G. Chestnut Creek Management Unit 7

1. Summary Description

This section is intended to summarize the overall character and condition of Management Unit 7 (MU7). Subsequent sections will discuss specific issues (e.g., *riparian* land use and public infrastructure, channel *stability*, etc.) in greater detail.

MU7 is approximately 3200 linear feet (0.61 miles) in length and includes the segment of Chestnut Creek immediately downstream of New York State Route 42 Bridge (BIN: 1025010) to NYC DEP Portal from the Neversink Reservoir (Photos 1 & 2). *Drainage area* at the upstream and downstream ends of the management unit is 12.1 and 21.1 square miles, respectively, and includes direct flow from Red Brook, NYCDEP Portal, and effluent discharge from the Grahamsville Waste Water Treatment Plant (Photo 3). A USGS stream gaging station (#01365500 Chestnut Creek at Grahamsville) is located along Chestnut Creek approximately 600 ft. downstream of the confluence with Red Brook (MU7 General map, Figure 1).

The stream corridor along MU 7 varies in channel shape or *morphology*, floodplain function, riparian habitat and channel stability. Vegetative community and riparian areas were documented as being significantly healthier than other local units. In general, moving from the upstream unit, the channel becomes less *entrenched* with a flatter channel *slope* and a wider average channel width.

Photo 1. View looking downstream at Route 42 Bridge, cobble bar under bridge with main channel flowing into right abutment armed with riprap.

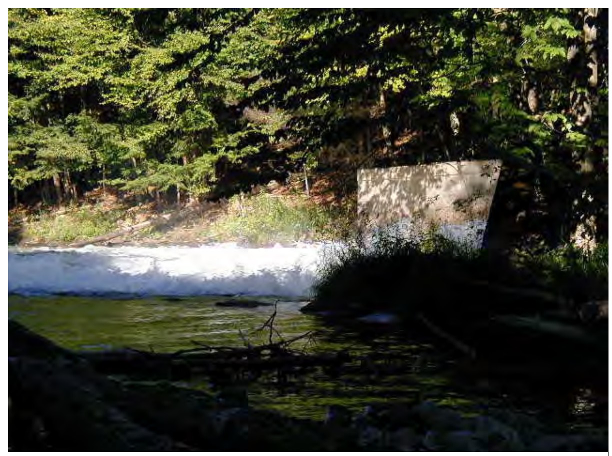


Photo 2. NYC DEP water portal from the Neversink Reservoir, emptying into the Chestnut Creek on the outskirts of Grahamsville, NY.

Photo 3. Tributary from sewer plant outfall on NYC DEP property above USGS gaging station, Grahamsville, NY.

Consequently, gravel and finer sediment are more prevalent, with *sedimentation* and *channel migration* becoming more of a management concern. These materials take the form of numerous *sediment bars* located throughout the unit (Introduction to Stream Processes and Ecology, Volume I, Section III).

A number of natural constraints and human-made modifications were inventoried within the unit during the 2001 Stream Assessment Survey. These include traditional applications consisting of placed rock revetment, such as *riprap*, floodplain *berms*, and grade control structures such as check dams and weirs, as well as sewer and bridge crossings. Channel alignment has been historically constrained by high terraces, in areas along both banks. In the center of the unit, the stream channel currently impinges along the toe of a high bank along State Route 55, on NYCDEP property, resulting in severe erosion and *mass wasting* (Photo 4 & Appendix Projects Ranking).

Photo 4. Steep eroded left bank on DEP property, along Route 55-view looking downstream toward road & left bank from XS-170.

2. Riparian Land Use and Public Infrastructure

According to tax maps for 2000, there are 6 properties located within 150' of the stream in MU7 that include several small residential parcels, the Grahamsville Rural Cemetery, the Grahamsville Waste Water Treatment Plant, Power plant and property owned and operated by NYCDEP including the Grahamsville Laboratory, and a new NYCDEP Police Precinct. In comparison, the riparian corridor through MU7 is significantly less developed than MU6.

MU7 currently contains one bridge at State Route 42, located at the top of the unit. There is evidence of an historical bridge which was located downstream near the USGS gaging station. This bridge crossed Chestnut Creek toward Route 55 and but was removed in the late 1980's.

Historical aerial photographic assessment was performed to assess the natural changes and historic modifications to the stream channel and floodplain within MU7. 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. MU7 was assessed using remotely sensed imagery from 1963-2001 (Aerial Photos 5, 6 & 7).

Landowners in the area have reported that the stream channel through the State Route 42 Bridge was repositioned during reconstruction in 1996 (Landowner Concerns and Interests, Volume I, Section IV.B.6). The 2001 inventory documented

Photo 5. 1963 Aerial Photograph of Management Unit 7.

Photo 6. 1977 Aerial Photograph of Management Unit 7.

