Reach 1c (County Route 56 Bridge below L.MacGlashen to Peck Road Bridge)

Reach 1c consists of approximately 4,700 feet of stream, and runs between the new county bridge just down stream of the L.MacGlashen farm, to the county bridge at Peck Road. The site is located in valley zone 4 **(Figure V-11)** and has an average valley slope of 1.3%. The valley morphology is characterized by a broad valley floor, containing alluvial terraces and a well developed floodplain. The contributing drainage area ranges from 5.5mi^2 on the upper end of the segment, to 7.2 mi^2 on the lower end. The entire reach was subject to full restoration in 2001-02 (**Figure VI-9**). Land use in the reach is open space, with limited residential development.

Figure VI-9: View of restoration work undertaken in segment 1c during 2001.

Stream Morphology/Stability

The Phase I Inventory and Assessment in 1997 identified segment 1c as exhibiting signs of extreme erosion. The inventory noted that 2,580' of streambank, or 55% percent of the reach, was experiencing active erosion. Measurements of the impacted streambanks revealed 11.92 ft^2 of exposed streambank per linear foot, the highest rate of any reach on the Batavia Kill. Reach 1c contains B4 and C4 stream types, with changes in stream type related to the influence valley morphology on channel entrenchment. Active mass wasting (rapid downslope movement of rock or soil) was present along a high terrace that runs through most of the reach, with unstable banks exceeding 50 feet in height **(Figure VI-10, photo B,C)**. Erosion was also occurring along the low terraces in several areas in the reach **(Figure VI-10, photo A,E,F)**. Detailed assessment of reach 1c was initiated in the summer of 1998, and continued through 2001 when construction was initiated on the demonstration restoration project.

The GCSWCD completed a Phase I through Phase IV assessment including 15 monumented cross sections, a survey of the longitudinal profile, and assessment of channel and point bar sediment characteristics. Monitoring was conducted annually in 1998, 1999, 2000 and in 2001 prior to construction. A topographic survey covering an area of approximately 32.5 acres was completed for the entire reach in 1998, and repeated in 1999 due to dramatic changes that occurred during the September 1999 flood event. Monitoring confirmed the highly unstable nature of the reach, and indicated that the channel was experiencing aggradation, degradation and lateral erosion at various locations through the reach.

Assessment of long term planform adjustments was conducted using aerial photographs from 1959 to 2000, which were adjusted to match the topographic survey completed by the GCSWCD. This allowed comparisons of the Batavia Kill's meander pattern over a period of 41 years, as well as evaluation of abandoned channels. **Figure VI-11** depicts the water surface from 1995 (blue) overlaid on a 2000 photograph. As shown, significant channel shifts had occurred throughout most of the reach, with major changes in channel planform observed after the 1999 flood event. During the flood, some sections of the stream channel moved in excess of 100 feet. As seen in Figure VI-11, planform adjustment has been active along almost the entire reach. The segments where planform does not appear to have changed are characterized as being moderately to highly entrenched.

Figure VI-11: Aerial view of channel planform changes between 1995 (blue) and 2000 (photo).

At the top of the reach, only minor planform changes were noted between 1959 and 1995, and a healthy riparian buffer was present during the1997 inventory. Between May 1995 and 1998 when the detailed assessment was initiated, the channel started to experience planform changes. The flood of September 1999 resulted in a substantial channel shift on the right bank, with the channel migrating over 75 feet . The channel avulsion occurred in spite of a dense riparian buffer.

Moving down the reach, a beaver dam 300 feet below the town bridge was observed to be impacting sediment transport through the reach **(Figure VI-10, photo G)**, with the channel filled with gravel and other sediments. The stream channel was responding to the channel aggradation with lateral erosion as the stream attempted to cut a channel around the beaver dam. Monitoring cross sections showed the development of a divided channel below the dam **(Figure VI-12)**, with the main (left) channel incising over one foot, and the right channel almost half a foot during the monitoring period. Further below the beaver dam, the channel was experiencing lateral erosion and over widening, as well as having degraded nearly 2 ½ feet.

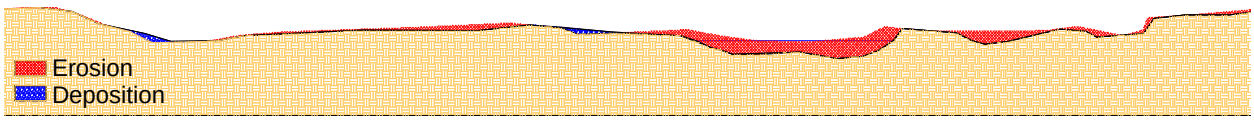


Figure VI-12: Monitoring cross section below beaver dam, note erosion of multiple channels on left side.

