D. Chestnut Creek Management Unit 4

1. Summary Description

This section is intended to summarize the overall character and condition of Management Unit 4 (MU4). Subsequent sections will discuss specific issues (e.g., *riparian* land use and public infrastructure, channel *stability*, etc.) in greater detail.

This unit is approximately 5450 linear feet (1.03 miles) in length and includes the segment of Chestnut Creek from approximately 450 feet upstream of the *confluence* with Scott Brook to a point immediately downstream of the Kelly Rd Bridge (MU4 General map, Figure 1). The drainage areas at the upstream and downstream ends of the management unit are 1.49 and 4.75 square miles, respectively (Photos 1, 2, & 3).

Land use along the stream corridor is predominantly forest along adjacent hillslopes with a number of residences and businesses situated along the *floodplain*. The *riparian* area on private residential land fronting on Route 55 and Slater Road is generally maintained as mowed lawn with scattered trees and shrubs. The riparian area adjacent to private businesses fronting on Route 55 is mostly parking lots, material and equipment storage areas, and small strips of mowed lawn. Although privately owned, a significant portion of the corridor along the adjacent hillslopes and terraces is maintained as forest. Storm water runoff from yards is conveyed predominantly as *sheet flow*. The parking lots and equipment storage areas drain to

Photo 1. Cross section 58– view looking downstream behind Revolutionary War graveyard.

Photo 2. Cross section 63– view looking downstream.

Photo 3. View looking upstream -Rt. 55 to the right of view.

the creek via sheet flow and storm drainage culverts.

It appears that this section of Chestnut Creek was straightened and *channelized* at some time in the past. An analysis of a series of historic aerial photographs covering the period 1974-2001 indicates that routine channel maintenance occurred until recently (Aerial Photos 4, 5, 6, 7 & 8).

Revetment present, as well as information obtained from interviews with residents and town officials indicates that MU4 has been the focus of periodic maintenance activity. The banks have been armored along sections of the management unit. Efforts by landowners to protect property have resulted in approximately 14% of the channel length through this unit undergoing some type of alteration (e.g., *riprap*, stacked rock wall, and log cribwall). These protective measures appear to have been relatively successful in some areas, while less successful in other areas. It is evident that portions of the floodplain have been filled to accommodate development. These channel and floodplain modifications have resulted in a confined channel with a high width/depth ratio, low *sinuosity* and a relatively steep gradient. As such the creek and adjacent floodplain are more susceptible to stability and flooding problems (Public Infrastructure and Landowner Concerns and Interests, Volume I, Section IV.B.5).

2. Riparian Land Use and Public Infrastructure

There are 24 developed properties within the stream *corridor* along MU4 that include private residences and businesses as well as historically significant areas . The residential properties include homes and ancillary structures, such as garages and sheds. The commercial properties include businesses such as Grey's Woodworks that have large buildings for manufacturing wood products and storage of lumber, storage yards for finished products, offices, and parking lots. Other businesses include an auto repair shop and a septic contractor which are housed in large buildings with adjacent parking lots and equipment storage areas. There is also a gas station and deli. The historic properties include Revolutionary War and Civil War cemeteries.

Maintenance of infrastructure is a concern for local municipalities as well as landowners. There are four stream crossings and four drainage culverts in MU4. The stream crossing at Slater Road culvert is a 9 x 15 foot corrugated metal elliptical pipe (Photo 9). The cross-section of the culvert is narrower than the *bankfull* channel upstream and downstream of the culvert. Downstream landowners have reported erosion and maintenance problems. According to residents, an old culvert in the same location had been

Photo 9. View looking downstream at inlet of culvert under Slater Road.

Photo 4. 1974 Aerial Photograph of the upstream section of MU4.

Photo 5. 2001 Aerial Photograph of the upstream section of MU4.

Photo 6. 1974 Aerial Photograph of the downstream section of MU4.

Photo 7. 1995 Aerial Photograph of the downstream section of MU4.

