Reach 4g (Holden Property to Vogiatz Property)

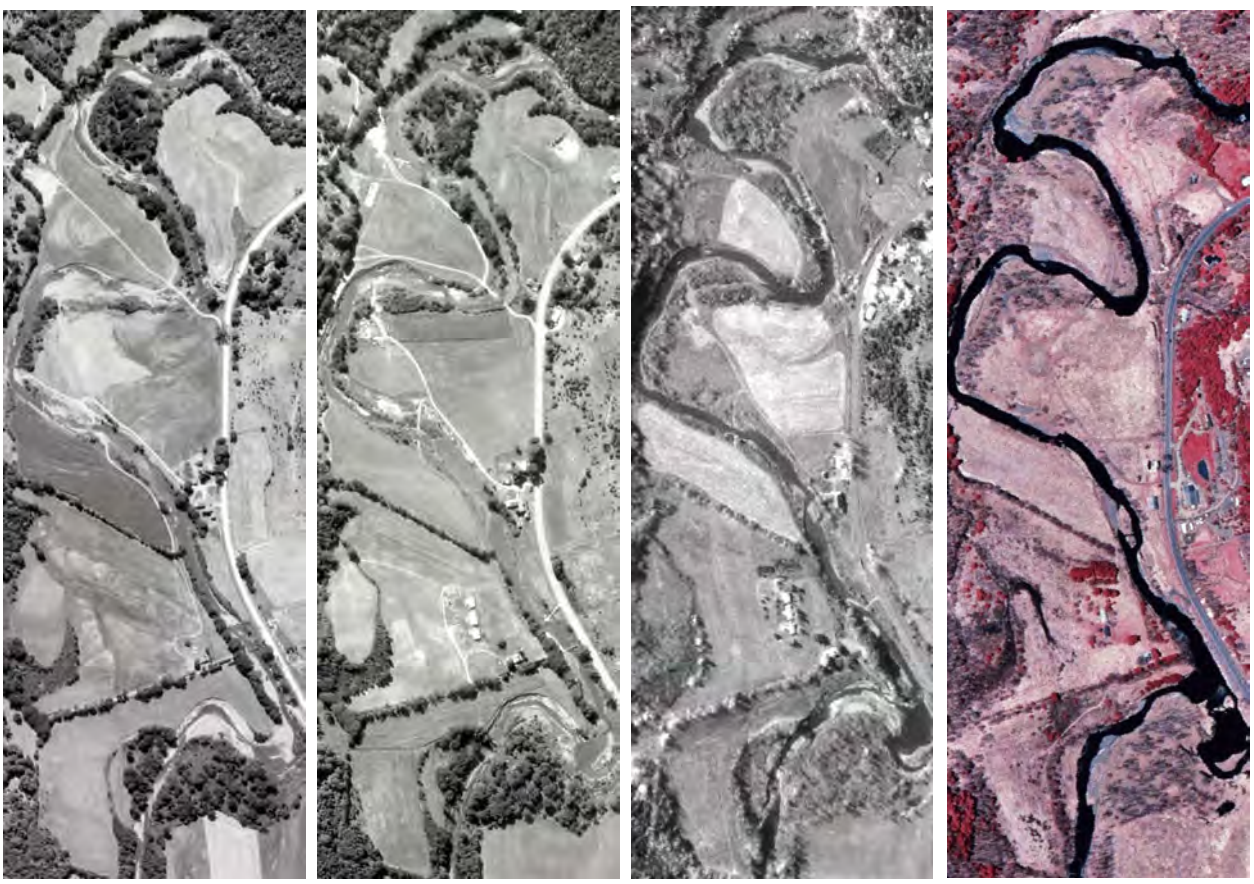
Reach 4g begins at the eastern boundary of the property owned by Suzanne Holden and continues approximately 8,000 feet downstream to a point where a significant change in valley slope occurs. The lower end of the reach is just below the point where a new log cabin with a pond are located on the south side of NYS Route 23 **(Map VI-5, Figure VI-79a, Figure VI-79b).** The reach ranges in drainage area from 61.8mi^2 to 63.7mi^2 , with three small unnamed tributaries contributing to the flow. Infrastructure within the reach is limited to a private cable suspension foot bridge that provides access to the Holden property.

