS Route 214 from the community church. This local swimming hole filled in sometime between 1980 and the time of the 2001 stream feature inventory described below (L. Gale, personal communication).

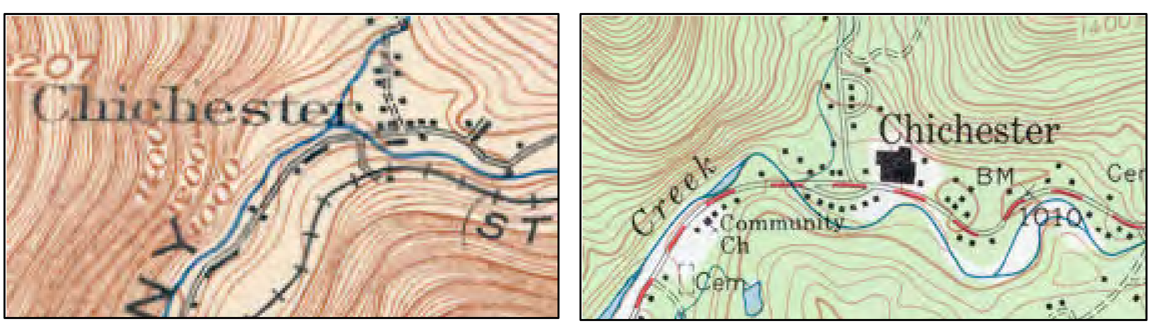


Figure 3 Excerpts of USGS topographic maps, 1903 and 1960

As seen from the historical stream alignments, the stream channel has not shifted significantly since 1959 (Fig. 3).

According to available NYS DEC records there have been no stream disturbance permits issued in this management unit.

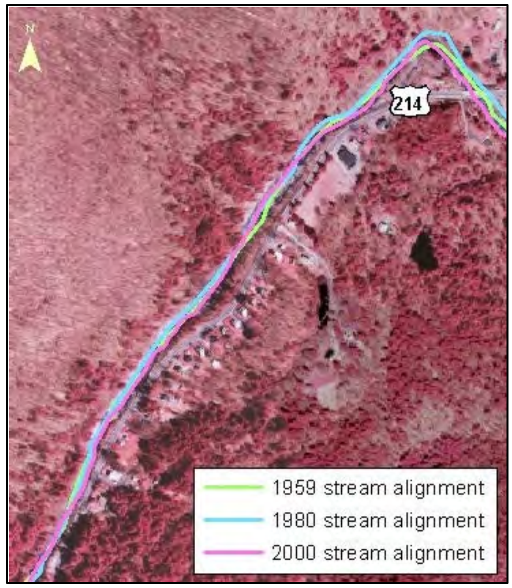


Figure 3 Historic stream channel alignments for Management Unit 19

Stream Channel and Floodplain Current Conditions

Revetment, Berms and Erosion

The 2001 stream feature inventory revealed that 10% (809 ft.) of the stream banks exhibited signs of active erosion along 3,997 ft. of total channel length (Fig. 1). Revetment has been installed on 16% (1,274 ft.) of the stream banks. No berms were identified in this management unit at the time of the stream feature inventory.