Photo 7. 2001 Aerial Photograph of Management Unit 7.

a large gravel bar had formed under the opening of the structure (Photo 8). Gravel deposition can result from inadequate bridge width or location over the bankfull channel width. Reduction of the *hydraulic* opening under a bridge causes ongoing maintenance problems as well as potentially results in higher stress along the bridge abutments. Field surveys verified that the deepest part of the stream channel currently runs directly into and along the right bridge abutment (see Photo 1). Evaluation of the bridge alignment and width over the bankfull channel width would be beneficial to both the longevity of the bridge and the integrity of the stream.

Photo 8. Cobble bar under Route 42 bridge along left abutment.

Bridges and culverts which have been constructed without proper consideration of *fluvial* (stream) processes can have negative impacts on stream systems and result in ongoing maintenance problems for structures themselves. These impacts are most commonly associated with inadequate sizing of the bankfull width and alignment of the bridge opening. Bridges with inadequate openings results in a loss of stream function and increase potential for numerous impacts upstream and downstream of the structures.

Storm water runoff from yards and parking lots is conveyed predominately as *sheet flow*. 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 predominately 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 the DEP Facilities and the Waste Water Treatment Plant. These properties do not have storm water management facilities for controlling runoff (Riparian Vegetation Issues in Stream Management, Volume I, Section IV.B.3, and Riparian Vegetation Management Recommendations, Volume II, Section II. A.1).

3. History of Stream and Floodplain Work

Traditionally, activities to straighten, widen, build up or deepen stream channels have been undertaken to increase floodwater conveyance and attempt to protect eroding streambanks throughout Chestnut Creek watershed. Similar to upstream units, a number of modifications to the stream and floodplain in MU7 were inventoried during the 2001 Stream Assessment Survey. Review of historic aerial imagery displayed a number of channel modifications and revealed expected corridor responses. Most evident was channel work performed between 1963 and 1974 where the channel in MU7 appeared to have been mechanically straightened and widened. Extensive areas of vegetation appear to have been removed.

Typically the practice of over-widening causes a decrease in stream velocity, which results in excessive sediment deposition, a reduction in *riffle/pool* complexes, and a loss of habitat. Channel braiding and extensive random gravel deposition were evident in later imagery. Further review of imagery from 1995 revealed that it took nearly 20 years for the floodplain to re-vegetate and to develop a single narrower channel.

General impacts of traditional approaches to stream management have been addressed in Stream Stewardship Recommendations, Volume II, Section II. Specific impacts and management considerations in relation to the assessment of MU7 are included with this section of the plan as well. Use of riprap around bridges is a common practice and usually is specified in design and construction due to hydraulic considerations and erosive forces created by the bridge opening during storm flows. The Route 42 Bridge has a continuous section of riprap along the right bank of the channel. Riprap begins at the bridge outlet and continues nearly 600 feet downstream (Photo 9). The purpose for the extent of the original installation was not established during the initial site investigation. Several impacts have potentially resulted from revetment placement, which includes redirection of stream flow toward the high bank area and increased entrenchment. Additionally, the stream channel in MU7 seems to be

Photo 9. End of rip-rap on right bank, downstream of Route 42 Bridge – on DEP property – view looking upstream from the center of the stream.

reducing channel slope by increasing belt width through erosion and lateral migration. This process is prevented by riprap, but is potentially amplified or transferred to the downstream areas.

Entrenchment in an upper *reach* is exacerbated by a floodplain *berm* located along the left bank. The berm is over 100 feet in length and is presumably constructed from sediment excavated from the channel bottom. Streamside berms are typically constructed to prevent infrastructure damage and flooding, however the purpose of this modification was not investigated during initial assessment. These embankments typically increase peak flood elevation and stream velocities, which result in increased erosive forces. Stream systems *entrenched* within floodplain berms are prone to channel degradation and other associated instabilities.

Berms such as these generally do not offer much, if any, protection from flooding. They can cause stream entrenchment and higher flood height or *stage* locally by preventing floodwaters from flowing over the floodplain, cutting off an important function of these flat areas. 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 important floodplain functions in small mountain streams. Removal or restructuring of some of these bermed areas should be considered to add floodplain functions to this area and reduce erosion and instability problems. Setting berms back from the stream provides a compromise solution, if berm materials are necessary either for stockpiles or flood inundation protection.

A common practice in the past for controlling erosion of stream beds, is the installation of cross channel check dams constructed of concrete, steel sheet piling, gabion baskets or other materials. MU7 contains two structures acting as check dams with apparently different purposes. Approximately 140 feet downstream of State Route 42 Bridge is a low head check dam structure (Photo 10). This structure generates a one-foot grade drop in channel invert below the structure. The nature of this check dam was not determined during the initial inventory, but these structures are frequently used to address stream channel *incision*, or to raise base stream flow elevation for easier water withdrawal. The structure may contain a sanitary sewer lateral, which were inventoried in upstream units, and should be investigated. Typical impacts of stream channel check dams include a local reduction of stream slope, increased deposition and increased bank erosion. Sediment transport through

Photo 10. Stone and cement bed-grade control-view looking upstream towards Route 42 Bridge.

