I. Chestnut Creek Management Unit 9

Background

This section is intended to summarize the overall character and condition of the Red Brook *tributary* to the Chestnut Creek *mainstem*, Management Unit 9 (MU 9). Subsequent sections will discuss specific issues (e.g., *riparian* land use and public infrastructure, channel stability, etc.) in greater detail.

In the summer of 2002, a stream inventory and assessment was conducted along Red Brook, MU9 by District staff. The inventory integrated photographic documentation throughout the management unit with the *GPS* (Global Positioning System) location of multiple physical attributes. The components were incorporated into a *GIS (*Geographic Information System) database and used in conjunction with various base maps to assess the corridor (MU 9 General maps Figures 1 & 2, Photo 1). The purpose of the assessment and the following description is to document the current condition of the stream corridor as well as identify both potential problem areas that could negatively impact Red Brook and Chestnut Creek, and *reference* areas that could be used to model ideal stream conditions for the *watershed*. Although the assessment was not as intensive as for the management units along the mainstem of Chestnut Creek, the inventory was used to create a summary description as well as generate prospective recommendations. The goal of the following description and summary is to facilitate future planning and integrate data collection efforts with other agencies, organizations and landowners.

1. Summary Description

MU9 is approximately 13,850 linear feet (2.62 miles) in length and includes the stream corridor of Red Brook tributary beginning at the outlet of Beaver Dam Pond (Photo 2) to its confluence with Chestnut Creek. The *headwaters* of Red Brook begin in the Town of Fallsburg where stream flow originates from a *wetland* area. Stream flow continues

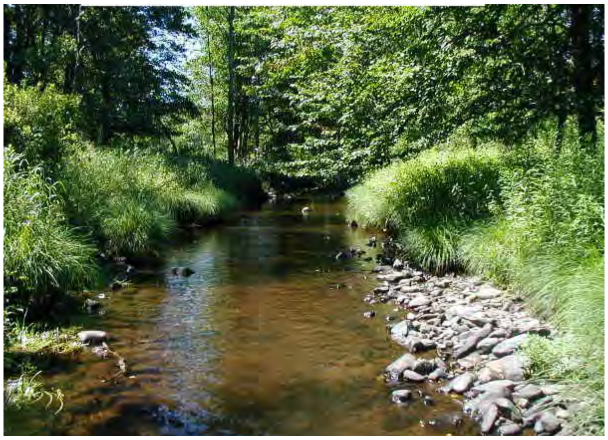

Photo 1. Reach view looking upstream from private bridge.

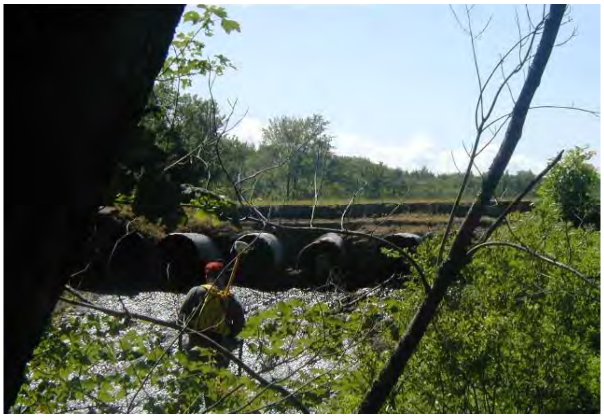

Photo 2. Beaver Dam Pond outfall. Six Culverts, looking upstream.

nearly 2.7 miles passing through two more wetland areas before entering Beaver Dam Pond. A single channel flows north, from a six *culvert* outlet at the dam, to its *confluence* with Chestnut Creek at MU7 in Grahamsville. The *drainage area* of Red Brook headwaters to the top of MU9 at Beaver Dam Pond is 3.65 square miles. An additional 5.21 square miles of drainage area is gained between Beaver Dam Pond and the mouth of Red Brook at Chestnut Creek with the introduction of five tributaries. The largest tributary to confluence with Red Brook enters from the west, upstream of the Route 42 crossing.

The drainage is primarily covered in forest, with agricultural land uses more prevalent in flatter sections of the *basin*. Agricultural land use begins near the middle of the drainage and extends to the confluence. Farm fields and pastures are maintained directly adjacent to the stream corridor throughout this area. Structural development primarily includes a mixture of private residences with several municipal and public buildings located in the lower portion of the MU.