The reach is located in Valley Zone 2 **(Figure V-11)** with an average valley slope of 0.3%. The valley is very broad, with a broad floodplain and an extensive belt width available for stream migration. Land use in the reach is primarily active hay fields, pasture, abandoned farm fields, and upland forest. Much of the reach is characterized by a broad floodplain corridor with many remnant channels and early stages of succession reverting the former farm fields. Development in the reach is limited to a handful of homes, all of which are located some distance from the stream.

Stream Morphology/Stability

The Phase I Inventory and Assessment conducted in 1997 identified reach 4g as one of the most unstable sections in the Batavia Kill watershed. Active erosion was observed along 4,288 feet of streambank, and an average of 7.2 ft^2 of exposed streambank per linear foot of stream length was inventoried. Active erosion was noted on 54% of the reach. The erosion was observed on at least one side of the stream channel through the majority of the reach. During the Phase I stream walkover, the GCSWCD also noted evidence of multiple remnant channels on the floodplain, indicating that stream planform has been dynamic for some period of time.

An assessment of past planform adjustments was conducted using a series of aerial photographs from 1959 to 2000. The aerial photos were matched and corrected to approximately the same scale in order to facilitate a side by side comparison of the Batavia Kill's meander pattern over an extended period **(Figure VI-72)**. A review of historical aerial photographs from the center section of the reach shows on-going channel adjustments in several places along the reach. The aerial photographs also reveal that the channel alignment through this section of the reach is characterized by broad, looping meanders that are truncated in several locations by NYS Route 23 and the base of the mountain. Side by side comparison of a time series of aerial photographs is also an excellent way to evaluate the status of the riparian buffer along the reach over an extended period of time. Unfortunately, the GCSWCD is limited to a 1959 flight series as the earliest record available.



In **Figure VI-73**, the stream water surface from 1959 (blue) has been superimposed on a photo from 2000. The most pronounced channel migration is seen in the upper right hand corner of the photo, where the stream has migrated over 480 feet toward the west since 1959. **Figure VI-74** is a closeup view of this area, showing the current (2000) location of the left (south) streambank superimposed as a yellow line over the 1959 aerial. This area is located just above the swinging footbridge, where NYS Route 23 runs immediately adjacent to the stream. It is interesting to note that in 1959, the stream channel actually meandered backward, up the valley, for a distance of a couple of hundred feet. This is a good indication of how flat the overall valley slope is.

In order to estimate soil loss from this one channel shift between 1959 and 2000, the plan view area of the channel shift was multiplied by an average bank height of 17 feet as determined from the monitored cross sections. During the 41 year period of interest, it is estimated that nearly 35,000yds^3 of material have been eroded from this meander bend. You will also note in **Figure VI-73**, that the lower half of reach 4g has also been experiencing planform changes. In those areas where the channel planform is truncated by the steep mountain slopes, planform has remained relatively stable.

Figure VI-72: Aerial photograph progression of center portion of reach 4g, left to right 1959, 1967, 1980 and 1995. NYS Route 23 can be seen at right of photo, swinging footbridge at lower right corner.

Figure VI-73: Aerial photo overlay of lower end of reach 4g showing 1959 stream channel (blue) superimposed over the 2000 photograph. Note significant meander shift in upper right corner along NYS Route 23.

To facilitate detailed assessment of reach 4g, it was further subdivided into two sub-reaches for data collection and monitoring. The reach was divided into an upper and lower reach near the middle, with 3,000 feet of channel in the upper half, and approximately 5,000 feet of channel in the lower half.

Figure VI-74: Close up of major meander shift in lower reach 4g. View of 1959 aerial photog with 2000 left bank location superimposed as yellow line. .

The upper portion, referred to as the Holden Site, has been monitored by the GCSWCD, with a full Phase III/VI assessment. In 1998, four monumented cross sections were installed through the upper section of this sub-reach, with six additional monumented cross sections added in 1999 **(Map VI-5)**. In conjunction with the monitored cross sections, a survey of 2,900 feet of the longitudinal profile of the streambed was completed. Particle analysis, including Wolman pebble counts and point bar samples, were taken to characterize the sediment regime in the sub-reach. A discussion of findings from representative cross sections follows.

