H. Chestnut Creek Management Unit 8

Background

This section is intended to summarize the overall character and condition of the Pepacton Hollow *tributary* to the Chestnut Creek *mainstem* Management Unit 8 (MU 8). 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 Pepacton Hollow, MU8 (Methodology used to Accomplish Goals, Volume I, Section I.E). The inventory integrated photographic documentation throughout the management unit with the *GPS* (Global Positioning System) location of multiple physical attributes. Components were incorporated into a *GIS* (Geographical Information Systems) database and used in conjunction with various base maps to assess the corridor. The purpose of the assessment and the following description is to document current condition of the stream corridor as well as identify potential problem areas that could negatively impact both Pepacton Hollow and Chestnut Creek and as well as stable *reference* areas that could be used to model ideal stream conditions for the watershed. Although the assessment was not as intensive as in management units along the main stem 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 integrated data collection efforts (MU8 General map, Figures 1 & 2).

1. Summary Description

MU 8 is approximately 11,270 linear feet (2.14 miles) in length and includes the stream corridor along the Pepacton Hollow tributary, beginning approximately 1300 feet above the end of Pepacton Hollow Road to the *confluence* with Chestnut Creek. Pepacton Hollow watershed collects 7 small tributaries, which combine to form the 3.55 square mile sub-basin. The confluence of Pepacton Hollow and Chestnut Creek is located in the Town of Neversink, downstream of Clark Road Bridge and upstream of Hilltop Road Bridge.

The headwaters above MU8 contain 26,300 feet (5.0 miles) of stream channel, which drain 1.9 square miles along Denman Mountain hillside. The *headwater* section of Pepacton Hollow includes various types of *entrenched* stream channels, which are dominated by large cobbles and boulders (Photo 1). The headwater section of Pepacton Hollow drops 880 feet in elevation over its length, which equates to a channel slope of 3.5

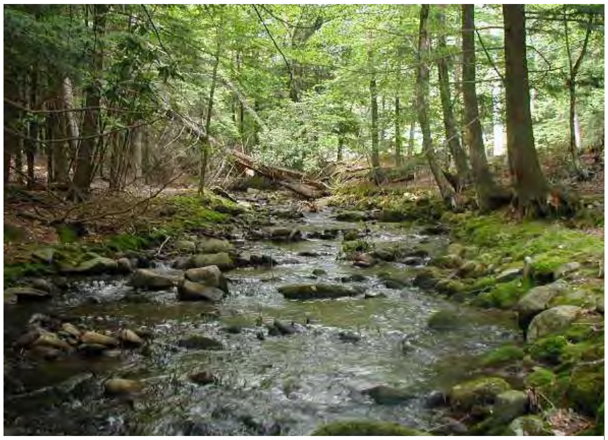

Photo 1. Reach view looking upstream.

percent.

Four small *perennial* tributaries totaling nearly 6,700 feet (1.26 miles) and numerous small *ephemeral* watercourses enter Management Unit 8 before its confluence with Chestnut Creek (Photo 2). The stream channel in Management Unit 8 falls nearly 460 feet in elevation, corresponding to an average channel slope of 4 percent. The drainage is primarily forested, with private residential structures mainly fronting along highways in the *basin*. Natural valley confinement, as well historic road construction, has greatly influenced the historic channel behavior.

Field evidence and review of map data revealed the upper portion of the stream channel is steep in slope, and confined in a narrow valley. Many sections of the channel impinge on steep side slopes causing high potential for *mass wasting*

Photo 2. View looking up steep tributary on the side of a hill, which flows to the left bank of mainstem Pepacton Hollow along Camp Road.

and bank failures. Failures can occur in response to relatively small lateral channel adjustments. A number of small perennial tributaries flowing down these slopes were inventoried, showing evidence of potential *erosion* and instability upstream (Photo 3). Confluence instability was marked by irregular accumulations of *sand* and *gravel* at tributary mouth extending into mainstem Pepacton Hollow. The channel contained a substantial volume of woody debris and included a number of areas with the potential to form debris jams.