Route 42 Bridge may be affected by the check dam. Often a stream will migrate around a check dam requiring ongoing maintenance. Use of extensive riprap discussed above may have been implemented to prevent loss of this check dam.

The second structure is a v-notched weir located at the USGS gaging station, 1,400 feet downstream from State Route 42 Bridge (Photo 11). The effects of this structure independently were not evident from the assessment, however the combination of these structures and the apparent instability of the high bank between them will need to be incorporated in future analysis, restoration and management of MU7.

Photo 11. Stone step weir on DEP property at USGS gage.

Channel modifications appear to have occurred in MU 7 prior to 1963, associated with unstable areas. The channel was braided throughout many sections along the length of MU 7, particularly upstream of the failing DEP bank. Braiding could be a direct result of previous channel maintenance or in combination with prior flood events. Historic peak flow data shows several large flood events occurring in the 1950's, with the largest flow of 4,640 cfs recorded on October 15, 1955. The riparian corridor consisted of a thin strip of vegetation along MU 7 channel banks and floodplain from State Route 42 Bridge to the sewer outfall. Below the outfall the buffer looks to be continuous through the end of the unit (see Hydrology and Flood History, Volume I, Section IV. B.2, & Aerial Photos 5, 6 & 7).

The 1974 and 1977 imagery displayed many of the same channel and floodplain features present in 1963. Most evident was apparent *channelization* and widening between 1963 and 1974. Virtually all riparian vegetation was removed from the floodplain in the upper half of unit above the sewer outfall. Extensive sediment braiding and random gravel deposition increased throughout the area during this time period.

Gravel *bar* formations increased in size from 1974 to 1977 with the apparent tendency of the channel to become more defined, however no established vegetation was documented on these formations. Extensive sediment formed at Chestnut's confluence with Red Brook, denoting reduced transport capabilities of Chestnut Creek and potential instabilities located within Red Brook. Large spread bar formations were present upstream of the historical bridge remains.

By 1985 the stream had redeveloped into a more defined, single thread channel with increasing amounts of riparian vegetation. There were no visible central depositional features noted and a small number of side channel point bars. By 1995, side channel point bars had become completely vegetated, with a single thread stream channel. The lower bridge crossing had been removed. The high bank was completely vegetated. Limited bar formation around and in front of the DEP high bank was noted, however formations just downstream Red Brook Tributary were inventoried.

High flows in the period between 1995 and 2001 have exposed a large section of erosion along the high bank, removing all vegetation from its face. Data from the Chestnut Creek gage station, located within MU 7, was unavailable for this time period, however nearby stream gages revealed large storm events occurring in both 1996 and 1999. Migration of channel and bank lines was clearly evident as well as a channel shift up valley along the lower portion of the *meander*. This migration may have reduced the local slope and therefore increased deposition in the area of the bank. The 2001 aerial further displayed a down valley meander migration of nearly 60 feet. This migration directs flows into the face of the bank further threatening its stability.

4. Channel Stability and Sediment Supply

During the 2001 Stream Corridor Survey, MU7 was divided into 5 reaches on the basis of the Level II – Morphologic Description (Rosgen, 1996). The largest percentage of channel is of the C stream type, which makes up 56% of the units total length MU7. The C channel types are generally stable and common in the lower, flatter portions of many local watersheds. These stream types are highly dependent on woody vegetation for maintaining stability. In addition, they are susceptible to stability problems where sediment loads are high, as is the case in this unit. The second largest portion (23%) of this unit includes highly entrenched F *stream types*. Because they lack a floodprone area, 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. Moderately entrenched channel types B3, and B1 comprise the remaining portion of the unit (22%). With 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.

The 2001 Stream Assessment Survey in documented nearly 450 feet of the stream bank actively eroding and failing in MU7. This erosion occurs in three sections on both the left and right banks as well as the high bank of concern. Areas with minimal vegetation along the bank as well as high bank height to bankfull height ratios tend to experience increased bank stress and erosion rates.

Sediment supply varies within the unit. Storage of sediment in the form of both sidebars and central bars is evident throughout the entire unit. A number of these bars are vegetated, however some areas indicate recent or ongoing deposition. Cobble and gravel comprise the predominant substrate within the bankfull channel and bar formations. Also a small amount of exposed bedrock has been identified below the bridge at Route 42 and below the gage. The morphological data collected along MU7 is summarized in Table 1 in order progressing downstream from the Route 42 Bridge. Also see Stream Type and Cross Section location map, Figure 2.