Photo 8. 2001 Aerial Photograph of the downstream section of MU4.

placed to direct streamflow towards the center of the channel. The old culvert was replaced in the mid to late 1980's with a new culvert that was shorter and placed at a skew relative to the stream channel. This skewed position resulted in storm flows being directed against the downstream *meander* bend contributing to *erosion* of the banks. In 1996, the Town repaired the culvert and stabilized 50 feet of banks downstream of the crossing. Subsequently, the landowner placed additional *riprap* along downstream sections.

A privately owned bridge is located at the Botsford/Scheirer Property (Photo 10) approximately 380 feet downstream of the Slater Road culvert. The bridge appears to be in good condition, and consistent with the bankfull channel width in the immediate upstream and downstream cross sections. However, landowners have reported maintenance problems and development of a mid-channel bar downstream of the bridge as well as a gravel bar along the right bank upstream of

Photo 10. View looking downstream at private crossing below Slater Rd. Channel is split with a center island. The banks and island are well-vegetated with willows, but stream seems to be choked into the right bank.

and through the bridge opening. The reason for the sediment deposits is not conclusive. However, reports of improper alignment of the upstream culvert crossing, presence of a debris jam downstream, ongoing maintenance creating overwidened conditions and sediment deposition appear to be inhibiting the stream's ability to transport its sediment. Reduction or changes in hydraulic opening under a bridge can cause ongoing maintenance problems and potentially result in higher stress on the bridge or structure. Evaluation of bridge alignment could benefit redesign and maintenance of the bridge and stream in this reach.

The County bridge at Kelly Road (CBN: 386, BIN: 3229170) was built in 1979 (Photo 11). In appears that the bridge was designed to convey larger, less frequent storm flows, probably the 25-year event. The bridge is subject to a biennial inspection by NYSDOT, which indicates that the decking, abutments, and wing walls are in good condition with no significant changes in scour. The bankfull cross sectional width both upstream and downstream of the bridge are only slightly larger than the span of the bridge itself.

Photo 11. Looking downstream at Kelly Road Bridge.

A privately owned footbridge is located at the rear of Grey's Woodworks approximately 1600 feet downstream of the bridge at the Botsford/Scheirer Property and was not evaluated as it does not appear to be more than a primitive foot crossing and does not exert any hydraulic control on the stream.

As noted above, storm drainage culverts conveys storm water runoff from parking lots and equipment/materials storage areas directly to the creek. Three storm drainage culverts were identified in this management unit during the 2001 Stream Assessment Survey (Photo 12).

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 or lawn. The size and land use characteristics of the areas draining to the outfalls identified, as well as the potential for storm water retrofit opportunities was not evaluated as part of the initial assessment. However, a review of the aerial photographs indicates that the properties along the corridor with the highest percent impervious surfaces include Grey's Woodworks, the auto repair, and septic contractor properties, as well as a portion of the Town Highway Facility on the opposite side of Route 55. Recent improvements, working with the NYC DEP, have incorporated storm water management into their plans for dealing with parking area runoff.

A planned extension of the existing sanitary sewer system may enable residents, currently using on-site treatment

Photo 12. Storm drain outfall behind Zanetti's along Route 55.

and disposal systems to connect to DEP's Grahamsville Sewage Treatment Plant. Four extensions to the existing sanitary sewer system are being planned, three of them emanating out of Grahamsville. One of the extensions being planned will extend along Rte 55 west for approximately 1.5 miles from Clark Road to Armstrong Road, upstream of Scott Brook. In some places the sewer alignment will be close to Chestnut Creek. Depending on its ultimate location, the installation of the sewer system could impact a significant length of the riparian area along the creek. In addition, it may be necessary to install lateral extensions across the creek to serve properties on the opposite side of the creek from the sewer main. Current construction specifications, which require that sanitary sewer lines be installed a minimum of three feet below the streambed should minimize the potential for the laterals to create a situation similar to the sewer crossing grade drop caused at Davis Lane discussed in MU6. Careful planning of the main sewer alignment can reduce impacts to the riparian area along Chestnut Creek.