Photo 3. View looking upstream at left bank and confluence with another tributary downstream of Photo 2 (on right side of the photo) that flows under Camp Road. Significant erosion.

Historical channel work and concern for public infrastructure were discussed during the planning process. Further information obtained from interviews with residents documented concern for impacts from flooding and public infrastructure, stream bank erosion, and excessive woody debris. A particular area of concern was the uppermost large culvert structure in which recent storms have overtopped and caused damage to the road (Photo 4) (Public Infrastructure Concerns and Interests, Volume 1, Section IV.B.5, and Infrastructure Recommendations, Volume II, Section II.A.2).

Photo 4. Recent storms have overtopped the road at this culvert, causing damage to the road. FEMA funding replaced guardrail seen in photo, 2002.

Numerous streamside *berms* were inventoried during initial assessment. Berms consist primarily of side cast materials from the stream channel. One dumping area was inventoried along the unit and apparently functions as a *floodplain* berm.

2. Riparian Land Use and Public Infrastructure

According to tax maps for 2000, there are thirty-one known properties in MU8, which contain or are bounded by the stream. Private property containing residential structures account for the predominant development within the corridor. Relative density residential structures is minimal in comparison with other management units. Although most of the private residential structures front along 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 MU8 is sparsely populated and showed evidence of only minor anthropogenic impact from the private residences. Potential for growth along Pepacton Hollow is limited by steep adjacent slopes but nonetheless generates concern for proper planning and land use. In comparison, historic development and continued encroachment have been noted along the mainstem of Chestnut Creek. Chestnut Creek management units have displayed these impacts both at the unit level and throughout the entire main stem. In general, volume as well as water quality of the runoff is a function of the size and characteristics of the land area each system drains. For example, land areas with a high percentage of impervious surfaces tend to generate considerably more runoff than areas that are predominantly forest. Impacts become more pronounced when applied to areas containing small amounts of development as an initial condition.

Six stream crossings, as well as fourteen culverts including those for stormwater, roadside drainage and tributary outfalls were inventoried along Pepacton Hollow corridor in MU8. Crossings include a private bridge to the Slater property (Photo 5) located at the top of Pepacton Hollow Road, and three structures which are maintained by the Town of Neversink Highway Department. The box culvert under Pepacton Hollow Road (Photo 6) is County owned and maintained, and is subject to NYSDOT biennial inspections. A single culvert, stream crossing Route 55, is maintained by NYSDOT. Inspection and maintenance records for these structures have yet to be reviewed.

During the planning process and public meetings, concern was raised by

Photo 5. View looking downstream toward Slater Bridge and Camp Road.

Photo 6. Looking upstream at County box culvert Pepacton Hollow Rd.

Photo 7. Culvert crossing under Pepacton Hollow Road.

Photo 8. Looking at culvert (top of photo) under Pepacton Hollow Rd. right stream bank, stream flow right to left.

stakeholders regarding the existing 6.5-foot diameter culvert crossing under Pepacton Hollow Road (Photos 7 & 8). Local residents reported on several occasions floodwater crested the road and caused substantial damage throughout the area. Floodwaters kept landowners from their homes and/or landlocked from other access roads. Site inspections and the 2001 Stream Assessment Survey, noted the culvert pipe crossing under the roadway is of insufficient size to pass bankfull discharge. Several problems can directly result from an undersized culvert in this location. A backwater condition can occur when the culvert pipe is unable to carry the volume of water delivered to it during a storm event. This can cause floodwater to re-route around and over the culvert pipe causing damage to the roadway and erosion at its re-entrance point with the stream channel. Backwater conditions can also cause sedimentation upstream of the culvert and lead to streambank erosion as lateral forces on the bank are increased (Landowner Concerns and Interests, Volume I, Section IV.B.6).