Information obtained from interviews with residents and town officials paired with field inventories identified actively eroding DEP high bank as the primary concern in MU 7. The stream bank is currently located within 20 feet of the state highway, amplifying the priority for concern. Estimations using aerial photography that more than 73,000ft^3 of sediment has been eroded from this single bank in six years between 1995 and 2001. The high eroded bank is currently over 100 feet long and 30 feet high (see Public Infrastructure and Landowner Concerns and Interests, Volume I, Section IV.B).

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 2001 Stream 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 may 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

Table 1 - Summary of Morphological Data for Reaches along Management Unit 7 .

Reach	Length (ft)	Area (ft^2)	Width (ft)	Mean Depth (ft)	W/D	Ent	Slope (ft/ft)	Stream Type
1	567	59.1	37.0	1.6	23	1.6	0.016	B3c
2	363	81.5	47.6	1.7	30	3.4	0.009	C3
3	135	82.3	74.0	1.1	67	1.9	0.023	B
4	1421	70.5	33.8	2.1	16	4.1	0.014	C
5	311	124.0	65.8	1.9	35	1.1	0.006	F

Chestnut Creek/Rondout Reservoir System.

Planform, or stream pattern, through MU7 was derived from current aerial photography. MU7 is characterized by an average radius of curvature of 260 feet and an average meander length of 558 feet. The belt width of MU7 ranges from 55 feet to 480 feet. *Sinuosity* or curvature of the channel is 1.17, which is slightly lower than expected for contributing stream types within the particular valley setting.

Sinuosity measurements from historical aerial photography show a continual increase in value from 1974 to present. As previously mentioned, the upper section of MU7 had undergone channelization work in the early 1970's. The stream channel appears to be continuing to make adjustments as a result of that work over 30 years ago. Sinuosity values have increased in the upper section from 1.02 to 1.14, with a corresponding increase in channel length of over 180 feet, illustrating that the stream is attempting to regain its natural form.

High Bank Failure

General cross-section and meander geometry along this management unit is typical of streams that have undergone extensive anthropogenic impact. MU7 has been affected by erosion and reduced sediment transport during large storm events, and more prevalent lateral migration. Again this type of migration becomes a problem erosion threatens infrastructure or property. Numerous factors contribute to current migration in the unit including geology, riparian vegetation, flooding and anthropogenic impacts.

The high bank of concern is located 800 feet downstream of State Route 42 Bridge on NYCDEP property. The bank is 38 feet in height at its center and over 100 feet long. The bank at its center is uniform in slope with a bank angle of approximately 42 degrees. Bank configuration in 2001 was considered over-steepened, in comparison to upstream and downstream areas of the same terrace formation and is presently located less then 20 feet from Rt. 55. It has been estimated using aerial photography that more than 73,000 ft^3 of sediment has been eroded from this single bank in the six years between 1995 and 2001. No protective vegetation existed on the bank top, face, or toe of the bank (Photos 12 & 13).

Suspected cause of failure was initialized by sediment *entrainment* from water flowing parallel to the bank, causing erosion by removal of soil particles at the bank toe. Field evidence revealed the soil

Photo 12. Monitoring cross section, DEP 2, eroded left bank.

Photo 13. Monitoring cross section, DEP 1, left toe of eroding bank close up of Photo 9, stream flow left to right.

composition of the bank is distinctly different from materials in other local banks. Interviews with local residents and town officials indicate that bank material is composed of tailings from construction of the water portal from the Neversink Reservoir, which enters into Chestnut Creek just downstream. The bank soil composition was characterized as homogeneous fine sediment, with limited stratification, again not typical of other more resistant native materials found in other local banks.

Field inspections revealed slumped grass from the top of the bank along the bank toe indicating active erosion and slumping. The 2001 Stream Assessment Survey included establishment of monitoring cross sections, two of which were placed in the area of the high bank, to verify this process. The bank was evaluated using a *Bank Erosion Hazard Index (BEHI)* scoring system, which evaluated parameters such bank height, vegetation rooting depth and density, bank surface protection, angle and materials. The bank was rated with an extreme potential for erosion, which is the highest applied score in the entire Chestnut Creek mainstem.

Historically, the bank material has been unable to withstand the near bank stress imposed by flow in the channel. Further compounding the risk of continued bank failure is a lack of suitable bank protection along the bank toe, exacerbated by current stream alignment. Apparent from historic imagery is the trend of increasing sinuosity and channel length in the area of the high bank through lateral migration at the bank, and a channel avulsion downstream. The 2001 aerial photo further displayed down valley migration of the meander leading into the area of the bank, directing flows into the face of the bank. The effect of this migration is suspected to have reduced local slope, and increased deposition in the area of the bank, ultimately accelerating erosion into and at the bank.