3. History of Stream and Floodplain Work

As noted Chestnut Creek appears to have been straightened and *channelized* at some time in the past. Channel work to remove gravel deposits and maintain flood conveyance has been routine until recently. Development of the riparian corridor along Chestnut Creek historically involved *floodplain* fill. Filling floodplain areas to accommodate development on private as well as public land is still a common practice in the Chestnut Creek watershed. Maintenance of public infrastructure and the extension of public services have required periodic encroachments on the channel and floodplain.

Efforts by the Town, as well as landowners focused on protecting infrastructure and property have involved the installation of *riprap* (Photo 13), stacked rock walls, and a log cribwall along 14% of the channel length through

Photo 13. View looking upstream– rip-rap on left bank– Rt. 55 is on the right side of the picture.

this management unit. These protective measures appear to have been relatively successful in some areas, while less successful in other areas. For example, a section of a log cribwall installed near the downstream end of the unit is failing (Photo 14).

Photo 14. Beginning of log crib wall on left bank view from right bank near bottom of MU4, before the entry of the Claryville Road tributary.

General impacts of traditional approaches to stream management have been addressed in the Watershed Recommendations for Best Management Practices, Volume II, Section II.A of this plan. Specific impacts and management considerations in relation to the assessment of MU 4 are included with this section of the plan.

4. Channel Stability and Sediment Supply

During the 2001 Stream Assessment Survey, MU4 was divided into ten *reaches* on the basis of the Level II – *Morphologic* Description (Rosgen, 1996). Stream classification for Chestnut Creek predominantly follows the Rosgen classification system with a few exceptions (see Intro to Stream Processes Volume I, Section III.D, and Watershed Assessment, Volume I, Section I.E.2). Three reaches in MU4 (#8, 9, and 10) contain very short sections of bedrock, though these reaches are otherwise dominated by cobble-sized sediment. Because locations of bedrock exposure still represent an important control on stream morphology, these sections were documented as a double stream type, such as B1/B3. A B1/B3 reach would be predominantly a B3 (cobble), but would have section(s) of B1 (bedrock) too small to be broken out into a separate reach or reaches. Additional reach type splits may include borderline slope classification, such as B3/B3a, where "a" signifies an A channel slope with a B cross-section morphology.

The largest portion (62%) of this unit includes moderately *entrenched* channel B-types. With a low width to depth ratio (i.e., 11 – 16) and mature vegetation on the banks these types of channels tend to be very stable and are generally effective at moving sediment transported from upstream reaches (MU4 Stream Type & Cross Section map, Figure 2).

Highly entrenched reaches (i.e. F-types) account for 38% of the total length. 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 where they can contribute to channel instability and flooding. The *morphological* data collected along the reaches is summarized in Table 1 and illustrated in Figure 2.

As evident in the current aerial photographs, the channel *planform*, or stream pattern, along this management unit is characterized by low *sinuosity* and *meanders* with large radii of curvature. The altered meander geometry is the result of channel straightening to accommodate development of properties along the stream corridor and periodic channel maintenance. For example, a significant portion of the upper reaches of Chestnut Creek are confined between the commercial properties on left floodplain along Route 55 and steep hillslopes adjacent to the right banks and terraces.

An analysis of a series of historic aerial photographs covering the period 1974 – 2001 indicates that routine channel maintenance activities and subsequent natural channel adjustments are on-going. The effects of the channel maintenance and natural adjustments are most evident in the 1974 and 1995 aerial photographs. Prior to 1985 most channel and floodplain work appears to have been confined to the upper reaches in the vicinity of Slater Road. However, by 1995 it is evident that a considerable amount of work had occurred along the reaches to the rear of the commercial properties along Route 55.

A standard approach to channel maintenance involves excavating channels that convey large storm flows (e.g., 25-, 50-, or even 100-year peak 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.

Table 1 - Summary of Morphological Data for Reaches along Management Unit 4. The last reach in MU4 is shared with the first reach in MU5.