Field inventories were used to characterized the stream *channel* in the upper portion of the basin as a low gradient channel with sediment consisting predominantly of finer *sand* and *gravel*. Although a natural process, excessive *bar* formations documented throughout the area, raised concern for potential channel instability. The area was found to be forested with ample vegetation for maintaining general physical stream *stability*. Vegetation was providing substantial overhead cover, which generates numerous benefits including decreased water temperature for fisheries habitat (Riparian Vegetation Issues in Stream Management, Volume 1, Section IV.B.3).

The lower portion of the tributary was characterized by a steeper channel slope, less floodplain connection and larger channel materials. The inventory documented a number of potential issues including floodplain disconnection resulting from historic stream alterations; reduced riparian buffer widths from development, and potential areas contributing to increased stormwater runoff.

During the planning process and public meetings, concern was raised by stakeholders (Landowner Concerns & Interests, Volume 1, Section IV.B.6) regarding excessive woody debris (see definition for large organic debris creating debris jams within the unit. Further information obtained from interviews with residents documented concern for impacts from streambank *erosion*, excessive woody debris, and habitat impacts from infrastructure and channel processes.

2. Riparian Land Use and Public Infrastructure

According to tax maps for 2000, there are nineteen known property owners in MU 9, holding twenty-one parcels which are contained or bounded by Red Brook. Private property containing residential structures account for the primary development within the corridor. Relative density of the residential structures is minimal in comparison with other management units. Although most private residential structures front along the roadways within the basin, and are not in direct contact with the channel and corridor, they have potential influence on the quality of the resource.

The current stream corridor through MU9 is sparsely populated and displayed only minor anthropogenic impact from the private residences. The potential for growth along Red Brook generates concern for proper planning and land use. In comparison, historic development and continued encroachment have been noted along the mainstem Chestnut Creek. Chestnut Creek management units have displayed these impacts both at the management unit level, and throughout the mainstem as a whole. In general, the volume as well as the water quality of the runoff is a function of the size and characteristics of the land area each system drains (Introduction to Stream Processes and Ecology, Volume I, Section III). For example, land areas with a high percentage of *impervious surfaces* tend to generate considerably more runoff than areas that are predominantly forest. The impacts become more pronounced when applied to areas containing small amounts of development as an initial condition.

Land around public buildings near the confluence with Chestnut Creek is predominantly parking lot and mowed lawn. Storm drainage probably conveys storm water *runoff* from these parking lots directly to Red Brook and Chestnut Creek. Storm water retrofit opportunities were not evaluated as part of the initial assessment, however the review of aerial photographs indicates that the properties along the corridor with the highest percent impervious surfaces include the Grahamsville Wastewater Treatment Plant the Powerplant and property owned and operated by NYCDEP at the Grahamsville Laboratory. All structures and parking lots are located at the confluence of Red Brook and Chestnut Creek and are located directly adjacent to the stream corridor.

Seven stream crossings and one spring drainage culvert were inventoried within the stream corridor of MU9. These bridges and culverts are located on both the mainstem of Red Brook and one along Route 42 on a tributary draining to Red Brook. The crossings include the private NYCDEP Bridge (Photo 3) and the County bridge at South Hill Road (CBN:216,BIN:3356140) built in 1947 (Photo 4). Biennial Inspection conducted for the NYS DOT indicates that the South

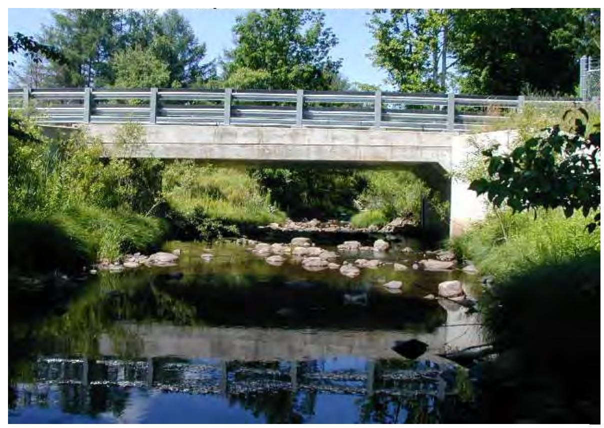

Photo 3. DEP bridge over Red Brook.