Undersized culverts are more susceptible to upstream debris blockages, increasing potential for the stream to divert around the culvert during high flow events. Constriction that an undersized culvert can place on the stream channel can cause an increase in stream velocities through the culvert, causing stream bank erosion downstream of the culvert.

The stream channel itself appears fairly stable and in relatively good physical condition in the vicinity of the culvert. Improvements throughout the area can only benefit by correcting the road crossing and culvert first. In the area surrounding the culvert, there is well-established mature riparian vegetation that is providing sufficient streambank protection and overhead cover for fisheries habitat. Disturbance of this vegetation should be minimized during any re-construction of the bridge area or stream channel. SCSWCD has partnered with the Town of Neversink and NYC DEP to help remedy this site (Stream Stewardship Recommendations, Volume II, Section II).

As pointed out in the Introduction to Stream Processes and Ecology Section Volume I, Section III.A, natural streams are composed of three distinct flows that include: a *base flow* or low flow channel, which provides habitat for aquatic organisms; a *bankfull* channel, which is critical for maintaining sediment transport; and floodplain, which effectively conveys flows greater than the bankfull discharge (i.e., 1 – 3-year peak flow).

Standard engineering practices design bridge and culvert crossings so that they can safely convey large storm flows (e.g., 25-, 50-, or even 100-year peak flows) without overtopping the structure and associated roadway. In addition, the channel immediately upstream and downstream of bridges is commonly reconstructed (i.e., channelized) so that it contains those same storm flows without overtopping the adjacent streambanks. While enlarging the channel to improve its ability to convey storm flows may seem logical, in fact this approach usually creates channels that have poor habitat, are ineffective at transporting sediment, and require constant maintenance. These engineered channels are generally designed to convey all flows (base flow, bankfull flow, and flood flow) in a single channel that is relatively straight, very wide, and trapezoidal in cross-sectional area, with a uniform profile.

In these altered channels, baseflow is usually very shallow or may actually flow beneath the substrate because it is spread out over such a large surface area. The uniform profile replaces the typical *riffle-pool* sequence with a continuous shallow riffle-run that provides no cover for fish to avoid predation or strong flushing currents. A very wide, shallow channel is less efficient at moving sediment under bankfull flow conditions. As a consequence, sediment (e.g., *sand, gravel, cobble*) tends to accumulate, developing lateral and/or mid-channel bars along these altered reaches.

3. History of Stream and Floodplain Work

Development of the riparian corridor in Chestnut Creek watershed historically involved floodplain fill and/or 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 9.5% of the channel through this MU8.

Three types of revetment were found in MU8. Riprap was found in two locations (Photo 9), totaling 90 feet, and a stacked rock wall measuring 160 feet was also inventoried. Berms made of side-cast channel material totaling 830 feet were found in five locations along Pepacton Hollow (Photo 10). The purpose of the berms was not determined, but seem to be a historic remnant of management for flooding. These berms have kept the stream from utilizing its natural floodplain.

Photo 9. View looking downstream at riprap on right bank.

Floodplain berms such as these generally do not offer much, if any, protection from flooding, and can result in higher flood stages 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.

Small, low, *discontinuous floodplain* benches perform an important floodplain functions in small mountain streams. 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 compromise solution, if flood protection is required. Further assessment should be performed in the area of the berm as well as upstream and downstream. Assessment should quantify the degree of disconnection of the stream from its floodplain to determine impacts of the berm to the channel and quantify the benefits of removal or redesign.

Photo 10. Looking at undercut right bank and berm, stream flow left to right.

The Stream Assessment along Pepacton Hollow identified an area of floodplain which contains a 500-foot long section of dumped refuse and discarded litter. The area contains a mix of glass and metal waste and is located immediately adjacent to the active stream channel (Photo 11). There are large trees growing through the debris, indicating that it has remained relatively stable and has been present for some time. Several site inspections have been made by SCSWCD, the Town and NYC DEP, but have not revealed any contaminants leaching from the site. Although the area may not currently contribute to impaired water quality, it does remain an aesthetic concern.

