B. Chestnut Creek Management Unit 2

1. Summary Description

This section is intended to summarize the overall character and condition of Management Unit 2 (MU2). Subsequent sections will discuss specific issues (e.g., riparian land use and public infrastructure, channel stability, etc.) in greater detail.

MU2 is approximately 1600 feet (0.30 miles) in length and includes the segment of Chestnut Creek from approximately 950 feet up valley to 300 feet down valley of the Benton Hollow Road culvert crossing. The *drainage area* at the upstream and downstream ends of the management unit is 0.84 and 1.21 square miles, respectively, without the introduction of any major *tributaries* (MU2 general map, Figure 1).

MU2 begins at the transition of the *corridor* from a forested wetland setting to a grass dominated meadow (Photo 1). The *channel* is narrower, less steep, and has a greater *sinuosity* and *floodplain* connection than upstream and downstream units. Channel materials consist of *sand* and *gravel*, which deviate from connecting units dominated by coarser sediments. *Sediments* are stored in the form small side channel *bars*, however the general minimal occurrences of the formations as well as vegetative characteristics indicate that the reach is effective at moving supplied sediment. The floodplain connection serves an important function for the inventoried *stream types*. The physical condition of the channel is generally *stable*, however it is suspected that the unit is susceptible to disturbance if the vegetative structure does not remain intact (Introduction to Stream Processes and Ecology, Volume I, Section III).

Photo 1. View looking upstream toward XS-17.

Land use along the corridor is primarily noncultivated fields with a few homes located along Neversink and Benton Hollow Roads. Vegetation along the corridor is predominantly grassland meadow along the head of the unit and along the channel in wetter areas. Vegetative communities transition to shrubs and larger trees between the Benton Hollow Road culvert and the start of Management Unit 3. Impervious surfaces include Neversink and Benton Hollow Roads and two residential properties along the adjacent hill slopes and floodplain. One particular residence located along the downstream outlet of the culvert was constructed in close proximity to the channel and is potentially located within the 100-year floodplain. Although privately owned, only a small percentage of the land area contains impervious surfaces or is maintained as lawn.

An analysis of a series of historic aerial photographs covering the period 1974-2001 documents the stability of the reach and consistent land use. The area has remained grassland meadow with dense vegetation and minimal change in land use and riparian structure in the 30-year record. There was considerable evidence of channel lateral adjustment through the series, but deemed consistent with the stream types present. (Aerial Photos 2, 3, & 4).

The 1995 aerial photo and the 2000 map backdrop show the area of Management Unit 2 inundated with water. Although the causes of the increased stage have not been investigated, it is presumably caused by a high flow event, a downstream channel or debris blockage, or beaver damming.

Field inventories, as well as information obtained from interviews with residents and town officials indicate that MU2 has required minimal recent maintenance activity.

As documented in following management units, downstream units of Chestnut Creek have been substantially modified by development within the stream corridor. These modifications have degraded habitats through a variety of means, including the fragmentation and destruction of habitat by road construction and development, and the introduction of invasive plants, such as Japanese knotweed and multiflora rose. These invasive species, as well as the anthropogenic modifications to the *riparian* corridor have jeopardized important secondary corridor benefits; including critical habitat, food, shade for the stream, filtering mechanism for pollutants in runoff, and travel ways for wildlife. The ability to support present and future wildlife populations, including