Reach	Length (ft)	Area (ft^2)	Width (ft)	Mean Depth (ft)	W/D	Ent	Slope (ft/ft)	Stream Type
1	350	18.3	18.4	1.02	18.8	1.77	0.038	B1a
2	162	17	20.8	0.9	26	2.05	0.058	B1/4a
3	37	16.6	17	1.0	17	1.8	0.033	B4
4	379	24.9	23.9	1.06	23	1.27	0.022	F3b
5	492	24.3	21.3	1.2	19	1.68	0.034	B3
6	270	30.9	23.5	1.33	18.9	1.3	0.030	F3b
7	619	32	26.8	1.25	23	1.28	0.024	F3b
8	2356	36.8	25.2	1.5	17.2	1.6	0.027	B
9	426	38.9	29.3	1.3	22	1.35	0.024	Fb
10	646	41.7	26.2	1.6	17	1.4	0.015	F1/F3

As pointed out in the Introduction to Stream Processes and Ecology, Volume I, Section III, natural streams are composed of three distinct flows that include: a *baseflow* or low flow channel, which provides habitat for aquatic organisms; a bankfull channel, which is critical for maintaining sediment transport; and a floodplain, which effectively conveys flows greater than the bankfull discharge (i.e., 1 – 3-year peak flow). However, the engineered channels routinely constructed during channel maintenance activities are generally designed to convey all flows (baseflow, 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 reduced channel capacity places considerable stress on adjacent streambanks under storm flow conditions. The resulting bank erosion and lateral migration widens the channel further, undercutting and toppling bank trees that can create debris jams.

Debris jams and other channel obstructions can 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 gravel contributes sediment to downstream reaches. The 2001 Assessment Survey identified the largest debris jam, located at the upstream end of the Grey/Mickelson Property, has contributed to *aggradation* along approximately 800 feet of stream channel (Photo 15). The accumulated material has flattened the channel gradient and reduced channel capacity thereby contributing to flooding of adjacent properties as well as bank erosion in this area. Immediately downstream of the jam the streambed drops sharply in a step. A *headcut* or sharp step in the stream bed, tends to continue to erode, moving the entire step upstream as it cuts into the bed and into the fine sediment accumulated behind the debris jam. Information obtained from interviews with residents and town officials indicates that this and the surrounding area has been an on-going maintenance problem for more than 17

Photo 15. Debris jam and *head cut* behind Grey's Woodworking just upstream of XS180.

years.

Historic bed *degradation* and floodplain fill contribute to the current entrenched situation along Reaches 1, 4, 6, 7, 9 and 10. Exposed bedrock currently provides grade control along a significant portion of the unit, thereby preventing further widespread channel degradation (Photo 16).

Photo 16. View looking towards left bank at bedrock stream bed MU4.

Preliminary observations indicate that the most of the channel along this management unit is laterally stable. Lateral control along the majority of the management unit is provided by mature trees and shrubs. The 2001 Stream Assessment Survey determined that there is a moderate amount of erosion however, 926 feet (17%) of the streambanks are actively eroding (Photo 17). Bank to bankfull height ratios along this unit ranged from 1.1– 5.5, confirming that a significant length of the channel is *incised*. Rosgen (2002) notes that bank to bankfull height ratio is a good measure of vertical stability, as well as an indicator of *sediment* supply potential. Results of the

Photo 17. Eroded right bank – view looking upstream near the bottom of MU4.

stability assessment show that the banks along the actively eroding areas have very high bank erosion potential, meaning that the potential for continued bank erosion, loss of trees and channel migration and bank erosion potential is very high compared to other sites. Because the channel is cutting into terraces and fill slopes in some areas they will continue to be a significant source of sediment for downstream reaches.