4. Channel Stability and Sediment Supply

Although the 2002 Stream Assessment 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 MU8 contains several general channel types. *Stream types* range from entrenched to moderately entrenched and have predominantly moderate width to depth ratios with relatively low sinuosity (Introduction to Stream Processes and Ecology, Volume I, Section III).

Channel materials such as large cobble and gravels were identified as the dominant sediment size, with isolated areas of bedrock totaling 240 feet. *Bar* formations were frequently noted and consisted of predominantly small side channel formations. Several sections containing recently deposited central bars indicated potential for localized channel aggradation (Photo 12 & 13). Aggradation is caused by the stream flow not having force to move the available sediment through the system, allowing it to deposit along the channel bottom. If total stream energy is less than the energy required to transport the sediment provided, the streambed will aggrade. Several areas were inventoried where the active channel had recently aggraded to nearly the elevation of the active floodplain, completely reducing channel capacity (Photo 13). Sand and fine gravel were

Photo 11. View showing old dumping site along Pepacton Hollow stream bank. Stream flow is left to right.

Photo 12. View looking downstream at aggradation.

Photo 13. Looking upstream at mid-channel bar in left branch of split channel.

inventoried along the mouths of several tributaries, which is typical at a stream confluence by nature's design.

Preliminary observations indicate the majority of the channel along this management unit is laterally stable (i.e., bank erosion rates are low). Mature trees and shrubs in combination with natural rock armoring provide lateral control along the majority of the management unit (Photo 14). The 2002 Stream Assessment documented approximately 830 feet of streambank erosion, which equates to 3.7% of the channel length. Erosion occurs in nine sections along the corridor ranging

Photo 14. Looking downstream at wooded stable reach with large boulders.

from 11 ft. to nearly 175 ft. in length. These occurrences seem to be random in distribution along the entire streams length and vary in type and scale. Many eroded areas included undercut banks causing large trees to fall into the stream (Photo 15).

Photo 15. Looking downstream at major debris jam on right branch of split channel.

The upper reaches of MU 8 contain two primary areas of erosion totaling more than 1850 square feet. Streambank heights generally range between 10 ft. and 15 ft. through the area. One additional area along Camp Road contains a steep eroding bank approximately 70 ft. in height (Photo 16). Stream bank erosion is more extensive in areas where the stream channel impinges against steep, natural hill slopes. Erosion in these areas has caused larger bank failures and mass wasting from the displacement of material along the toe of these slopes.

The lower reaches of Management Unit 8 contain five primary areas of erosion totaling 9,340 square feet of exposed streambank. Severe mass wasting was observed along a 40 ft. tall, 150 ft. long section of streambank. A number of smaller eroding banks were identified where undercutting of the banks have caused large trees to fall into the stream channel (Photo 17).

The 2002 Stream Assessment documented a number of areas containing debris jams and channel blockages. Although wood recruitment is a natural and necessary process for mountain stream stability, current volume likely exceeds natural rates. Some areas were documented with debris jams spanning the entire active channel. These blockages are seemingly affecting the capacity to move the water, sediment and smaller debris (Photo 18).

Debris jams and other channel obstructions may cause problems by trapping sediment, which initiates and/or accelerates development of gravel bars and further reduces channel capacity. Subsequent bed erosion and removal of the deposited gravels contributes sediment imbalance to downstream reaches. Alternately, small blockages can create and maintain beneficial physical habitat (Photo 18), as well as assist in controlling stream channel incision and degradation. Extent and effect of wood debris should be quantified and compared to indices that provide information on quantity and include stream types present. Further annual monitoring of the area for continued growth and potential impact would be an effective management strategy for woody debris, jams and channel impacts. Streambank erosion should be further measured and quantified and compared to other physically similar local streams. This could be further quantified for management purposes by evaluating stream types and natural sensitive areas within the corridor as well as assist in prioritizing enhancement opportunities.