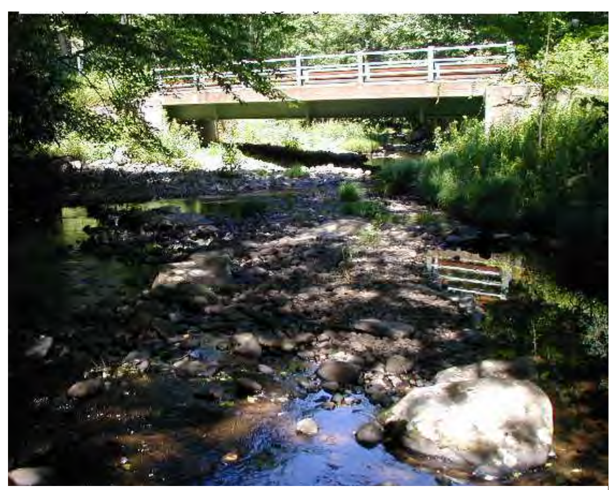

Photo 4. View looking at South Hill Road Bridge.

Hill Road bridge has settled over time, causing some cracking. Debris along the has blocked all of the right side and the deck exhibits longitudinal, transverse cracking and fatigue prone welds. The report also indicated that the waterway opening was undersized to pass higher *stream flows*.

There is a private farm culvert crossing, two double culverts, one on Beaver Dam Road which appears to be having difficulty transporting sediment indicated by the presence of sand bars, however, no further studies have been conducted at this site (Photo 5). There is also another double culvert at a private crossing in which one of the culvert pipes is smaller and elevated to an overflow height seemingly to assist the larger culvert at higher flows (Photo 6). There is a six culvert outlet crossing at the mouth of the Beaver Dam pond (see Photo 2) and one small culvert that feeds an intermittent spring.

There is single “hanging” box culvert, located on an unnamed tributary crossing State Route 42, just upstream of the tributary’s confluence with Red Brook upstream of the South Hill Road Bridge (Figure 2). The base of the culvert is severely scoured and weathering, as the stream flow passing through its narrow confines has created a scour pool at the outlet (Photo 7). Project stakeholders voiced concern regarding the current condition of the channel at the outlet as well as the potential barrier to fish migration. Local anglers have expressed that Brown trout exist both upstream and downstream of the structure, though whether upstream fish are resident is unknown. The stream channel below the outlet has developed a large scour *pool* resulting in a three to four foot elevation

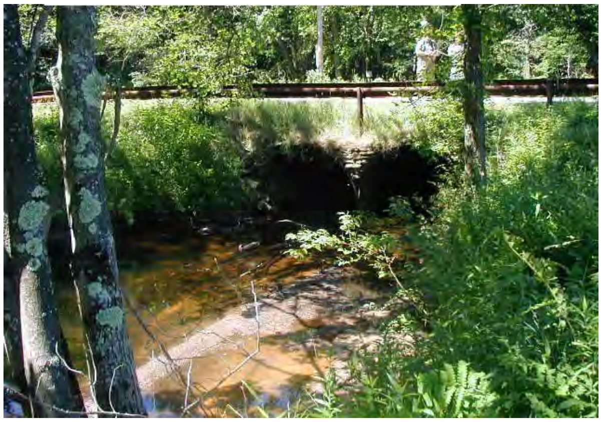

Photo 5. Looking upstream at twin culvert Beaver Dam Road crossing.

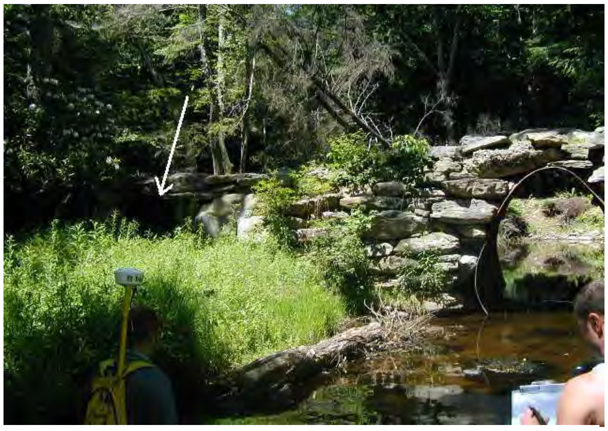

Photo 6. Looking downstream at double culvert Over-flow culvert is indicated by white arrow.