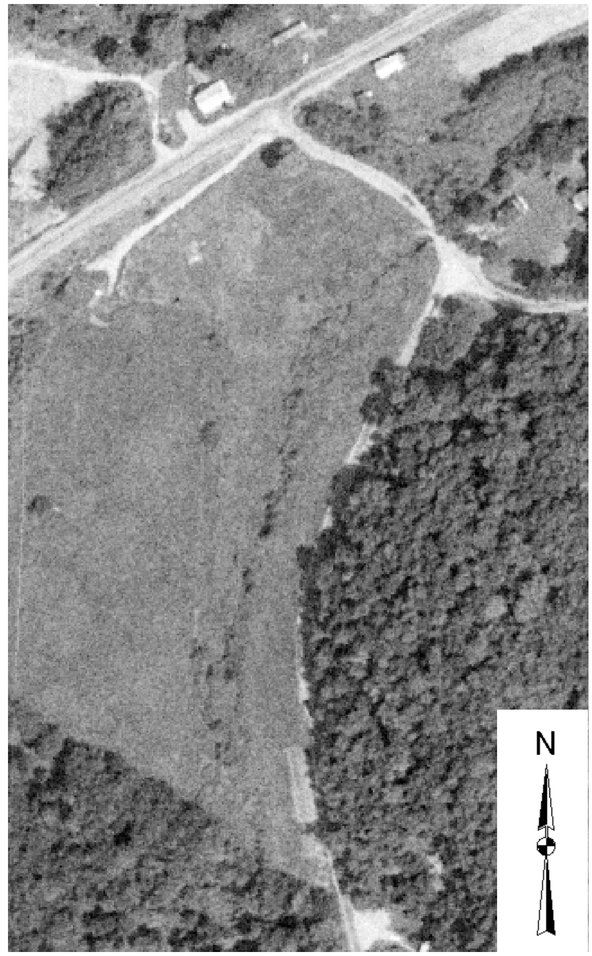

Photo 2. 1974 Aerial Photograph of Management Unit 2.

Photo 3. 1995 Aerial Photograph of Management Unit 2.

Photo 4. 2001 Aerial Photograph of Management Unit 2.

riparian habitat critical for migratory birds, waterfowl, and other river dependant species will be heavily dependant upon the management of riparian lands. Therefore, the focus of concern for MU 2 is for the preservation of the current healthy riparian community, which will in turn assist in preserving the general physical stability of the unit (Riparian Vegetation Issues in Stream Management, Volume I, Section IV.B.3, and Riparian Vegetation Management Recommendations, Volume II, Section II.A.1).

2. Riparian Land Use and Public Infrastructure

There are five privately owned land parcels in within the stream corridor along MU2. The land may have been historically cleared for agricultural purposes leaving the corridor without larger tree species that dominate corridors along both upstream and downstream units. Current land use along the corridor is primarily non-cultivated fields with a few residences located along Neversink and Benton Hollow Roads. Vegetation along the corridor is predominantly grassland meadow at the head of the unit and along the channel in wetter areas. Vegetation species transitions to shrubs and larger trees below the culvert at the connection with the downstream unit. As stated, impervious surfaces include the Neversink and Benton Roads and two homes containing ancillary structures along adjacent northern hill slope and lower southern floodplain. One particular residence in the floodplain and is located at the outlet of the culvert in close proximity to the channel. Although privately owned, only a small percentage of the land area contains impervious surface or is maintained as lawn.

The current stream corridor through MU 2 is sparsely populated and displayed only minor anthropogenic impact from the private residence. The potential for population growth along the unit generates concern for proper planning and land use. In comparison, historic development and continued encroachment have been noted along lower portions of Chestnut Creek. Several management units have displayed impacts both at the management unit level, and throughout the entire main stem.

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. 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.

Maintenance and public infrastructure is generally a concern for local municipalities. The Chestnut Creek flows through one culvert under Benton Hollow Road in the lower portion of the unit (Photo 5). The construction of the road and culvert may affect the conveyance of

Photo 5. View looking upstream at culvert under Benton Hollow Road.

flows from the upstream drainage. As stated, the relative size (hydraulic opening) and elevation of the road base in relation to the floodplain, presents a management concern. Inspection of the culvert, in combination with assessments of upstream and downstream channel geometries or *planform*, determined that the width of the culvert opening is significantly less than the *bankfull* channel widths of surrounding reaches. This condition can generate a backwater effect above the culvert and potentially lead to sedimentation, accumulated channel debris and accelerated channel migration upstream of the structure and possibly affect the channel and properties downstream as well.

Management of the current culvert configuration should include field inspections of debris blockages at the culvert as well as evidence of upstream flood elevations after storm events. Scheduled replacement and future improvements should incorporate *geomorphic* considerations of stream shape and condition for both the upstream and downstream reaches. Design considerations should include the natural slope break of the valley surrounding the reach, potential for channel aggradation or degradation, and protection/enhancement of the current floodplain connection, as well as the size and placement of the structure.