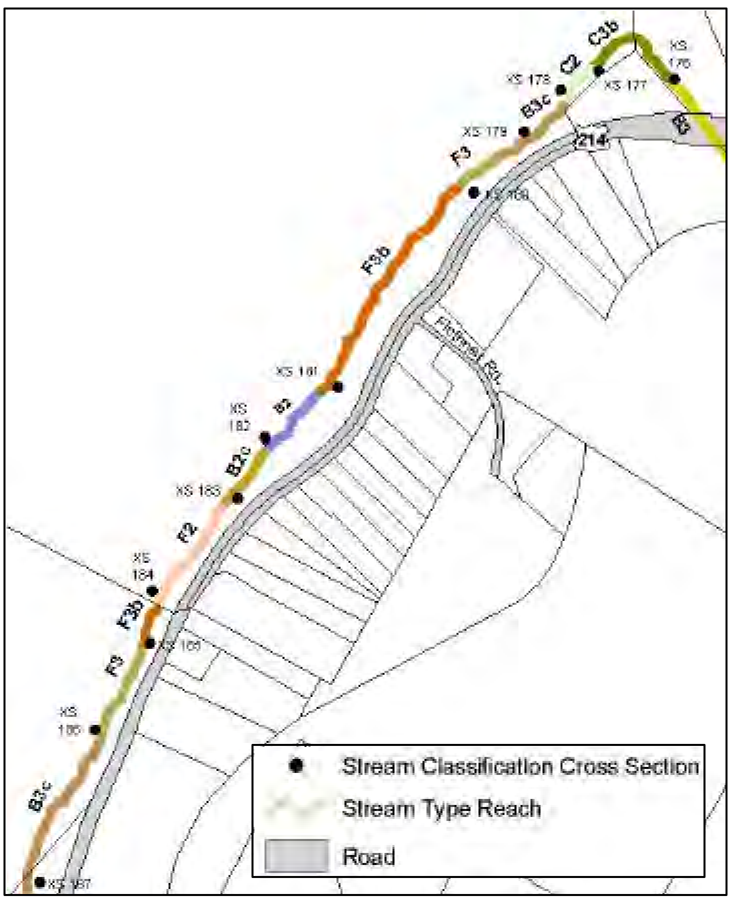


Figure 4 Cross-sections and Rosgen stream types for Management Unit 19

Stream Morphology

The following description of stream morphology references insets in the foldout Figure 23. “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. 4), creating small reaches with differing morphologic characteristics, which are classified as different *stream types* (See Section 3.1 for stream type descriptions).

This management unit is characterized by a general confinement of the channel by valley form and infrastructure encroachment. With the exception of the one reach, *sinuosity* is extremely low. Channel slope fluctuates dramatically throughout the unit, and bed material is generally coarser than elsewhere in the Stony Clove, with a large amount of bedrock and boulders present. While the channel is controlled vertically by bedrock, lateral adjustment is causing bank erosion at several locations.

Management unit #19 begins as the Stony Clove emerges from under the Chichester Bridge, with a 191 ft. reach of B3 stream type (Fig.5). The stream channel is moderately *entrenched*, or confined within the stream banks during high flood events. The slope of the stream channel is 2.0%. The bed material is dominated by cobble, but large boulders and bedrock are abundant.

Figure 5 Stream Type B3 looking upstream

At the top of this reach, a tributary, originating on the steep mountainous slopes of the Ox Clove, enters the Stony Clove Creek from the right stream bank just below the Chichester Bridge (Inset H). This unnamed stream runs 3.4 miles, adding 3.9 $mi.^2$ to the drainage area of the Stony Clove, or an increase of about 14%. The headwaters of the Ox Clove tributary are unclassified by the NYS DEC best usage classification system. The last 0.7 miles of the stream is classified as C(t). This classification indicates the best use for this stream is supporting fisheries, including trout and non-contact activities.

Beginning at the top of this reach, 267 ft. of rip-rap has been installed on the left stream bank (Inset G).

Approximately 50 ft. downstream from the Chichester Bridge (Inset D) there is a grade control structure. This structure prevents stream channel *degradation* by allowing water to safely drop from one stabilized grade to a lower grade and preventing bed erosion from advancing up the stream channel. Maintaining a stable channel grade and elevation under the Chichester Bridge protects the bridge from abutment scour. A large pool has developed downstream of this structure.

As the stream reconnects with its floodplain on the left, stream type transitions to C3b for the next 394 ft. reach. The slope of this reach increases to 2.6%. As seen in Figure 6 looking downstream, a mid-channel bar has begun to form near the top of this reach. This channel *aggradation* is likely resulting from a backwater effect caused by the hard bend to the left just downstream. The stream channel is beginning to widen and may eventually lead to increased bank erosion in this area. On the left stream bank there is an overflow channel which conveys water during high flow events.

Figure 6 Bedrock

The channel takes a sharp turn to the left as it hits the bedrock valley wall. The stream falls down a cascade and into a plunge pool along the left stream bank. The lower of half of this reach is steep with an abundance of large boulders and bedrock.