Photo 16. Shows very steep eroding right bank along the upper reaches of Pepacton Hollow along Camp Road.

Photo 17. Eroding right bank and fallen trees, incised section, along Camp Road.

Photo 18. View looking downstream from left bank at steam wide debris jam.

Evaluating reaches along Chestnut Creek to determine whether they are contributing to sediment problems in the Chestnut Creek/Rondout Reservoir System was a component of the Assessment Survey. The preliminary results of the fieldwork indicate that the actively eroding banks and mid-channel bars noted above are a source of sediment to downstream reaches. Where they accumulate, these sediments can reduce channel capacity and contribute to localized channel stability problems.

Sediments eroded from reaches along Chestnut Creek are generally coarse (i.e., sand, gravel and cobble). Unlike other watersheds where exposed silt or clay deposits are a water quality concern because they contribute very fine material to the suspended load, these coarser sediments tend to move as bed load and settle out quickly after storms. As a consequence, sediment eroded from the streambed and stream banks along this management unit does not appear to directly affect water quality within the Chestnut Creek/Rondout Reservoir System.

An historical aerial photographic assessment was performed to assess natural changes and historic modifications to the stream channel and floodplain within MU 8. Field assessments and historical documentation can be combined with interpretation of the imagery in order to develop a causal analysis relating to current channel stability and morphology. MU 8 was assessed using imagery from 1977, 1985, and 2001 (Aerial Photos 20-22).

It is evident from the aerial imagery that land use and general riparian density appears not to have changed significantly over the period covered by the aerial series.

5. Riparian Vegetation

Vegetated *riparian* zones act as a buffer against pollution and are therefore very important in mitigating adverse impacts of human activities. Forested riparian buffers facilitate stream *stability* and function by providing rooted structure to protect against bank erosion and flood damage (Photo 19). Streamside forests also reduce nutrient and sediment runoff and provide organic matter that can be used by aquatic life, while providing shade to dampen fluctuations in stream temperature. Wide riparian buffer areas protect streams from runoff and generally provide better habitat for plants and animals than narrow buffers (Introduction to Stream Processes and Ecology, Volume I, Section III).

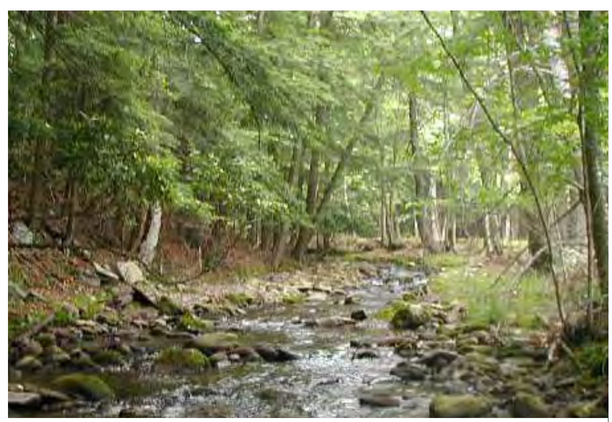

Photo 19. View looking upstream from inlet end of culvert under Pepacton Hollow Road at intersection with Brenner Road.

The 2002 Stream Assessment did not investigate specific streamside (riparian) plant species or density, other than to note areas of insufficient or stressed vegetation that could affect stream stability, flooding or erosion threats, water quality or aquatic habitat for fisheries. Riparian areas appeared generally stable and consisted of mature vegetation. The riparian areas in Pepacton Hollow are largely forested, although the community of the forest is frequently interrupted by infrastructure including the adjacent roadway (Pepacton Hollow Road) and multiple stream crossings. The riparian width is limited by the presence of the roadway and may restricts the amount of filtration and stabilization that a larger stream buffer may more readily provide.