In general, current channel configuration and channel inefficiencies may tend to lead to further erosion at the high bank. Without treatment, the bank failure will likely continue both upstream and downstream. This current trend amplifies priority for remediation of this bank. To be successful, any stabilization scheme must deal with this imbalance either by reducing velocities, increasing bank erosion resistance, and/or removing or re-directing the force. Sediment transport inefficiencies should be examined and addressed in any remediation effort. Permanent treatment of the bank should be performed in conjunction with channel improvements both upstream and downstream. An immediate temporary stabilization effort should be considered along the bank toe to prevent further failure and potential catastrophic damage to the adjacent highway.

5. Riparian Vegetation

Streamside assessment conducted in 2001 did not investigate specific streamside (riparian) plant species or density, but recorded areas with insufficient or stressed vegetation that could affect stream stability, flooding or erosion threats, water quality or aquatic habitat.

The majority of MU7 has good vegetative cover except in areas where the channel runs fairly close to a roadway. Stream types present indicate that riparian condition is extremely important to current stream channel stability. Riparian condition throughout the reach varied in relation to length, bankfull stage and topography.

The upper half of MU7 contains primarily deciduous brush (willows and alder) with grass understory, at moderate to high densities (Photo 14). A large area containing maintained fields exists along the upper portion of the unit on the right floodplain. The lower section of the unit consists of more dense mature stands of deciduous trees along both floodplains. Although floodplain vegetation was deemed adequate to provide general stability, areas with a relatively low rooting depth to bank height provided minimal vegetative stability. Historical aerial photograph analysis shows an increasing density of riparian vegetation from 1997 to present.

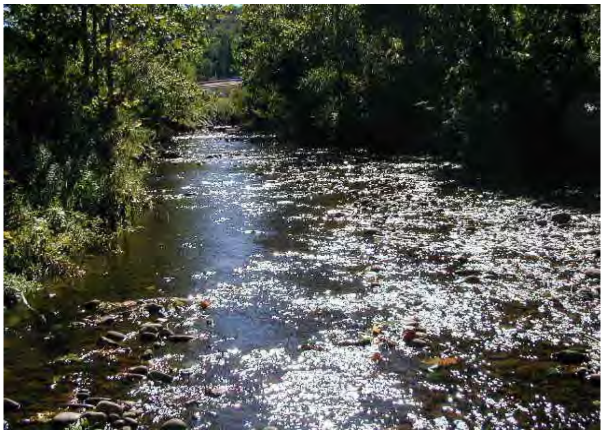


Photo 14. Reach-view looking upstream from XS-170 on DEP property.

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 (see Project Partners, Volume I, Section II).

The following discussion includes specific restoration and management recommendations for Management Unit 7, as an 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

Restoration and Management Recommendations Management Unit 7

1. Relocate and stabilize the stream channel in the area of the high eroding bank. (See following section)

2. Perform further assessment of the Red Brook tributary to determine the extent of erosion and potential sources of excess sediment to the mainstem of the Chestnut Creek in Management Unit 7.

3. 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 Waste Water Treatment Plant. 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.

4. Assess the potential effects of the check dams on channel stability, sediment transport, habitat improvement, and fish passage. Remove poorly sited and/or poorly functioning check dams, with attention to promoting multi-objective restoration.

5. Evaluate the potential for increasing the riparian buffer between the NYCDEP facilities and Chestnut Creek in order to establish a functioning wooded buffer zone and floodplain area. Stabilize the banks and provide long-term lateral control by reestablishing bank vegetation composed of native trees, shrubs and grasses.

6. Evaluate the potential of replacing or modifying stabilized areas (riprap), as needed with alternative stabilization techniques including bioengineered vegetation and vane/log style structures. These techniques can prove to be more aesthetically pleasing, promote physical habitat, and facilitate other multiple secondary benefits.

8. Evaluate the State Route 42 Bridge for the ability to convey both bankfull and flood flow, as well as proper sediment transport. Design modification should reduce scour and provide for fishery passage.

9. Assess the local condition and stream width at remaining abutments from the historical bridge. Evaluate bankfull width accommodation and the potential for removing the abutments if necessary to improve flood conveyance, aesthetics, and potential liability.

10. Establish a better angle on unstable banks and lower the bank to bankfull 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.

11. Provide grade control structures (e.g., cross vanes) at key points along the channel to maintain bed stability as an alternative to bank armoring, after conducting on-site inspections and detailed assessment at problem areas.

12. 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 after conducting on-site inspections and detailed assessment at problem areas.

13. Continue to monitor the reach for the establishment of knotweed and establish an eradication and control program as needed.

High Bank Area Management Recommendations

The Summary and Description of MU7 represents an initial investigation of causes and risks associated with the high bank failure. Recommendations for channel relocation combined with bank stabilization techniques are based on the obvious risk to public infrastructure (State Rt. 55) and human welfare, as well as site assessments which identified a high probability for further bank failure. Immediate temporary stabilization is recommended to give program partners time to analyze potential restoration alternatives, seek available resources, and identify project objectives and constraints. Any temporary stabilization efforts should be planned so as they can be incorporated into a final restoration project. The final restoration project should consider utilizing a multi-objective approach toward project implementation, which could effectively include many additional benefits outlined within this plan.