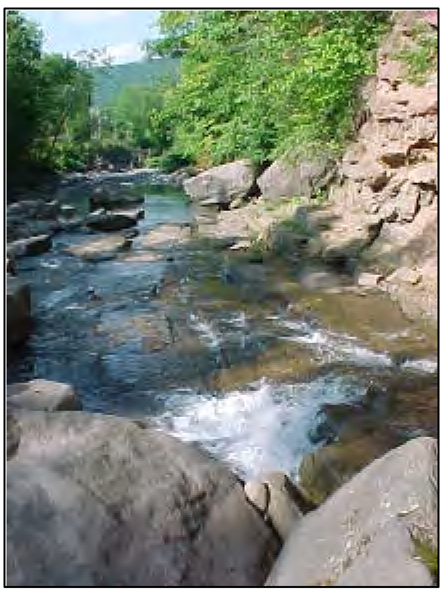


Figure 7 Cross-section 178
Stream Type C2

As the dominant bed material increases to boulders, stream type transitions to C2 for a short 168 ft. reach (Fig. 7). This reach remains steep with a slope of 1.8% and consists of a large cascade. For approximately the first third of this reach, the bed and right stream bank are bedrock.

There is a federally designated wetland along the stream in this management unit (Fig. 8). This wetland, which is 1.6 acres in size, is classified as palustrine scrub-shrub, broad-leaf deciduous, and temporarily flooded (PSS1A).

Figure 8 Federally Designated Wetland

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 2.6 for wetland types description and regulations).

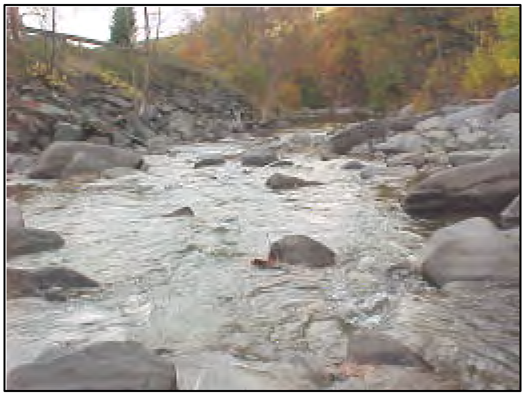


Figure 9 Cross-section 179
Stream Type B3c

The channel becomes moderately entrenched by the NYS Route 214 embankment on the left, and the dominant bed material decreases to cobble, as stream type changes to B3c for the next 306 ft. reach (Fig. 9). In the middle of this reach, the overflow channel rejoins with the Stony Clove mainstem. The *thalweg*, or deepest part of the stream, flows against the steep left stream bank. The NYS DOT has installed 326 ft. of rip-rap (Inset F) along the lower half of this bank.

As the stream widens and becomes yet more entrenched, stream type transitions to F3 for the next 180 ft. reach (Fig. 10). This reach is composed of a large glide, with an extremely flat channel slope of 0.4%.

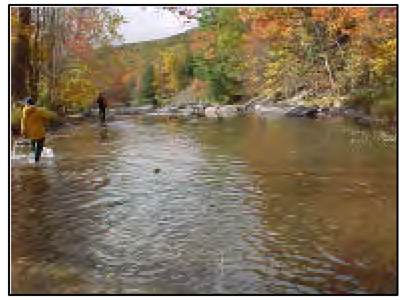


Figure 10 Cross-section 180
Stream Type F3

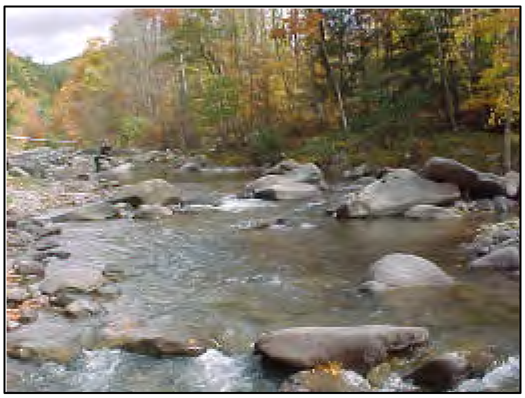


Figure 11 Cross-section 181
Stream Type F3b looking upstream

Proceeding downstream, the channel slope increases to a steep 2%, changing stream type to F3b for the next 888 ft (Fig. 11). This reach consists of a series of cascades followed by plunge pools and rapids. The bed material is dominated by cobble but large boulders are abundant.