Cross section #2 is located near the top of the Holden site, at a point where the channel is heading away from the base of the mountain and toward NYS Route 23 **(Map VI-5)**. The left stream bank at the cross section is 17 feet high, and has migrated over 5.5 feet during the monitoring period **(Figure VI-75)**. The riparian vegetation in this area consists of

mature spruce, but the rooting depth/density is not adequate to provide stability to the bank. The property owner has attempted to address the erosion problem with rip-rap, but many of the boulders have since been dislodged and are currently located in the main stream channel 200 feet downstream. **(Figure VI-71a photo E,F)**.

The cross section also indicated that extensive deposition had occurred on the opposite side of the channel. The cross section did not reveal any degradation of the channel, and the deposition was consistent with lateral channel migration. The channel does not appear to be over-widening, with the width to depth ratio and channel cross sectional area remaining fairly constant. The limited period of observation, compounded by the occurrence of a major flood during the period, make it difficult to make a definitive judgement on trends related to the channel dimension.

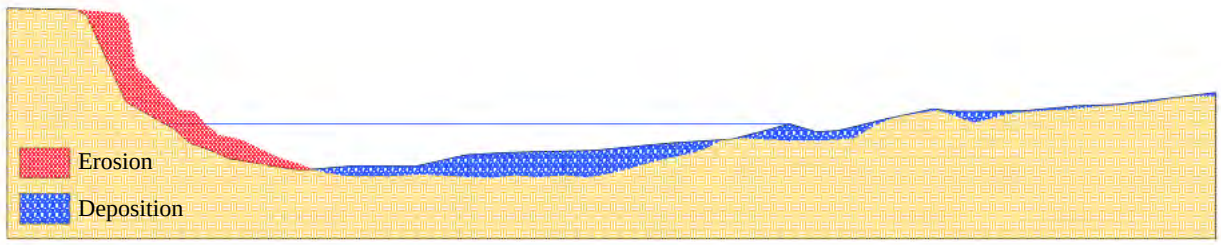


Figure VI-75: Overlay of cross section #2 Holden property, 1998 & 2000.

Cross section #3, located just downstream, has also experienced significant lateral movement, shifting 12 feet during the two years **(Figure VI-79A photo B)**. Continuing downstream, the channel alignment between cross sections #3 & #4 has been a concern due to the erosion risks associated with NYS Route 23. The current planform alignment directs the Batavia Kill's flow directly into the right bank, before it makes a hard 90 degree turn down the valley. The New York State Department of Transportation has used heavy rock rip-rap along a 525 foot section of the right bank where the stream is parallel with the roadway to protect the right-of-way. As seen in **Figure VI-79a**, the presence of the low terrace on the south, and the roadway on the north greatly reduces available belt width through this section of the reach.

The combination of the valley morphology and the hardened streambank along NYS Route 23 are thought to be primary factors influencing stability in this section of the reach. The limited belt width provides limited opportunity for a stable channel alignment, and the rip-rap prohibits channel adjustments that would tend toward the development of a more stable sinuosity. The erosive forces placed on the banks near NYS Route 23 are simply redirected across the channel and downstream. In addition, in the area between cross sections #4 & #5, the landowners maintain an at-grade crossing for access to their homes. The crossing is only usable during summer low flows, but had required routine grading to maintain a passable surface. Repetitive grading of the streambed has a high probability of initiating or maintaining an unstable condition.

The remaining portion of the Holden site, represented by cross sections #5 to #9, has

experienced fairly minimal erosion during the monitoring period. **Figure VI-76**, illustrates the surficial erosion measured at cross section #5, which is fairly represenitive of this section of the reach. In the area covered by these cross sections, the measured erosion was considered insignificant, especially when considering that the September 1999 flood event occurred during the period between the two surveys. The stream banks through the entire Holden site are composed of non-cohesive materials adding to the susceptibility to hydraulic erosion. Evaluation of the longitudinal profile at the lower end of the Holden site has shown that the channel has lost its natural riffle-pool complex through cross sections #7, #8 and #9, with the stream profile changing to a near uniform channel bottom.