The Sullivan County SWCD, the Town of Neversink, NYCDEP, NYSDEC, and NYSDOT and should work with consulting engineers trained in geomorphology and natural channel design to evaluate existing high bank instability.

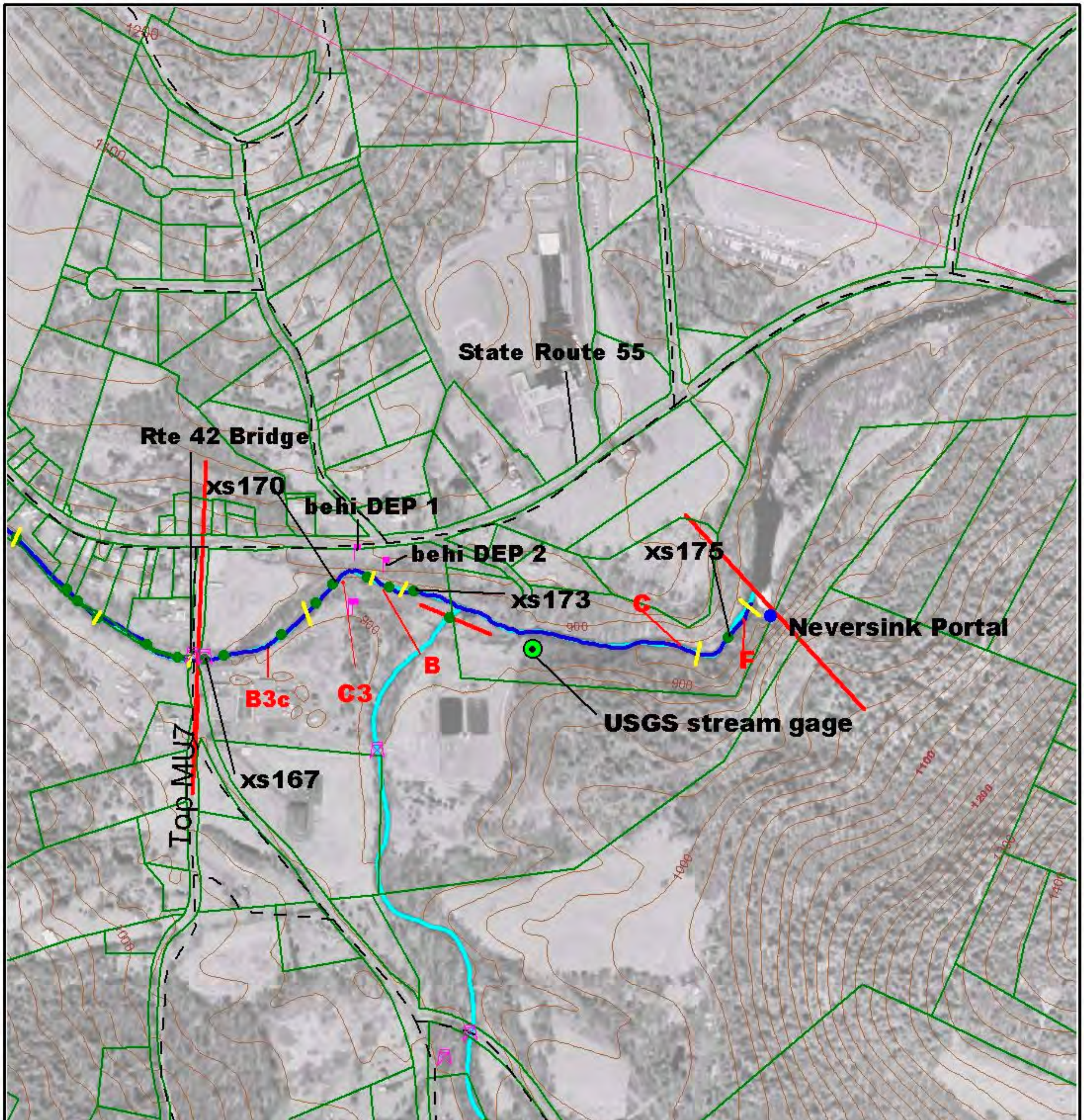
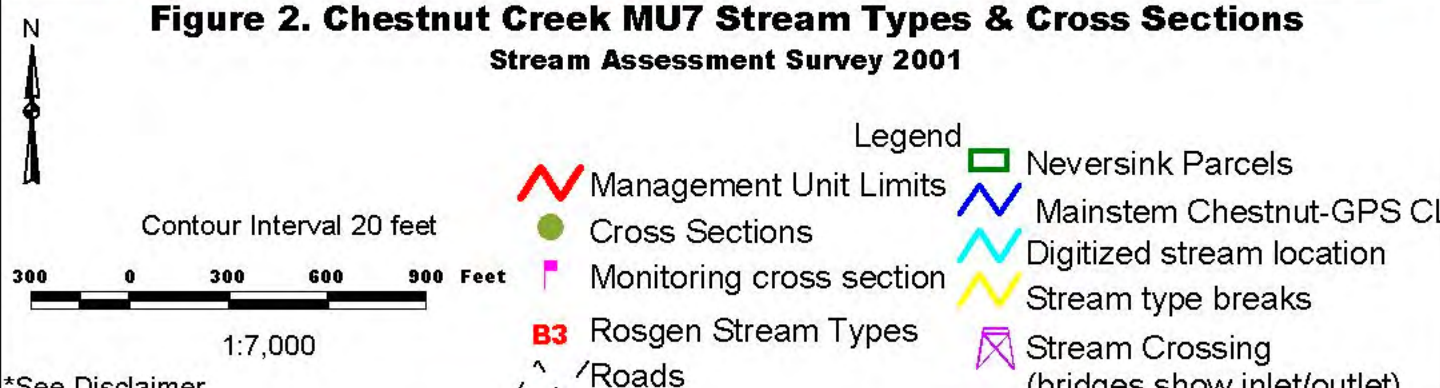