Bank erosion monitoring site #25 is located along 506 ft. of the right stream bank of this reach (Inset C). The stream flows directly against the valley wall, increasing the *shear stress*, or force of flowing water, on the stream bank during high flow events. This hillslope, composed primarily of lodgement till, is being undermined by toe erosion, resulting in the mass wasting of the bank. Compounding this erosion problem, the face of the stream bank has been stripped of vegetation, leaving it vulnerable to erosion resulting from runoff from the steep hillslope above. The exposed lodgement till has a high silt and clay content, and contributes significant suspended sediment loads during high flow events. Clay inputs into a stream are a serious water quality concern because they increase *turbidity*, degrade fish habitat, and can act as carriers for other pollutants and pathogens.

The Bank Erodibility Hazard Index (*BEHI*) score of site #25 is ranked “High”, the third highest prioritization category in terms of its vulnerability to erosion (Fig. 12). This bank erosion site is considered one of the highest priorities for restoration due to its large eroding area, high shear stress, and its significant threat water quality.

From visual observations, it appears this bank erosion site is growing in severity and areal extent with each heavy rainfall. During the 2001 survey, it was estimated that the total erosion area of this site was 27,572 $ft.^2$, qualifying it as the largest eroding area along the Stony Clove Creek.

Figure 12 Bank erosion site #25

Recommendations to restore this site would include stabilizing the toe of the right stream bank, and installing a bioengineered treatment of the hillslope. In-depth survey and design would be required to plan a stream restoration project at this site.

At the end of the erosion site, bedrock emerges on the right stream bank, extending 1,308 ft. downstream through the next four reaches.

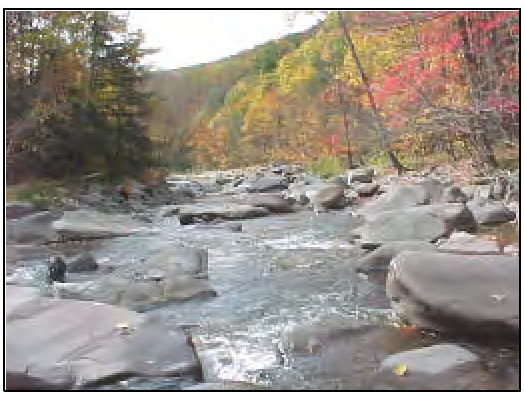


Figure 13 Cross-section 182
Stream Type B2

As channel slope increases to 3.3% and the dominant bed material increases to boulders, the stream type transitions to B2 for the next 312 ft. reach (Fig. 13). This moderately entrenched reach is dominated by cascades. Stream reaches with boulder cascade morphologies are generally considered highly stable.

Continuing downstream, channel slope decreases to 1.2%, changing stream type to B2c for the next 240 ft. Although not as steep as the previous reach, the boulder cascade morphology continues through this reach.

As the channel once again becomes entrenched, stream type transitions to F2 for the next 442 ft. of stream. Boulders continue as the dominant bed material and slope remains fairly flat at 1.4%.

While the right stream bank is armored with bedrock, along the left stream bank the NYS Route 214 embankment is experiencing erosion. Bank erosion site #26 (Inset B) begins at the top of this reach and extends 304 ft. along this stream bank. Shear stress during high flow events has severely eroded the toe of this road embankment, and presents an immanent threat of road failure.

The BEHI score of site #26 is ranked “High”, the third highest prioritization category in terms of its vulnerability to erosion (Fig. 14). This bank erosion site is considered a medium priority for restoration due its threat to infrastructure and water quality from eroding clay.

Figure 14 Bank erosion site #26

Recommendations to restore this site include regrading the stream bank and installing a low floodplain bench planted with appropriate native shrubs. Willow fascine and sedges should be installed along the toe of the bench to reduce erosion susceptibility. If necessary, rock vanes could be used to redirect shear stress away from the stream bank. In-depth survey and design would be required to plan a stream restoration project at this site.

The only USGS gage on the Stony Clove Creek mainstem is located on the left stream bank at the end of this reach (Inset A). This gage (#01362380) has a drainage area of 31.5 mi^2 and has been collecting data from February 1997 to the present.

As channel slope increases to 2.7%, dominant bed material becomes finer and the stream type changes to F3b for the next 152 ft. Although the dominant bed material is cobble, there are still abundant boulders. Bedrock is exposed along the right stream bank through the upstream half this reach.