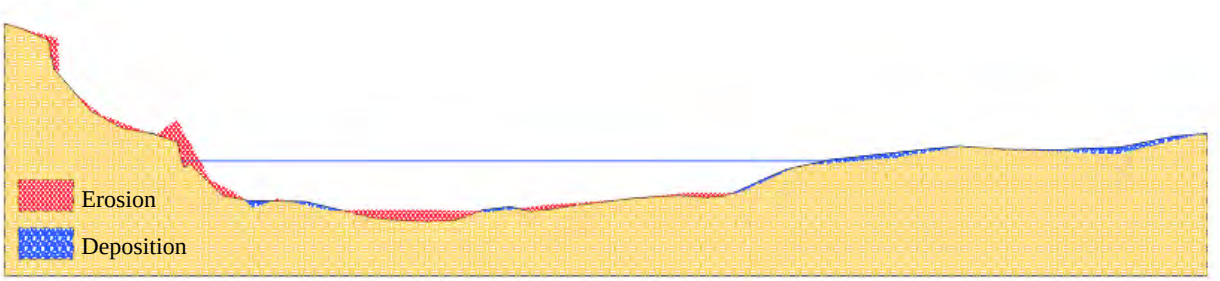


Figure VI-76: Erosion and deposition changes at cross section #5 between 1998 and 2000.

While the cross sections located at the Holden site have varied in their respective rates of erosion, monitoring of the changes in channel dimension has not shown any evidence of channel aggradation or degradation since monitoring began in 1998. Stability through the Holden site is poor, and an analysis of streambank conditions in 1999 indicated that these problems are likely to continue. Using the Bank Erodability Hazard Index (BEHI) rating methodology, the GCSWCD found that the erosion potential in this section of reach 4g ranged from high to very high for five out of nine cross sections which were monitored **(Figure VI-77)**.

The lower sub-reach of reach 4g is approximately 5,000 feet long. This section of the reach is also considered highly unstable **(Figure VI-79b)**, containing nearly 2,600 feet of stream bank erosion. The sub-reach includes one monumented cross section and a survey of a portion of the stream profile. Stream type classification at the cross section indicates a C4 channel (Rosgen 1996), which is characteristic of essentially the entire length of reach 4g.

The cross section is located on a riffle, and potentially does not represent the lateral erosional process observed in

Cross Section	BEHI Score	Erosion Potential
#1	33.6	High
#2	40.8	Very High
#3	27.3	Moderate
#4	25.8	Moderate
#5	34.2	High
#6	31.2	High
#7	27.4	Moderate
#8	31.9	High

Figure VI-77: BEHI values and erosion potential class for monitoring cross sections at the Holden site.

the lower portion of reach 4g. As seen in **Figure VI-78**, monitoring has shown only minimal erosion on the left and right banks, with no evidence of channel degradation or lateral migration through the monitoring period.

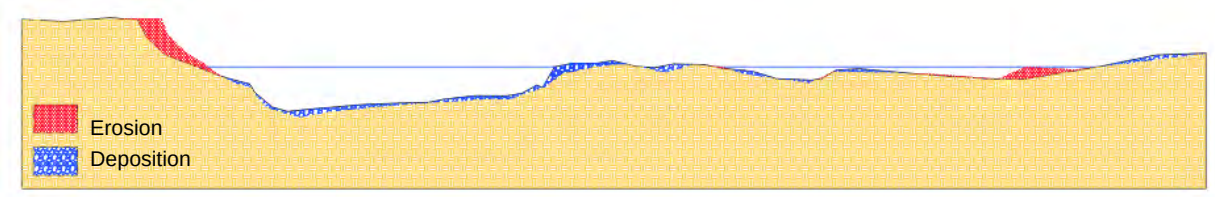


Figure VI-78: Cross section located near the bottom of Reach 4g, 1998 & 2000.

Analysis of aerial photos of the lower sub-reach **(Figure VI-72, Figure VI-74)** shows past channel shifts in some areas to have exceeded 200 feet since 1959. A soil loss estimate was generated by determining the area of channel migration from the aerial photographs and multiplied by the bank height of 13 feet measured at the cross section. The results yielded an estimate that approximately 118,000 cubic yards of material had been eroded from this section of the reach. At the time of the Phase I Inventory, as well as during the monitoring period, the GCSWCD noted numerous locations through the reach experiencing active erosion **(Figure VI-79b photo B,C,G,I)**. The channel morphology, soils, riparian vegetation, and other stream corridor features are essentially identical throughout reach 4g, and the observed scope and rate of instability will most likely not be mitigated without intervention.