Moving down the reach, the alignment of the channel had migrated to a position against a high terrace on the right streambank **(Figure VI-10, photo B,C)**. The terrace averages approximately 55 feet in height, and runs approximately 2200 feet along the center of reach 1c. Prior to restoration, approximately 1,075 feet of stream channel was directly against the high terrace, with large slope failures present. Mast wasting of the high terrace was facilitated by erosion at the toe of the bank **(Figure VI-13)**. The low terrace, running along the opposite bank also showed equal signs of instability **(Figure VI-10, photo E)**.

Figure VI-13: Eroded high terrace at middle of management segment 1c.

The middle section of reach 1c has been extremely dynamic. Aerial photo interpretation revealed lateral migration of nearly 150 feet occurring between 1959 and 1995. Between 1995 and 1999, the stream migrated back toward the south over 100 feet, and was continuing to actively erode **(Figure VI-14)**. Minor erosion was noted during the first year of monitoring with approximately 1 foot of stream bank erosion. Between 1999 and 2000 the channel incised 2.6 feet and eroded 15 feet of the left stream bank.

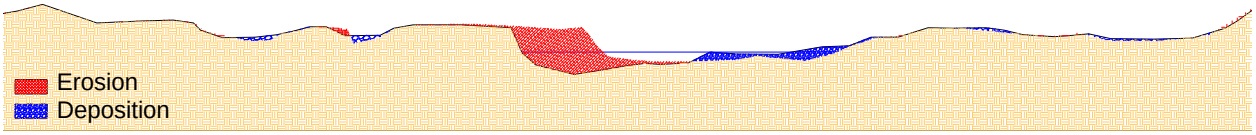


Figure VI-14: Lateral erosion of low terrace and channel degradation at cross section #8 located in the middle of reach 1b.

During the period between 1998 and 2001, a section of the reach just above cross section #8 was experiencing extreme degradation. While not captured by the monitoring cross section, the reach incised approximately 8 feet in two years. Streambanks that were approximately 4.5 feet in height at the onset of monitoring, had increased to over 12 feet in height in some places. The severe degradation was caused by an active head-cut that was moving through the reach.

The lower half of reach 1c was primarily characterized as an aggradation area, with excessive sediment deposition, multiple channels, and poor riparian conditions. Typical of aggradation areas, channel planform was highly variable, with even small storm events significantly changing the stream pattern. Between 1995 and 2000, some sections of the stream laterally migrated over 100 feet. Additionally, aggradation was transferring erosional forces against the outer banks, with active erosion on both the left and right banks noted during the assessment process **(Figure VI-15) (Figure VI-10, photo E)**.

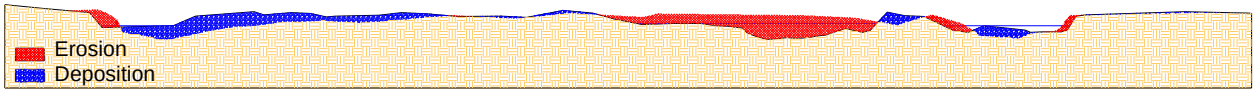


Figure VI-15: Monitoring cross section (#14) at the lower end of reach 1c indicated extensive deposition and erosion associated with rapid planform changes. Note erosion at both far edges of the channel, as well as the poor width to depth ratio and channel over-widening.

The exact cause of the aggradation in this section of the reach is difficult to determine with any degree of certainty, and is likely a combination of multiple factors. The most significant influence on aggradation at the lower end of the reach can be attributed to both the Peck Road bridge and the C.D.Lane flood control structure. In both cases, a back water effect appears to be influencing sediment transport, with sediment deposition upstream of the bridge causing the stream channel to braid into three separate channels **(Figure VI-10, photo A)** . As the stream responds to aggradation by increased lateral erosion, the continued over widening of the channel further reduces sediment transport capacity.

Historical photographs, dating back to 1959, appear to indicate that this has been a depositional area for at least 41 years. In 1990, the Peck Road bridge was replaced after being damaged in a flood. While the new bridge appears to have adequate width to accommodate the bankfull channel, it lacks sufficient flood plain drainage. Aggradation in the lower end of reach 1c is also influenced by the instability problems upstream. Reach 1c has evidence of multiple head-cuts, which typically result in aggradation downstream where the channel slope is flatter. Aggradation is facilitated by the extra sediment produced by the head-cut.