As part of the Assessment Survey, *monumented* cross-sections were installed in a number of locations along Chestnut Creek to monitor stream bank erosion and streambed changes (e.g., aggradation) in specific reaches of concern. Accordingly, two Bank Erosion Hazard Indexing cross-sections (BEHI) were established and surveyed as BEHI 1,2 & 3 (MU4 Stream Type Cross Section map, Figure 2) in MU4, upstream and downstream of the confluence with Scott Brook (Photos 18 & 19). The cross-sections will be resurveyed and compared to the initial surveys to document the rate at which stream bank/ bed changes occur. Data obtained from these surveys will also allow estimates of

Photo 18. Monitoring cross section 2, left bank above the confluence of Scott Brook with the Mainstem Chestnut Creek. Tree roots and rocks are providing some protection and good habitat.

Photo 19. Monitoring cross section 3, below confluence of Scott Brook with the Mainstem Chestnut Creek. Stream flow is from left to right.

sediment loadings to be developed.

Evaluating the 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 field work 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 may reduce channel capacity and can contribute to localized channel stability problems.

The sediment 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 sediment* 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.

5. Riparian Vegetation

The riparian area along Management Unit 4 can be characterized as: reaches adjacent to parking lots and equipment storage areas with narrow or no buffers; reaches with mowed lawns and scattered trees and shrubs; and reaches along steep hillslopes and terraces with mature forest. In riparian areas where narrow buffers are present, their width is generally less than 50 feet. Along developed properties, the riparian vegetation has been affected by clearing, routine yard maintenance, and other land use activities. The properties along the stream corridor with the lowest percent of riparian vegetation and buffer include the upper reaches where private residences front along Slater Road and Route 55 and in the middle reaches and lower reaches to the rear of the commercial properties.

During the Assessment Survey *Japanese knotweed*, an *invasive species*, was sighted along the banks in this management unit. It occupied a total of 120 feet on both the left and right banks in two separate locations. Invasive, exotic, non-native plants such as these crowd out the natural flora of the area and generally provide little streambank stabilization or habitat benefit (see 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 4, 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 4

1. Repair and stabilize the worst erosion sites along MU4 and the tributaries draining to the Unit.

2. Implement storm water management for the properties with the highest percent impervious surface along the corridor, including the Town Highway Facility and the commercial properties along Route 55, and any other significant impervious areas identified during the field reconnaissance recommended below. 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.

3. Evaluate the potential for reconstructing the channel along the historically active reaches from upstream of the Slater Road culvert to a point below the debris jam and gravel deposits at the rear of Grey's Woodworks, in combination with recommendations 4, below.

4. In combination with recommendation 3, above, evaluate the Slater Road culvert and Botsford/Scheirer bridge to determine the best method for reducing bank erosion and improving sediment transport under

bankfull and flood flow conditions. Suggest planting water-hearty shrubs to anchor the existing stream banks along lawn-kept areas.

5. Convert existing F-types and unstable B-types to stable B-type channels by removing existing debris jams, removing midchannel bars, and reconstructing overwide and entrenched channels with lower width/depth ratios and wider floodplain area.

6. Establish a better angle of repose on unstable banks and lower the bankfull to bank height ratio by grading high, vertical banks. Stabilize the banks and provide long-term lateral control by reestablishing bank vegetation composed of native trees, shrubs and grasses.

7. Install flow diverting structures (e.g., rock vanes, J-Hook vanes, etc) at key points along the channel, as an alternative option to bank armor, to reduce stress in the near bank region in conjunction with detailed assessments to maintain channel morphology and stability.

8. Work with landowners to establish a wooded buffer zone along reaches with little or no woody vegetation.

9. Initiate a knotweed eradication and control program along this unit.

10. Monitor areas with debris jams and channel blockages for changes in channel stability and threat to infrastructure.

11. Evaluate failing revetment for replacement with stabilization structure to maintain naturally functioning channel. Should include bioengineering and/or re-vegetation.