Photo 7. View from mid channel looking upstream. Scour pool at outlet of Route 42 box culvert. Eroding right bank 10’ high.

difference in grade between the outlet invert and *base flow* of Red Brook. A potential causes for the elevation difference is excess channel scour produced by the *hydraulic* condition developed through the culvert. The steep slope of the culvert, lining and geometry are the suspected causes of this condition. Another potential cause of the grade difference is channel *incision* along the main stem of Red Brook leaving a perched condition, possibly a *headcut,* or downcutting, upstream migration, at the culvert. This scenario should be evaluated both for the immediate migration issue, as well as a possible indicator of local channel processes of Red Brook. The culvert bottom has begun to deteriorate revealing rebar supports along the bottom of the culvert and stress cracks in State Route 42 from culvert instability.

3. History of Stream and Floodplain Work

Development of the riparian corridor along Chestnut Creek Watershed historically involved floodplain fill and/or the construction of flood *berms* to protect structures placed in these areas. Filling floodplain areas to accommodate development on private as well as public land is still a common practice in the Chestnut Creek watershed. Efforts by landowners to protect property have resulted in modification of approximately 6% of the channel through this unit with various types of *revetment*.

Two types of revetment were found in MU 9. Several *stacked rock wall*s totaling approximately 340 feet we inventoried as well as a stone berm comprised of dumped fieldstone (Photo 8), which measured 1340

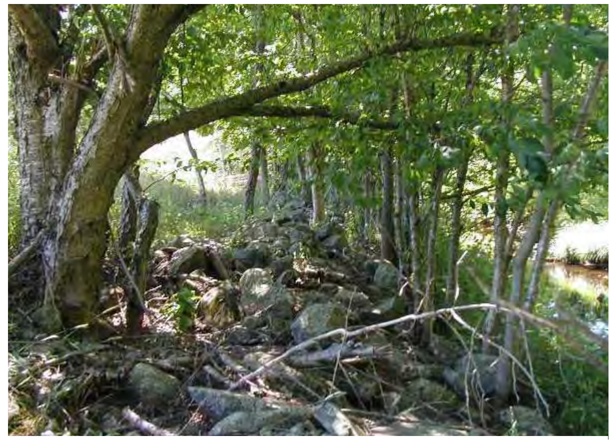

Photo 8. View looking upstream at dumped field stone on right bank.

feet. The purpose of the berm was not investigated, but it is suspected to be a historic remnant of land clearing for agricultural production and a protective measure from flooding (Community History and Current Conditions, Volume 1, Section IV.A). The berm is currently well vegetated with a large number of deciduous trees growing through the stones. The continuous makeup of the berm prevents flood flow from utilizing the undeveloped natural floodplain.

Floodplain berms such as these generally do not offer much, if any, protection from flooding, and can result in higher flood height (or stage) by preventing floodwaters from flowing over the floodplain. In situations where berms create higher flow *velocities* and channel stresses, channel erosion and down cutting can occur. Floodplains function to reduce flood velocity, increase absorption of floodwaters, encourage deposition of *silt* and fine sediments (keeping them from being washed further downstream) and decrease flood *stage*, in downstream areas.

Removal or restructuring of some of these bermed areas should be considered to add floodplain function to this area and reduce potential erosion and instability problems. Setting berms back away from the active stream can provide a compromised solution, if flood protection is required. Further assessment should be performed in the area of the berm as well as upstream and downstream. The assessment should quantify the degree of disconnection of the stream from its floodplain, impacts of the berm to the channel and evaluate the benefits of removal or redesign.

4. Channel Stability and Sediment Supply

Although the stream inventory conducted in 2002 did not include morphological stream surveys or channel evaluations, some general assessments can be made from the inventory and remotely sensed data. The stream channel in MU 9 primarily contains two general channel types. The upper watershed appears to have greater floodplain connection and a lower channel slope (Hydrology and Flood History, Volume 1, Section IV.B.2). Channel materials such as sands and gravels were identified as the dominant sediment size. Bar formations are more common as well as substantial woody debris located in the channel boundary. Progressing downstream, average channel slopes increase with predominantly larger channel sediment.