Figure 15 Rip-Rap and Culvert

For the next 354 ft., channel slope decreases to 1%, as the stream transitions to an F3 stream type. Beginning at the top of this reach, the NYS DOT has installed 611 ft. of rip-rap (Inset E) along the left stream bank to protect the NYS Route 214 embankment (Fig. 15).

Two stormwater culverts outfall along this rip-rap. Both culverts outlet on the rip-rap, reducing the risk of erosion from stormflow.

As the channel becomes moderately entrenched and flattens to a 0.8% slope, stream type becomes B3c for the last 370 ft. of this management unit. Rip-rap continues along most of the left stream bank of this reach.

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).

The high valley wall on the right and the highway road embankment on the left confine even large flood flows through this unit. Bedrock, abundant in this unit, armors the channel against incision that would otherwise be expected in these conditions. Bank erosion has become the prevailing energy dissipation mechanism in the unit, evident from the large failures of the unprotected valley wall on the right. Sediment conveyance through this unit is highly effective as a result of the entrenchment. This is evident in the coarseness of the bed material and the aggradation found in the next unit downstream.

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. 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).

The predominant vegetation type within the 300 ft. riparian buffer is forested (78%) followed by herbaceous (10%). Areas of herbaceous (non-woody) cover present opportunities to improve the riparian buffer with plantings of more flood-resistant species. *Impervious* area (8%) in this management unit is primarily private residences and NYS Route 214. This is of special concern in this unit, as 1,778 ft. of the highway lie within 50 ft. of the stream.