Figure 2. Chestnut Creek MU7 Stream Types & Cross Sections
Stream Assessment Survey 2001



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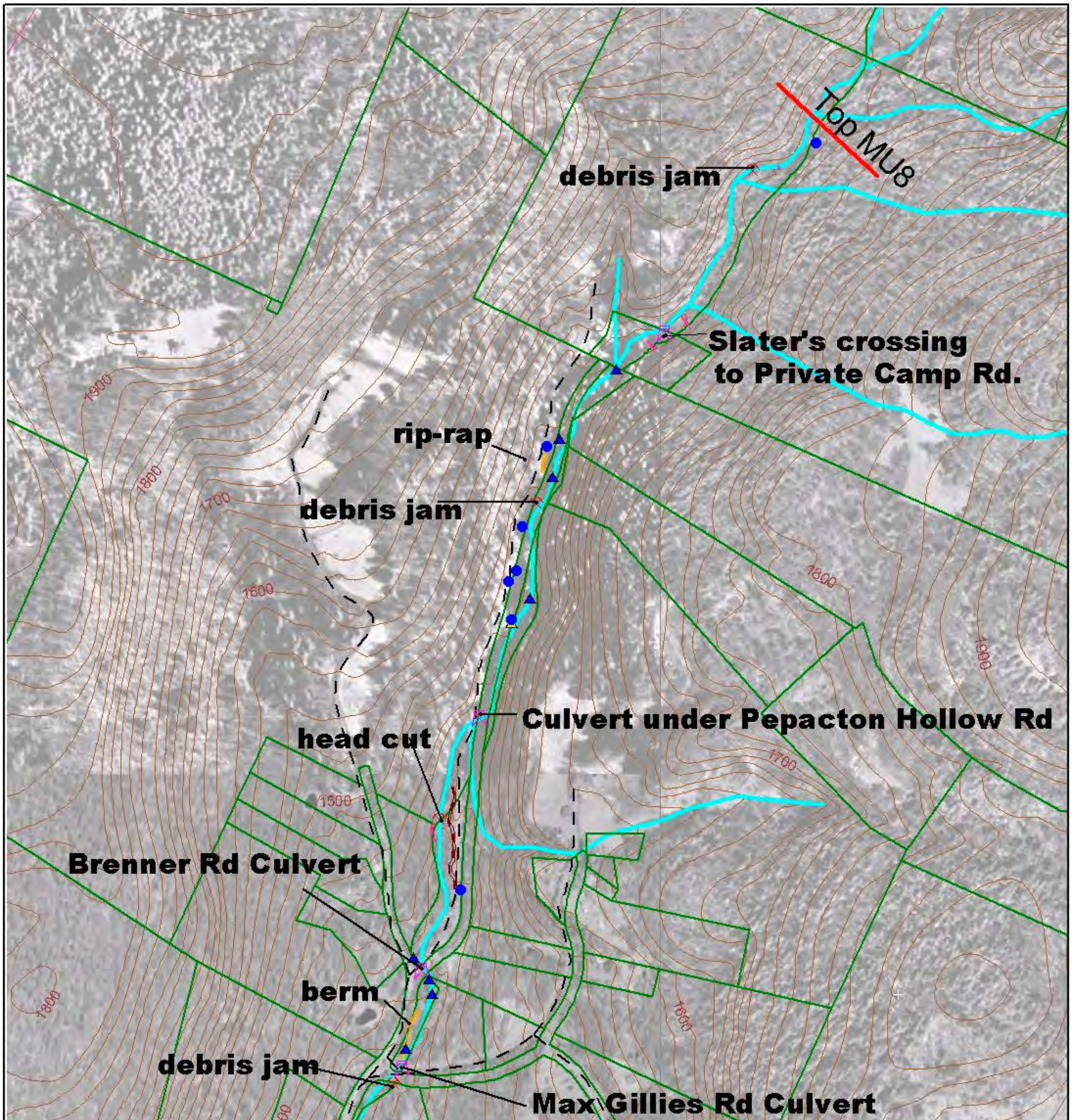