Preliminary observations indicate that most of the channel along this management unit is laterally stable (i.e., bank erosion rates are low). Mature trees and shrubs provide lateral control along the majority of the management unit. The inventory assessment documented 560 feet of the streambank erosion, which equates to 2% of the channel length. The erosion is located primarily in the upper watershed and occurs in four sections ranging from 85 ft. to nearly 200 ft in length (Photo 9). The exposures consist mainly of moderately undercut banks, located along areas with generally low bank heights. One bank, approximately 30 ft. - 40 ft. in height was inventoried, which potentially could be introducing a considerable volume of sediment to the stream system (Photo 10). Minimal information was collected along this bank. It is recommended that the relevant data be collected to determine the rate and magnitude of the failure as well as potential future impacts. In general, stream bank erosion in MU 9 seems to be less than other management units along Chestnut Creek.

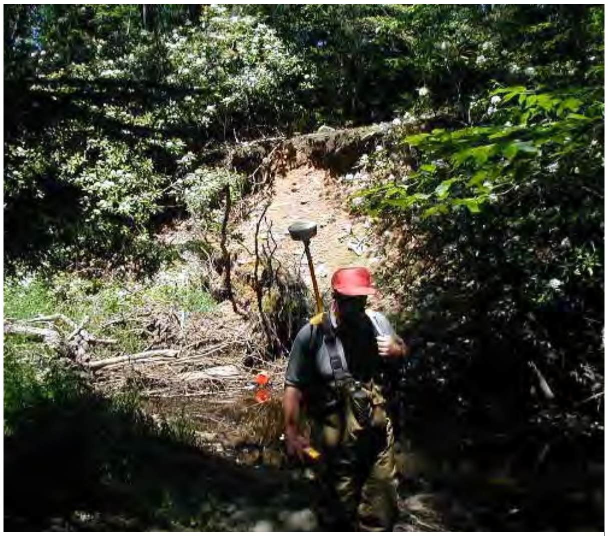

Photo 9. View looking at 30’-60’ eroded right bank. Lack of vegetation on top of cobble/gravel/sand. Fallen trees at base of bank.

The 2002 Assessment documented a number of areas containing debris jams and channel blockages (Photo 11). The areas were located exclusively in the upper watershed below the Beaver Dam Pond

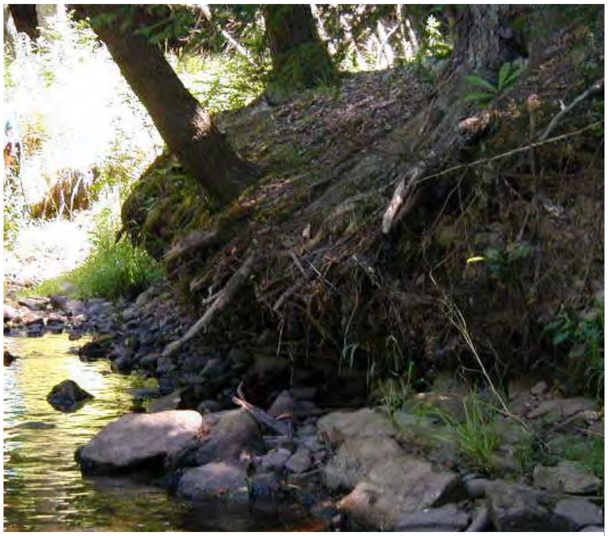

Photo 10. View looking at erosion and undercut trees on right bank.

Photo 11. View looking upstream at river wide log jam on Red Brook, can cause stream instability.

outfall. These debris jams and other channel obstructions cause problems by trapping sediment, which initiates and/or accelerates the development of gravel bars and reduces channel capacity. Subsequent bed erosion and removal of the deposited gravels contributes sediment to downstream reaches. Alternately, small blockages can create and maintain beneficial physical habitat (Photo 12), as well as assist in controlling stream channel

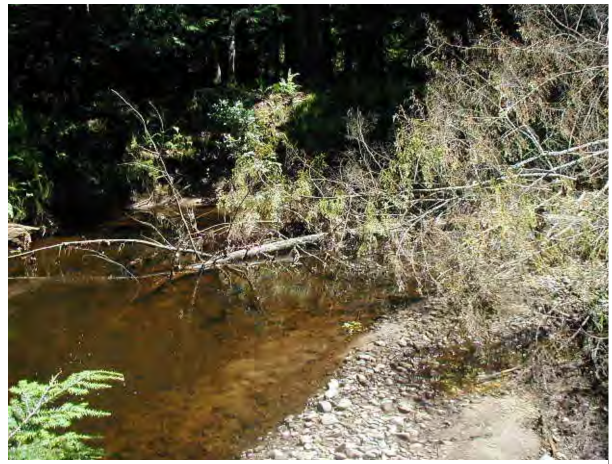

Photo 12. View looking at smaller debris jam on Red Brook, can add to habitat.