As pointed out in the Introduction to Stream Processes and Ecology, Volume 1, Section III, 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 a floodway or floodplain, which effectively conveys flows greater than the bankfull discharge (i.e., 1 – 3-year peak flow).

It is standard engineering practice to 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 or 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. Ironically, the accumulation of sediment and the development of bars significantly reduce the channel's capacity to convey the large storm flows for which it was designed. The stream through MU2 seems to have had very little alteration and hence has maintained a natural channel that transports sediment well and should be preserved as such.

3. History of Stream and Floodplain Work

As noted, many of the other MUs along the Chestnut Creek appear to have been managed at some time in the past in the vicinity of road crossings and expanding development. Channel work to remove gravel deposits and maintain flood conveyance has been routine in the past, commonly used throughout Chestnut Creek to maintain infrastructure. Development of the riparian corridor along Chestnut Creek has historically involved floodplain fill and/or the construction of flood *berms* to protect structures placed in these areas.

The 2001 Stream Assessment Survey revealed no evidence in MU2 of floodplain filling, berms or channel maintenance other than for the historic construction Benton Road. Further, the assessment of the historical aerial photography of MU 2 did not reveal any significant stream channel *stabilization*, modification, or maintenance although the central portion of the Management Unit appears to have been straightened at some point prior to 1974. Management of the reach including any future floodplain work should incorporate natural channel design principles with the understanding of the stream types present.

General impacts of traditional approaches to stream management have been addressed in the Watershed Recommendations for Best Management Practices, Volume II, Section II of this plan. Specific impacts and management considerations in relation to the assessment of MU 2 are included with this section of the plan.

4. Channel Stability and Sediment Supply

During the 2001 Stream Assessment Survey, MU2 was divided into five reaches on the basis of the Level II – Morphologic Description (Rosgen, 1996). The largest portion (67.5%) of this unit includes slightly and moderately entrenched channel types C5 and C4. Mature grasses provide lateral control along the majority of these reaches (Photo 6). Slightly and moderately entrenched reaches benefit from the rooted structure and stability of vegetation, exemplified by much of MU2. The large, well-vegetated floodplain in these reaches can assist in reducing the energy of the higher flows, dissipating velocity of the water, in addition reducing erosion and sediment

Photo 6. View looking upstream at XS-34.5.

inputs into the system. Several small stable areas containing side channel ponding were noted through the reach providing additional habitat benefits (Photo 7) (Stream Processes and Ecology, Volume I, Section III).

Photo 7. View of pollywogs in side channel.

The E5 stream type represents 29% of the channel in MU2. This channel type is typically riffle-pool sequenced with high meander-width ratios, high sinuosity, and low width/depth ratios and very low slope. The channel slopes of E stream types vary considerably but are typically very flat in these settings, narrow and relatively deep channels with long grasses and dense low growing shrubs along their channel perimeter and floodplain (Photo 8). The healthy vegetation through the unit facilitates trapping sediment from entering the system as well as assisting in stabilizing the bed and banks through the unit. The banks in these reaches are composed of very fine sediment, such as sand, silt and finer gravels. These materials can be moved and eroded easily, unless they remain well vegetated. In general, these reaches remain stable unless stream banks are disturbed and/or

Photo 8. View looking upstream from bend downstream of XS-16.

significant changes in vegetative structure occurs.

Highly *entrenched* reaches (i.e. F-types) account for 3.5% of the total length at the very bottom of the unit transitioning into MU3. Because they lack a floodplain area (i.e., an area adjacent to the channel where floodwaters can spread out and reduce the energy against the streambed and banks), entrenched reaches experience considerable stress during storm flow and tend to be more susceptible to stability problems, particularly bank erosion and bed scour or *degradation*. In addition, these types of channels route storm flow quickly to downstream reaches, further contributing to channel instability and flooding. A summary of morphological data collected through the unit is summarized in Table 1 and illustrated in Figure 2, Stream Type and Cross Section map.