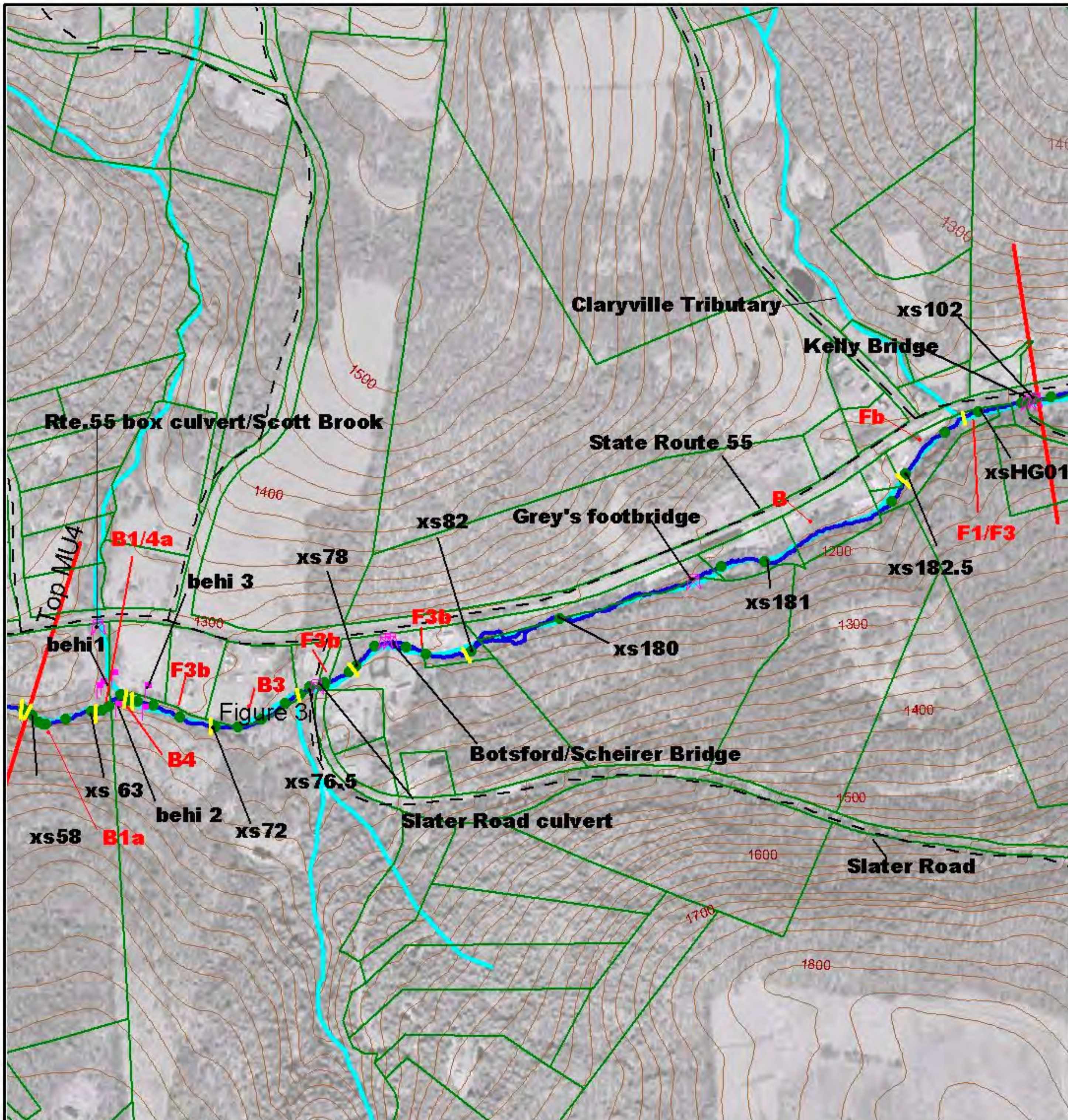

Figure 2. Chestnut Creek MU4 Stream Types and Cross Sections

Stream Assessment Survey 2001

N

Contour Interval 20 feet

300 0 300 600 Feet

1:7,500

*See Disclaimer

Legend

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)