Due to the narrow valley and relative steepness of the side slopes, the alignment of Pepacton Hollow Road closely follows the stream alignment. GIS coverages of the stream and roadway alignments were use to analyze the influence of the infrastructure on the width of the riparian areas. Various widths were applied to the alignments and used to estimate the percentage of stream channel located immediately adjacent to the roadway. Approximately 71% of the stream channel is located within 100 ft. of Pepacton Hollow Road. Additionally, 23% of the stream channel is located within 50 ft. of the roadway.

Although the relatively narrow width of the valley floor and the encroachment of Pepacton Hollow Road do not facilitate an extensive area for riparian establishment, the effectiveness of the existing buffer is extremely important. The buffer receives runoff of salt, gravel, and chemicals from the road, which can impact vegetative establishment and growth. Road maintenance activities also regularly disturb the soil along the shoulder and on the road cut banks. This disturbance can lead to the establishment of undesirable

Photo 20. 1974 Aerial Photograph of Management Unit 8.

Photo 21. 1985 Aerial Photograph of Management Unit 8.

Photo 22. 2001 Aerial Photograph of the upstream section of Management Unit 8.

invasive plants or add stress to the established plants.

6. Restoration and Management Recommendations

As presented previously, the Chestnut Creek Management Plan will be utilized to guide and facilitate stakeholders 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 8, 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 8

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

2. Evaluate the existing riparian areas located between the stream channel and roadway. Identify specific sites and prescribe treatments in areas which could benefit or enhance the existing riparian function.

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

4. Evaluate the existing revetment for replacement with an adequate stabilization structure which will maintain and promote a naturally function stream channel. Any stabilization technique should include bioengineering and/or re-vegetation.

5. Perform further morphological assessment along Pepacton Hollow to determine the character, stability, extent of erosion, and potential sources of excess sediment to the areas within Management Unit.

6. Extend assessments beyond the upstream limits of the MU8 into the headwaters of Pepacton Hollow to include all major tributaries.

7. Evaluate the existing floodplain berms to quantify the degree of floodplain disconnection, impacts of the berm to the

channel and evaluate quantify the benefits of removal or redesign.

8. Continue with evaluations in the floodplain area containing the dumped refuse. Consider removing the visible waste from the surface in order to prevent future entrainment of the waste and partially restore the aesthetic quality of the area.

9. Consider excavation and disposal of the waste material from the old dump site to improve both aesthetics of the area, stream stability and water quality.

10. 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 fishery passage during varying flow periods.

11. The culvert under Pepacton Hollow Road should be replaced with a suitable size crossing capable of providing adequate passage of base flow, bankfull flow and flood flow. Effort should be made to enhance the stability of the upstream and downstream reaches using adequate stabilization structure which will maintain and promote a naturally function stream channel.

12. Conduct further morphological stability assessments through the areas containing potentially eroding streambanks. Determine the significance, rate, and magnitude of the disturbance and consider stabilization and/or restoration if deemed necessary.

13. 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.

14. Promote floodplain protection, which is critical in maintaining stream stability in moderately entrenched reaches.

15. Continue to assess, inventory and identify invasive plant species and determine a plan to remediate.

16. 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 localized erosion. Treatment recommendations should target the reduction of debris at its source.

19. 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.

20. Monitor the areas containing debris jams and channel blockages for changes in channel stability and threat to infrastructure.