incision and *degradation*. Extent of wood debris should be quantified and compared to standards that provide information on quantity and include the association of the *stream types* present. Annual *monitoring* of the area for additional debris and potential impact would be effective management strategy woody debris, jams and channel impacts.

An analysis of a series of historic aerial photographs was performed to assess the natural changes and historic modifications to the stream channel and floodplain within MU 9. Field assessments and historical documentation can be combined with interpretation of the imagery in order to develop a causal analysis relating to the current channel stability and morphology. MU 9 was assessed using imagery from 1977, 1985, and 2001 (Aerial Photos 13, 14, & 15).

Aerial imagery shows land use and general riparian density has not changed significantly over the photographic series. Visual in the aerial series, the agricultural areas (seen on bottom left) have an extremely narrow riparian buffer in

Photo 13. 1977 Aerial Photograph of MU 9.

Photo 14. 1985 Aerial Photograph of MU 9.

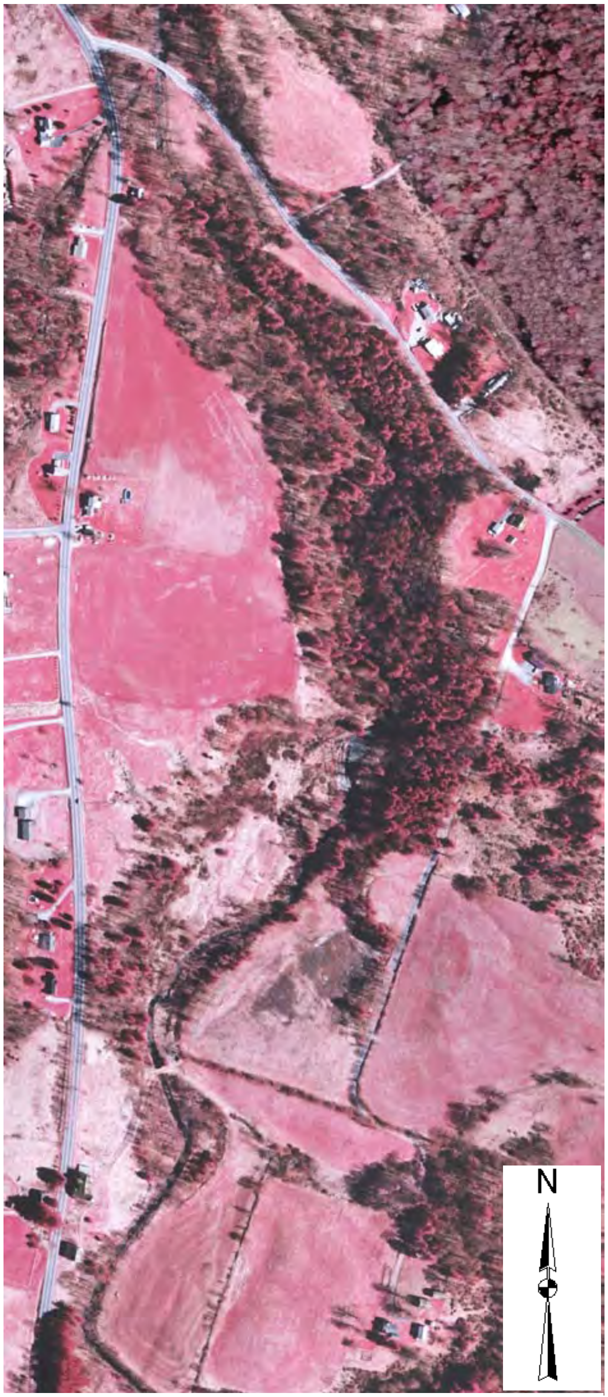

Photo 15. 2001 Aerial Photograph of MU 9.

comparison to downstream areas (top center) which are wider and have increased density.