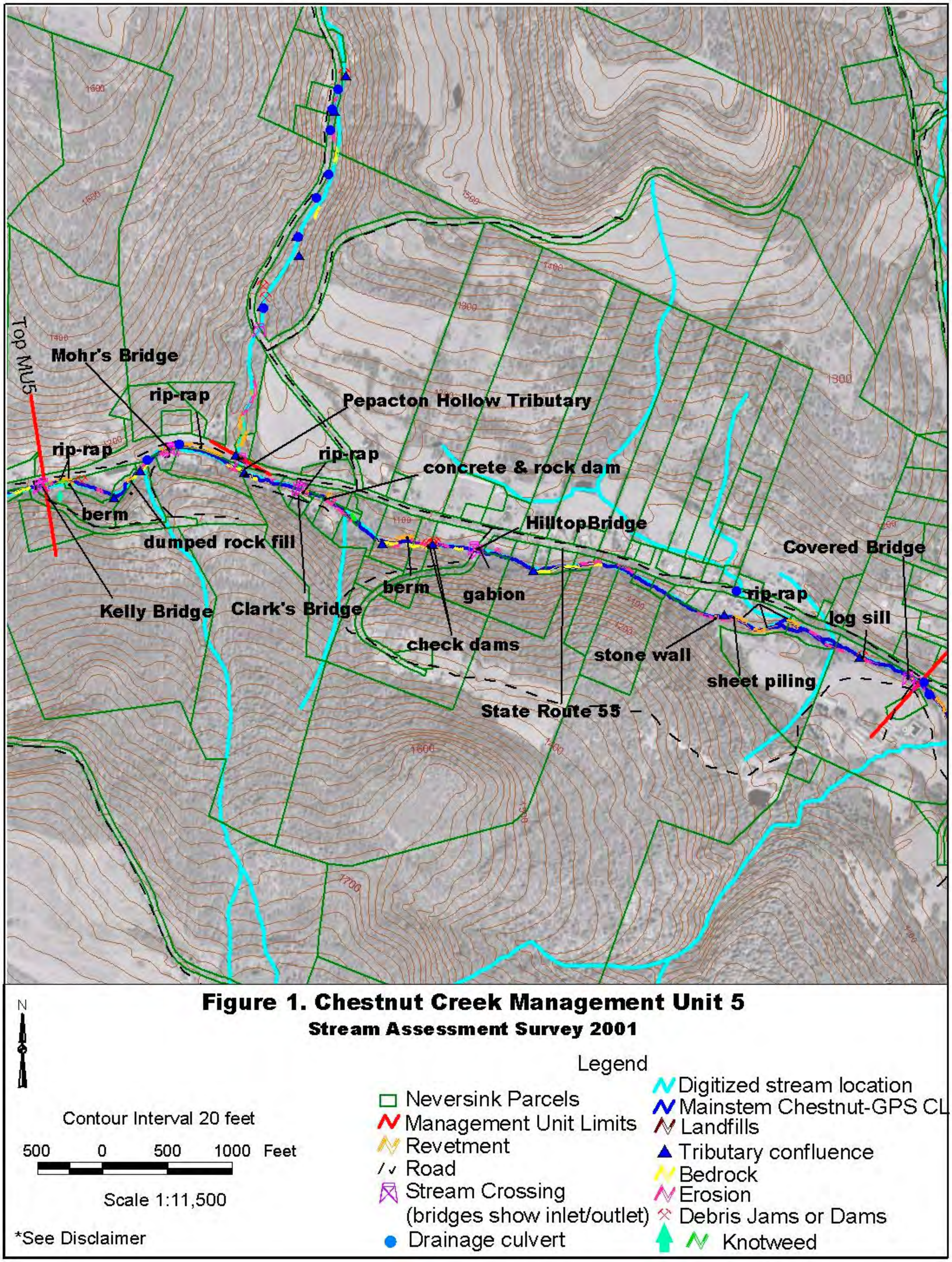

Figure 1. Chestnut Creek Management Unit 5

Stream Assessment Survey 2001