Riparian Vegetation

The condition of the riparian area in the segment was highly variable. At the head of the segment, much of the riparian area was characterized by open fields, with narrow strips of wooded riparian vegetation **(Figure VI-10, photo A,D,H)**. In the lower extent of the reach, the stream was bordered by denser, woody vegetation, however extreme boundary shear stress from channel aggradation and over-widening has resulted in the trees being undercut and lost. While the high terraces in the segment support vegetation at the top of the terrace, and once were stabilized by forest cover, the unstable faces of the terrace are too steep to support bank stabilizing vegetation. The portion of the streambank that is exposed to the erosional forces of the stream is predominantly unprotected by vegetation.

Establishment of an effective riparian buffer is a primary emphasis of the restoration design. The GCSWCD has replanted over 13 acres of floodplain with bare root trees and shrubs including hybrid poplar, white pine, river birch, streamco willow, red osier dogwood, American cranberry, button bush and other species. Additionally, extensive plantings of willows using bioengineering methods have also been completed. The GCSWCD will replant sections as necessary, and is using irrigation to help insure successful establishment.

Water Quality

Issues related to water quality in reach 1c were limited to turbidity. In 1998, the Town of Windham reported to the GCSWCD that the swimming beach at C.D.Lane Park was experiencing problems with sedimentation. Investigations of potential upstream sources revealed extensive clay and lodgement till exposures in reach 1c. While no water quality monitoring was completed, visual observations of the reach during higher flows clearly indicated that the reach was a significant contributor to turbidity and TSS . The primary goal of the demonstration restoration project was mitigation of this impact.

Infrastructure

Infrastructure in the reach includes three bridges. As noted earlier, the Peck Road bridge was replaced in 1990, with the other two bridges in the reach replaced in 2001 and 2002. A town owned bridge in the reach at the M. MacGlashen Farm had remained stable through the monitoring period, but was damaged beyond repair in September 2001 by an oil delivery truck. The old bridge had adequate width to prevent impacts on channel morphology, and the bridge was not impacting stream stability **(Figure VI-10, photo H).** Downstream of the town bridge, the channel was characterized by incised conditions, but the reach had remained fairly stable due to the presence of some coarser bed materials and thick willow vegetation.

Habitat

Prior to construction of the restoration project, habitat was of very poor quality. Lack of cover, poor riffle-pool structure, and loss of summer base flow were some of the problems noted. The restoration project is being monitored closely by the USGS to determine if the project was successful in improving fisheries habitat.

Reach 1c Summary

The entire length of reach 1c was determined to be a priority for restoration due to water quality impacts, and in 2001 and 2002 was restored using natural channel design methods **(See Section VII: Demonstration Projects)**. During the period of the stream restoration construction, both the county bridge at the top of the management segment, and the bridge to the M. MacGlashen farm were replaced. The GCSWCD will continue to work to establish effective riparian vegetation, and the project is being monitored for physical stability, as well as function.

Table VI-3: Management Recommendations Reach 1c.