5. Riparian Vegetation

Vegetated riparian zones act as a buffer against pollution and are therefore very important in mitigating the adverse impacts of human activities (, Riparian Vegetation Issues in Stream Management, Volume 1, Section IV.B.3). Forested riparian buffers facilitate stream stability and function by providing rooted structure to protect against bank erosion and flood damage (Photo 16). Streamside forests also reduce *nutrient* and sediment runoff, provide organic matter that can be used by aquatic life, while providing shade to dampen fluctuations in stream temperature (Photo 17). Wide riparian buffer areas protect streams from runoff and generally provide better habitat for plants and animals than narrow buffers.

The 2002 Stream Assessment conducted on Red Brook did not investigate specific streamside (riparian) plant species or density, other than to note areas of insufficient or stressed vegetation that

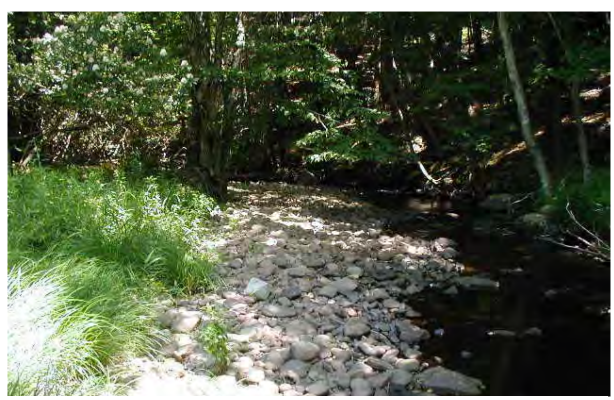

Photo 16. View shows diverse riparian buffer and larger cobble towards the end of a side bar.

Photo 17. Forested buffer provides shade and habitat for the stream.

could affect stream stability, flooding or erosion threats, water quality or *aquatic habitat* for fisheries. Based on these general, qualitative observations, riparian vegetation in MU 9 appears to be generally sufficient to provide the benefits of a healthy riparian area. Riparian areas appeared generally stable and consisted of mature vegetation. Several isolated areas including several maintained agricultural fields and areas along developed areas near the mouth of Red Brook (Grahamsville Wastewater Treatment Facility, NYCDEP Laboratories, and the Powerplant Substation) have the potential for increasing the quantity and quality of the existing riparian area by providing for larger forested buffer areas adjacent to the stream.

6. Restoration and Management Recommendations

As presented previously, the Chestnut Creek Management Plan will be utilized to guide and facilitate stakeholders (Stream Related Activities & Funding Sources & Agency Contacts, Volume 2, Section V) in their efforts to correct stream channel instability problems, restore and maintain natural floodplain functions, control runoff from developed areas to reduce pollutant loadings from channel and upland sources, restore and protect in-stream habitat, and reduce the need for future channel maintenance.

This section includes specific restoration and management recommendations for Management Unit 9, as well as a general discussion of the approach to stream *corridor* restoration and management recommended for the Chestnut Creek Watershed. The SCSWCD, NYCDEP, and other agencies and organizations will be working with the community to implement the restoration and management strategies outlined in this Management Plan. It is critical that stream and upland area projects be integrated to avoid potential conflicts in their respective objectives. Therefore, this section also includes comments and recommendations regarding the integration of proposed strategies in upland areas, in particular floodplain management and storm water management practices.

Restoration and Management Recommendations Management Unit 9

1. Promote protection and preservation of currently healthy riparian areas. Implement strategies to educate riparian landowners on the benefits of preserving the current riparian area and limiting land use changes.

2. Promote protection of currently stable stream channel. Implement strategies to educate adjacent landowners on the benefits of sustaining naturally functioning *stable* stream reaches.

3. Evaluate the existing revetment for potential replacement with adequate

stabilization structures where needed which will maintain and promote a naturally functioning stream channel. Any stabilization technique should include *bioengineering* and/or re-vegetation.

4. Consider efforts to promote land use planning within the corridor to protect the existing resource. Techniques for assessment could include "build-out" analyses that could effectively model the existing conditions and create comparisons between future proposed land use changes relative to stormwater runoff, water quality, habitat, erosion, and flooding threats. Analyses could be coordinated with further assessment of the current *morphology* and the developed understanding of the sensitivity of the stream corridor. These scenarios could be further quantified and paired with stakeholder expectations and uses of the resource.