The majority of the stream channel bed material in MU2 is composed of sand material, with gravels more prevalent in the lower reaches. The 2001 Stream Assessment Survey inventoried channel

Table 1 - Summary of Morphological Data for Reaches along Management Unit 1

Reach	Length (ft)	Area (ft^2)	Width (ft)	Mean Depth (Ft)	W/D	Ent	Slope (ft/ft)	Stream Type
1	437	12.8	11.2	1.2	9.69	3.15	.0044	E5
2	416	10.4	12.6	0.9	17.01	2.43	.0043	C5
3	26	10.5	8.6	1.2	7.17	2.10	.0004	E5
4	661	11.5	13.8	0.8	18.54	2.42	.0081	C4
5	56	13.2	33.5	0.4	85.00	1.5	.0105	F4

contained lateral bars. A majority of the bars are vegetated with grasses and are considered natural occurrences for the current channel morphology. In general, the unit is considered in balance with its current sediment regime.

Preliminary observations indicate that the majority of the channel along this management unit is laterally stable (i.e., bank erosion rates are low). Mature grasses and shrubs provide lateral control along the majority of the management unit. There are two small sections of only a few linear feet cut low bank (Photo 9). The erosion appears local and within a natural range for this stream type and should require little or no intervention.

Photo 9. View looking upstream at XS-17 towards left bank at outside of meander bend, stream flow left to right.

A component of the 2001 Stream Assessment Survey included evaluating the reaches along Chestnut Creek to determine the relative contribution to sediment problems in the Chestnut Creek/ Rondout Reservoir System. The sediments eroded from the 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. The preliminary results of the fieldwork indicate that although MU 2 contains fine sediment through its bed and banks, it currently has minimal impact to the overall sediment supply of the Chestnut Creek, due to the small amount of inventoried erosion and bed stability of these stream types in the presence of healthy riparian vegetation.

5. Riparian Vegetation

Vegetated streamside or *riparian* zones act as a buffer against pollution and are therefore very important in mitigating the adverse impacts of human activities. Vegetated buffers facilitate stream stability and function by providing rooted structure to protect against bank erosion and flood damage. Streamside vegetation also reduces nutrient and sediment runoff, provides organic matter that can be used by aquatic life, while providing shade to dampen fluctuations in stream temperature (Photo 10).

The stream assessment conducted in 2001 did not investigate specific 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. Based on these general, qualitative observations, the riparian vegetation in MU 2 appears to be generally sufficient to provide the benefits of a healthy riparian area. The riparian area Management Unit 2 is generally stable and consists of a wide variety of grasses, shrubs and flowering plants. The vegetation appears well established, and able to resist moderate disturbance during large storm events.

Many of the species seen in this area are native, however reed canary grass, a highly competitive species, was noted. This

Photo 10. View looking downstream at XS-34.5.

species may crowd out native vegetation which have ecological as well as stabilizing benefits. Healthy diverse native plant communities appear to inhibit the growth of the invasive species. Management for the reach should include a more detailed inventory and assessment of the non-native species, and consider methods for eradication (Riparian Vegetation Issues in Stream Management, Volume I, Section IV.B.3, and Riparian Vegetation Management Recommendations, Volume II, Section II. A.1).

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 2 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 2

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

3. 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.

4. Evaluate the existing culvert crossing 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.

5. 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.

6. Continue to assess, inventory and identify invasive plant species within MU2 and consider methods of eradication to prevent future establishment and potential dispersal into downstream areas.

7. Continue with efforts NYC DEP and the USGS have initiated developing a monitoring strategy in selected areas to document the channel stability, fish population and aquatic habitat for comparison purposes, as well as for inclusion into a local stable reference reach database for use on potential project areas within the Chestnut Creek watershed.