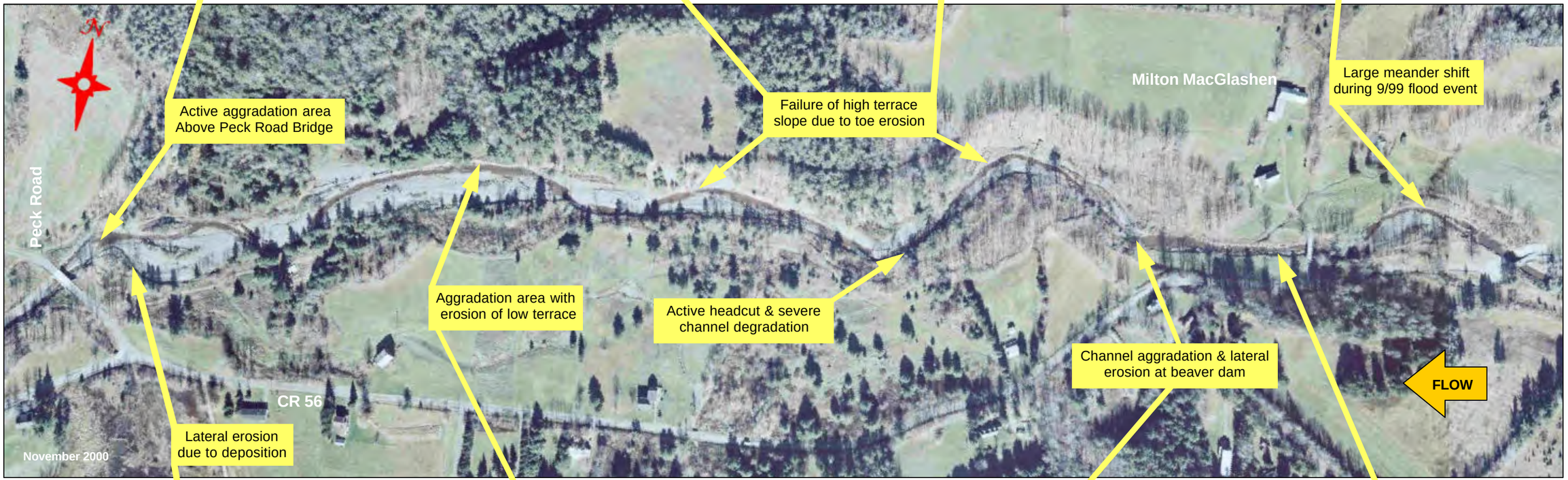
Reach 1c: County Bridge #3-30287-0 to Peck Road.	
Intervention Level	Protection - full segment was restored in 2001-02
Stream Morphology	Stream restored to C4/B4 stream type, extensive floodplain reconstruction was also a primary goal of the design. Project will be monitored to evaluate success in meeting water quality and stability goals.
Riparian Conditions	1. GCSWCD will continue to undertake planting of tree/shrub stock to reach vegetation cover goals. Re-planting and irrigation will be done as appropriate. 2. See General Recommendations.
Water Quality	No recommendations, pre-existing water quality impact addressed in restoration design. No current known impacts on water quality within the segment.
Infrastructure	1. Observe function of new bridges at top and middle of the management segment to insure no impact on restoration work. Adjust restoration project as necessary to address any observed problems. 2. Continue to assess impact of Peck Road bridge and C.D.Lane flood structure on sediment transport through the lower section of the reach. If sediment management is required, work with GC Highway Department to insure work is done to prevent degradation of restoration work. 3. Monitor new bridge at M. MacGlashen farm for impacts on stream form and function. Review impact of floodplain drains under approach fill to reduce potential backwater effect.
Habitat	See General Recommendations. Habitat will greatly benefit from restoration of the reach.
Further Assessment	1. Continue to monitor project to determine if stability goals have been met. 2. Complete additional hydraulic analysis of bridges within the management segment and the C.D.Lane flood control structure. 3. Continue to assist USGS with fisheries assessment on project reach.


A


B

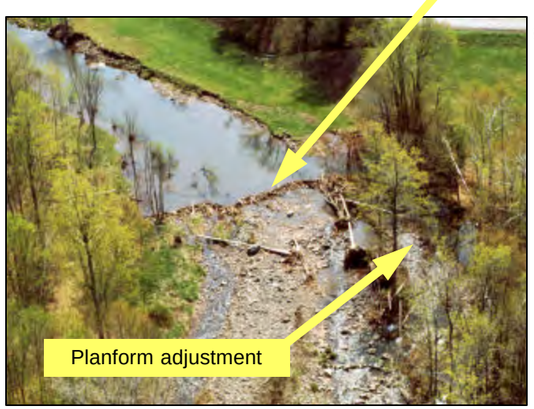

C


D




E


F



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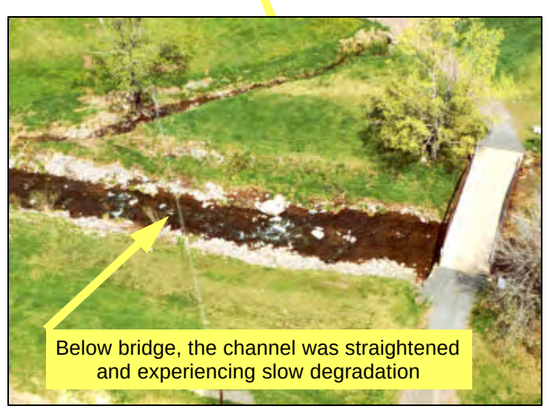

H

Batavia Kill stream Management Plan

Figure VI-10: Reach 1c