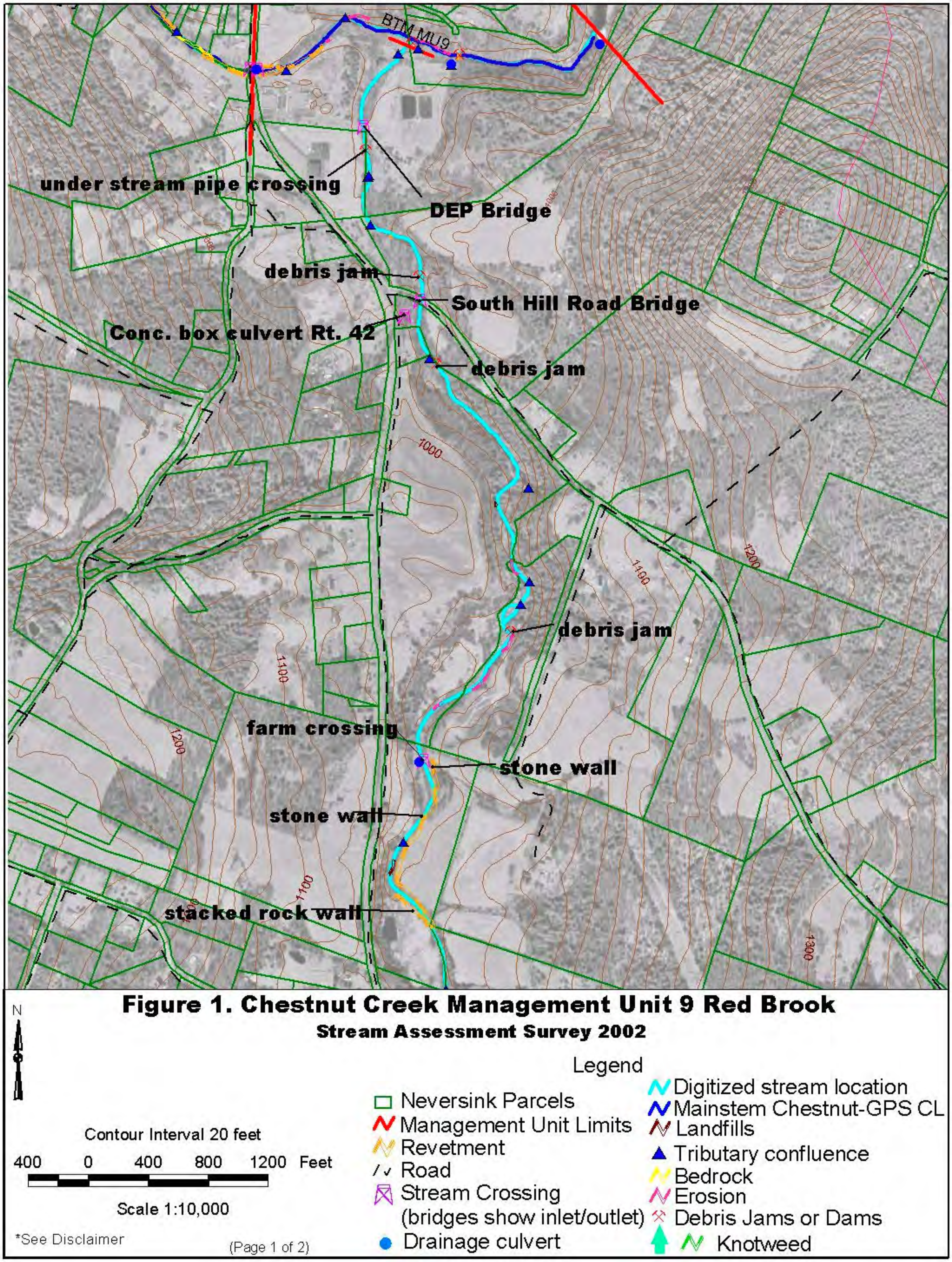

Figure 1. Chestnut Creek Management Unit 9 Red Brook

Stream Assessment Survey 2002

*See Disclaimer

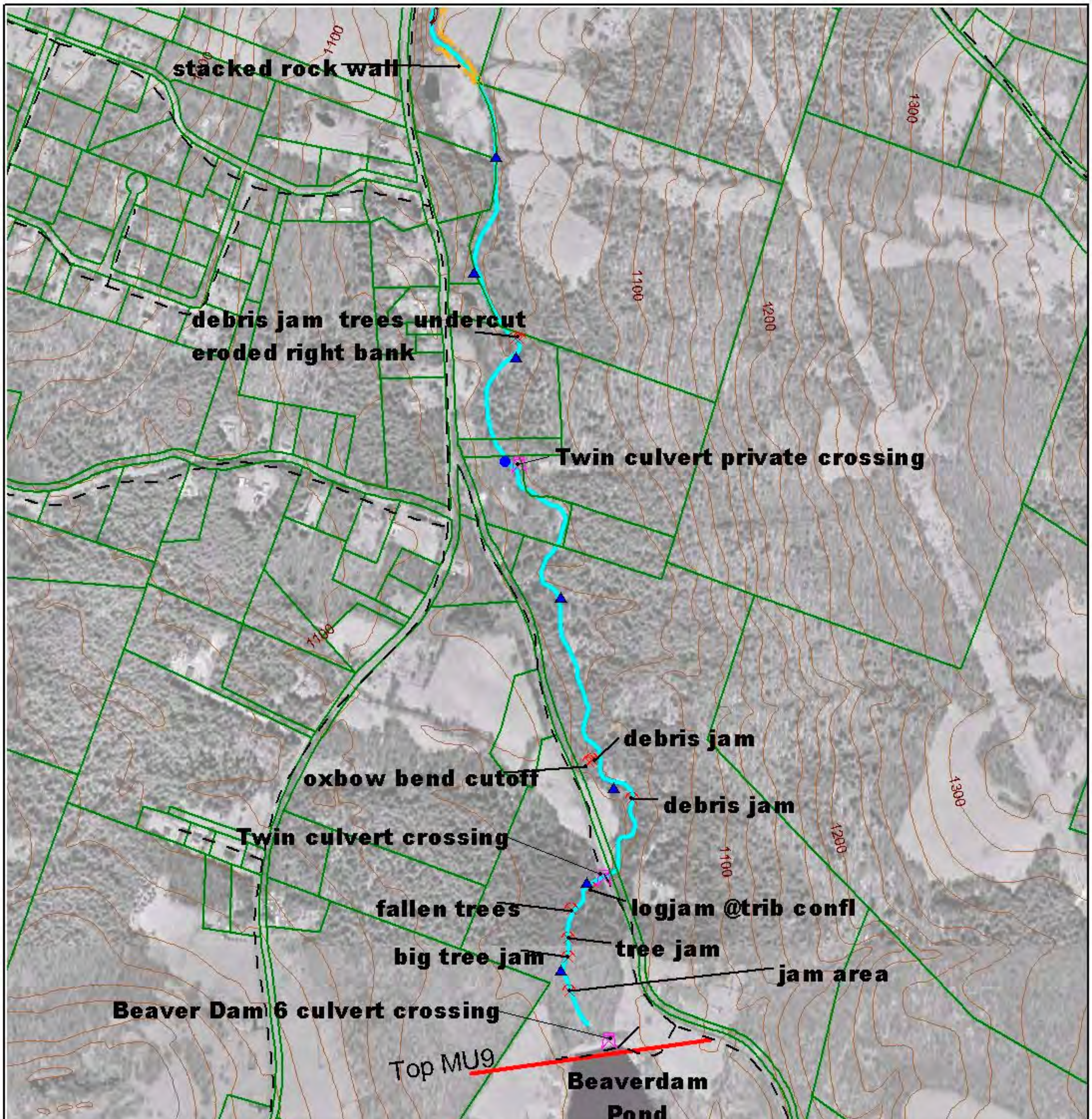

Figure 2. Chestnut Creek Management Unit 9 Red Brook

Stream Assessment Survey 2002

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Legend

- Neversink Parcels
- Management Unit Limits
- Revetment
- Road
- Stream Crossing (bridges show inlet/outlet)
- Drainage culvert
- Digitized stream location
- Mainstem Chestnut-GPS CL
- Landfills
- Tributary confluence
- Bedrock
- Erosion
- Debris Jams or Dams
- Knotweed

Contour Interval 20 feet

400 0 400 800 1200 Feet

Scale 1:10,000

*See Disclaimer