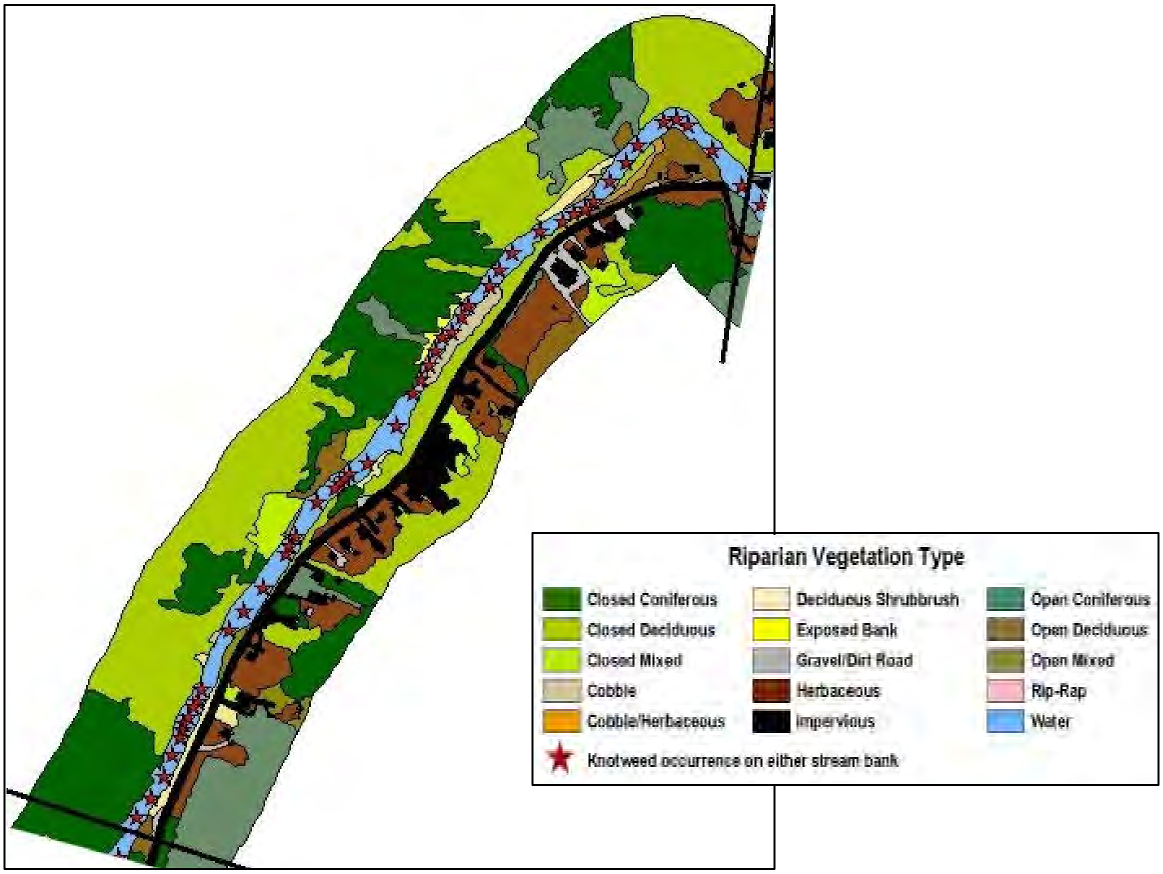


Figure 16 Riparian vegetation map of Management Unit 19

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. Three appropriate planting sites were documented within this management unit.

Figure 17 Planting site location map for Management Unit 19

Figure 18 Planting Site #50

Planting site #50 is located near the top of the management unit along NYS Route 214 (Fig. 18 & Inset F). Some failure is occurring at the toe of rip-rap installed on a steep slope. Japanese Knotweed has begun to grow through this rip-rap.

Recommendations at this site include *joint planting* the existing rip-rap, by inserting plantings into the soil between the openings in the rip-rap rocks. Joint planting will strengthen and increase the longevity of this rip-rap. These plantings will also improve the aquatic habitat by providing shade, resulting in cooler water temperatures. This planting requires coordination with the NYS DOT, as they are responsible for the maintenance of the rip-rap. It is also recommended to remove the Japanese Knotweed, which is an invasive non-native species. Japanese Knotweed does not provide adequate erosion protection because it has a very shallow rooting system.

Planting site #51 is located at bank erosion site #26 (Fig. 19 & Inset B). This site is experiencing minor erosion with loss of vegetation. Stabilization of this site is critical for protection of the NYS Route 214 embankment.

Recommendations to restore this site include regrading the bank and installation of a low floodplain bench, planted with appropriate native shrubs. Willow fascine and sedges should be installed along the toe of bench to reduce erosion risk.

Figure 19 Planting Site #51

Figure 20 Planting Site #52

Planting site #52 is located at the rip-rap along NYS Route 214 near the bottom of the management unit (Fig. 20 & Inset E). This rip-rap is on a steep slope with two invasive species, Japanese Knotweed and Honeysuckle, present.

Joint planting of the existing rip-rap and removal of the invasive species is recommended. The planting of this rip-rap requires coordination with the NYS DOT, which is responsible for maintenance of the rip-rap.

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 21 100-year floodplain boundary in Management Unit 19

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 NFIP maps, there are no houses located within the 100-year floodplain boundary in this management unit (Fig. 21). The current NFIP maps are available for study at the Greene and Ulster County Soil & Water Conservation District offices.

Bank Erosion

Stream banks in this management unit are predominantly stable, with only 10% (809 ft.) experiencing major erosion. Bank erosion monitoring site #26 (Inset C), located at the top of the management unit, is considered one of the highest priorities in the watershed for restoration. This is a large failure, and contributes a significant volume of soil and clay into the creek during high flows.