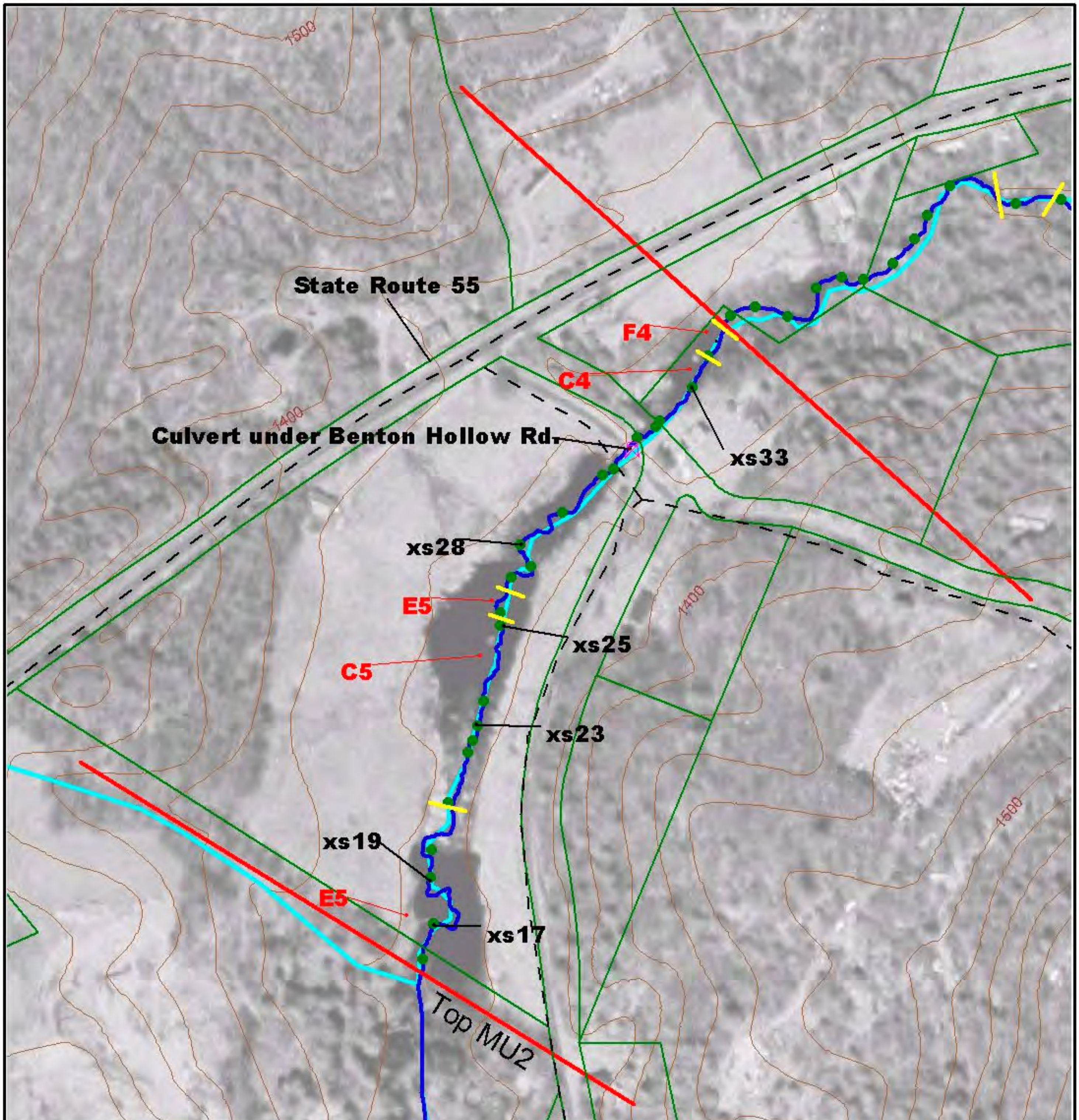

Figure 2. Chestnut Creek MU2 Stream Types & Cross Sections

Stream Assessment Survey 2001

N

Legend

Contour Interval 20 feet

100 0 100 200 300 400 Feet

1:3,000

*See Disclaimer

Management Unit Limits

Cross Sections

Monitoring cross section

B3 Rosgen Stream Types

Roads

Neversink Parcels

Mainstem Chestnut-GPS CL

Digitized stream location

Stream type breaks

Stream Crossing (bridges show inlet/outlet)