Figure 1. Chestnut Creek Management Unit 8 Pepacton Hollow
Stream Assessment Survey 2002

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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

300 0 300 600 900 Feet

Scale 1:8,000

*See Disclaimer

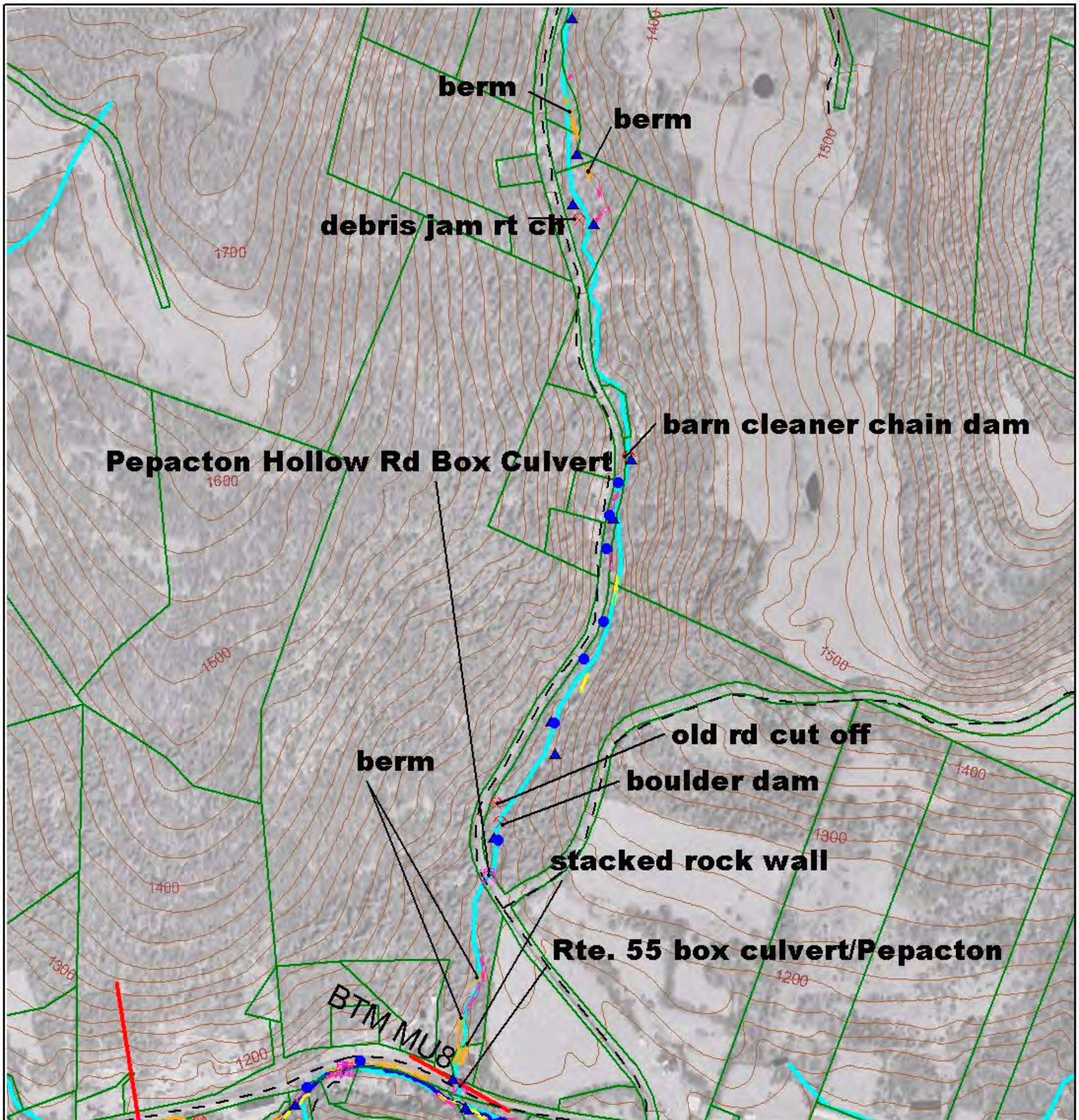

Figure 2. Chestnut Creek Management Unit 8 Pepacton Hollow

Stream Assessment Survey 2002

Legend

- Neversink Parcels
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