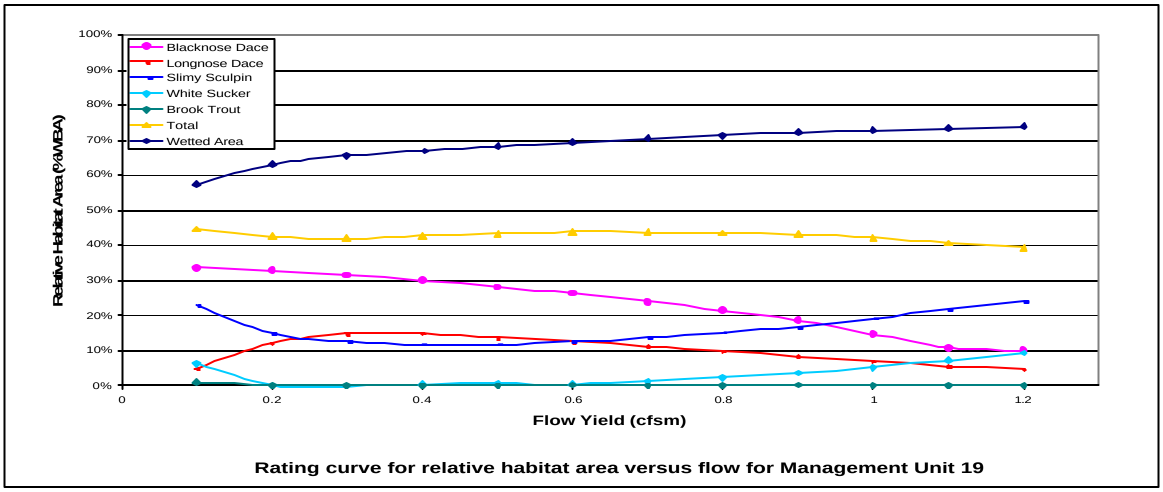
Infrastructure

While there are no imminent threats to roadways, NYS Route 214 runs immediately adjacent to the streambank in several locations (Insets E & F). While rip-rap may provide temporary relief from erosion at these locations, it is expensive to install, degrades habitat, and frequently fails. The planting recommendations for these sites, described above, can mitigate this threat.

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.

Management unit #19 runs close to the road, has large substrate with boulders and bedrock, some shallow margins, and rip-rap (Fig. 22). Flow velocities in this unit are somewhat slower than in Management unit #18. *Wetted area* covers about 60% of bankfull wetted area at low flows and increases to 80% at high flows in the lower portion of the unit. It has a variety of *hydro-morphological units* (HMUs), which change frequently with flow. In comparison to management unit #18, the hydro-morphology here is not as uniform under higher investigated flows. This is reflected in the fact that, while levels of suitable habitat vary differently for the individual species by flow, habitat levels for the target community remains relatively consistent. Blacknose dace and slimy sculpin have the highest amounts of suitable habitat available, but at different flow conditions. The same opposing trend appears between longnose dace and white sucker. Of the trout species, habitat only exists for brown trout, and in minimal quantities. The overlapping factors are low. (See Section 6.6 general recommendations for aquatic habitat improvement)



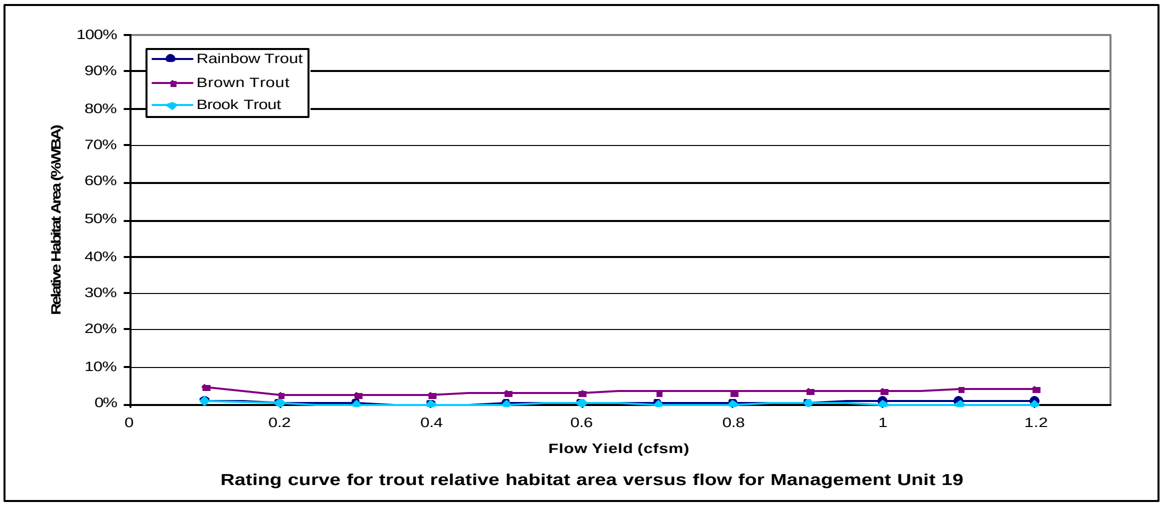


Figure 22 MesoHABSIM habitat rating curves for Management Unit 19

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. There are significant clay exposures at bank erosion sites which need to be addressed in this management unit.

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 are two stormwater culverts in this management unit.

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). Seven homeowners in this management unit have used this program to replace or repair their septic systems.