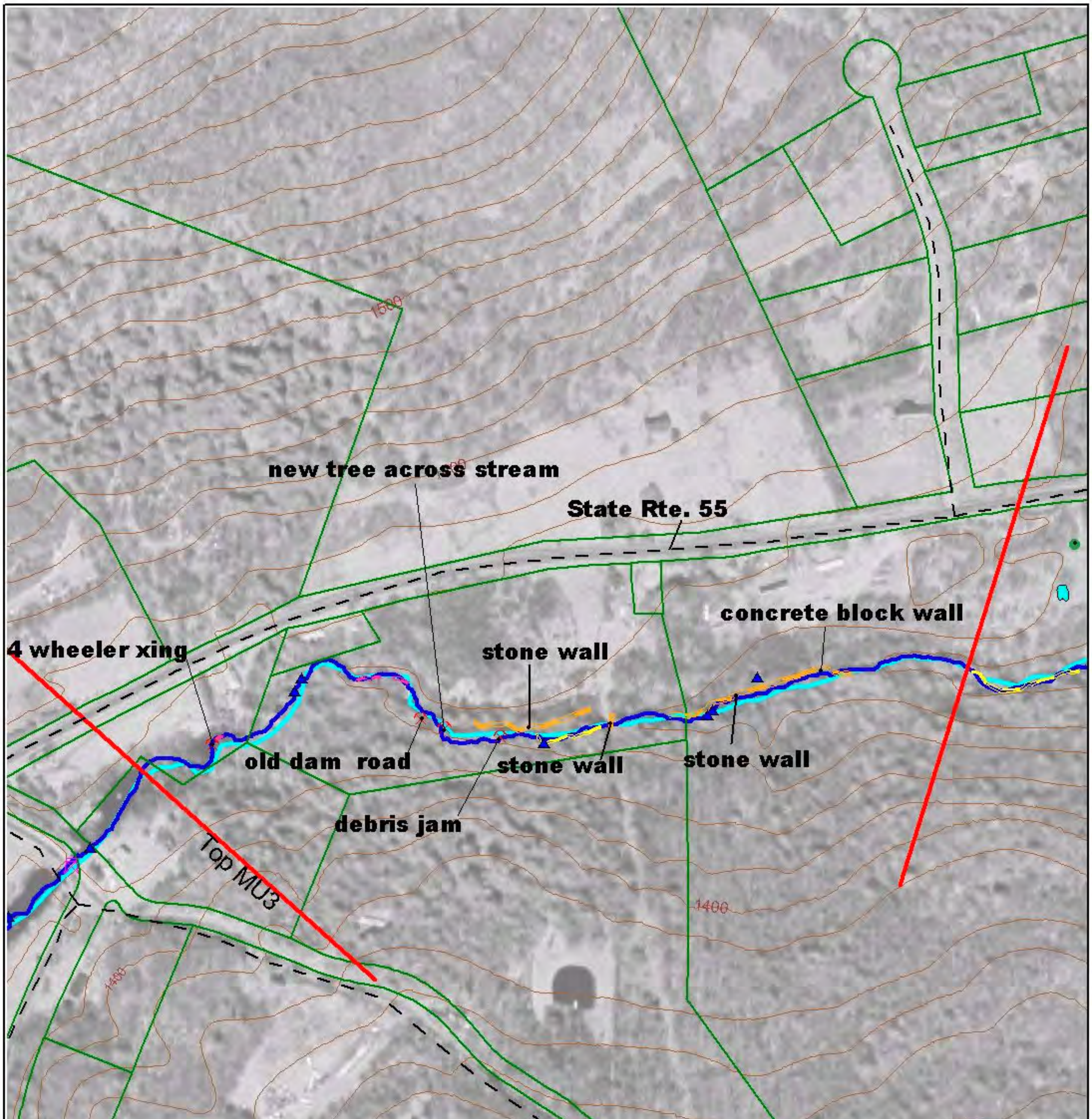

Figure 1. Chestnut Creek Management Unit 3

Stream Assessment Survey 2001

N

Contour Interval 20 feet

200 0 200 400 Feet

Scale 1:4,000

*See Disclaimer

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