5. Evaluate opportunities to assess stormwater impacts and retrofit or improve stormwater controls. Implement and/or improve on storm water management for the properties with the highest percent impervious surface along the corridor, including the DEP Facilities and the Wastewater Treatment Plant (also see MU7)

6. The storm water management facilities should be designed to provide water quality management for the first half-inch of runoff and quantity management that reduces the peak *discharge* runoff rate for the 1 – 3-year storm flows.

7. Perform further morphological assessment along the Red Brook tributary to determine the character, stability, extent of erosion, and potential sources of excess sediment to the areas within MU 9.

8. Evaluate the existing floodplain berm to quantify the degree disconnection of from its floodplain, impacts of the berm to the channel and evaluate quantify the benefits of removal or redesign.

9. Evaluate the existing bridge and culvert crossings for the ability to convey both *bankfull* and flood flow, as well as proper sediment transport. Additionally, any design modification should reduce scour and provide for fish passage.

10. Evaluate the existing bridge and culvert crossings for the ability to facilitate fish passage during varying flow periods. Specific attention should be placed on the Route 42 box culvert, on the tributary to Red Brook, where it is recommended that fisheries biologists examine potential migration barrier and assist with project designers to recommend potential enhancements.

11. Perform stabilization techniques only where necessary using best management practices which promote and maintain a naturally functioning stream channel. Stabilization techniques should only include methods which assist in the natural recovery of the localized sections and which will benefit the reach.

12. Work with landowners to establish and maintain a wooded buffer zone along reaches which contain little or no woody vegetation. Targeted areas should include the developed areas near the mouth of Red Brook including properties owner or operated by the Grahamsville Wastewater Treatment Facility, NYCDEP

Laboratories, and the Powerplant Substation.

13. Initiate an assessment to inventory and identify *invasive* plant species and a plan to remediate.

14. Monitor the areas containing debris jams and channel blockages for changes in channel stability and threat to infrastructure. Initiate an assessment to document the source and magnitude of the large woody debris to include the effects from upstream pond and wetland areas. Treatment recommendations should target the reduction of debris at its source.

15. Initiate a monitoring strategy in selected areas to document the channel stability for comparison purposes, as well as for inclusion into a local reference reach database for use on potential project areas within the Chestnut Creek watershed.

J. Management Units for Unsurveyed Tributaries to Chestnut Creek

Upland tributaries contribute flow, sediment and other materials to mainstem Chestnut Creek. Tributaries also provide valuable habitat areas for migrating species of fish and other animals, and source areas for healthy riparian communities. These areas are therefore important in any long-term study or plan for mainstem Chestnut Creek. Many smaller tributaries and headwater areas are steep, in narrow, largely undeveloped forested valleys, and/or owned by New York State. For this reason, assessments for Chesnut Creek were begun on mainstem and larger tributary streams in which active management is of greater short-term importance.

Several major tributaries to Chestnut Creek/Rondout Watershed including Scott Brook and Claryville Road (unnamed) tributary entering Chestnut Creek in MU4, and Denman Mountain "Bullet" Brook entering Chestnut Creek in MU6 have not been assessed beyond information collected through interviews within the community. Both remotely sensed data analysis and field reconnaissance should be conducted to assess and document existing conditions in each of these major sub-watersheds from their headwaters to confluence with Chestnut Creek.

Existing aerial photographic records, landuse and cover maps, geologic and soils maps and topographic maps should first be analyzed to determine areas where additional assessments may be recommended (e.g., locations where roads and streams are in close proximity, highly developed or cleared areas, road crossing areas, etc.). If possible, new aerial flights should be commissioned or procured to enable the most up to date analysis. All remotely sensed data should be geo-referenced (locations attached to coordinates on the ground so layers of information can be compared directly) and combined into existing Geographic Information System (GIS) databases held by Sullivan County Soil and Water Conservation District and New York City Department of Environmental Protection. These databases should be reviewed and updated periodically with the latest surveyed, satellite or photographic information.

Field reconnaissance should focus on verifying existing land use activities and land cover, identifying and documenting unstable conditions in upland and riparian areas, and characterizing stream channel morphology and condition, as well as identifying sources of point and non-point source pollution. Mapping and photographic documentation should include location with a GPS (Global Positioning System) hand-held unit and conversion to GIS map data.