The lower end of reach 4g is also of special interest due to the transition in valley morphology that occurs in this area. The flat, gentle valley slope (0.3%) of Management Segments 3 & 4 transitions to a fairly steep valley slope of 1.2%, with a significant increase in entrenchment due to natural valley features. Under these conditions, it is possible for headward migration of channel entrenchment to occur, further destabilizing the reach. Any activities in the transition zone that would promote channel degradation and the formation of a headcut could have a significant impact on reach 4g. While 4g does not appear to be exhibiting signs of degradation at the present time, a headcut migrating from the downstream reach would significantly impact entrenchment, erosion rates, and planform in the reach.

Riparian Vegetation

The riparian condition in reach 4g can be characterized as being fairly good for water quality benefits, but extremely poor for stability and fisheries habitat. With the exception of those areas of active erosion/deposition in the immediate stream channel, and two locations where NYS Route 23 runs very close to the stream, the vast majority of the reach appears to have adequate vegetation to address any upland impacts. A large section in the center and lower reach is characterized by extensive wetlands that have developed in old remnant stream channels. While there are still some agricultural uses at the top of the reach, the activities on these properties is limited to hay production and low intensity

pasture, with the existing buffer most likely adequate from a water quality perspective.

In regard to riparian vegetation benefits to stream channel stability and fisheries habitat, the existing conditions are poor at best. While some mature woody vegetation (trees) is present, as noted at cross section #2 above, the vegetation does not provide enough strength to counter the channel stability problems. In several places, mature woody vegetation is quickly being lost to bank erosion. Reach 4g has some of the densest stands of Japanese knotweed in the watershed, which is felt to be a major factor in reach instability. In large areas, the knotweed has completely overtaken the natural vegetation through the reach.

Water Quality

During the assessment of reach 4g, the GCSWCD noted no significant water quality problems. As noted earlier, the limited agriculture in the reach would be considered to have a very low impact, but may receive some benefit for improved buffers. The most likely impact to water quality would be from road runoff from NYS Route 23. In two places the roadway is close to the creek, with minimal if any buffer. Several stormwater outfalls are located in the reach, and they may benefit from retrofits that could reduce sediment and other pollutant loading from the roadway. All structures are located an adequate distance from the stream, and subsequently on-site waste water treatment systems do not appear to be an issue.

Infrastructure

Infrastructure located within reach 4g is primarily limited to a short stretch of NYS Route 23, and a private foot bridge. As noted previously, the stream clearly has an impact on a section of the roadway in the upper sub-reach. Currently, the channel alignment results in stream velocities being directed against the road right-of-way, with the area having been damaged after each of the recent flood events. NYSDOT has responded by replacing the heavy rock rip-rap, which in itself creates additional stability problems. The private foot bridge at the Holden residence has also experienced problems related to the stream. In a past flood, one of the abutments for the bridge was heavily damaged, and in 1999 large woody debris most likely lost from just upstream in the reach, snagged on the bridge and snapped one of the cables. Based on the GCSWCD's observations in the reach, mitigation of the impacts to infrastructure cannot be achieved without substantial intervention, and major reconstruction of the reach.

Habitat

As noted earlier, the Batavia Kill Stream Management Pilot Project did not include a detailed assessment of fisheries conditions. In general, the GCSWCD would suggest that habitat conditions are poor for a number of reasons. First, as noted in the discussion of stability on the Holden site, rapid rates of erosion and deposition do not present a condition conducive to good habitat. Frequent and rapid changes in planform disrupt the channel bottom, and as noted the reach has been losing its riffle pool structure. Additionally, the vegetative community in the immediate stream corridor does not contain the large, mature wooded buffers critical to providing shade cover and mitigate overheating of base flow.

The long section of rock rip-rap on the right bank as discussed previously, would appear to act as a heat sink, transferring heat from sunlight to the stream. The rip-rap has a southern exposure, with no shading vegetation, subsequently it has the potential to absorb substantial heat. Water temperatures in the reach are also not helped by the presence of a fairly large, shallow pool area adjacent to the active channel. Large water surfaces absorb more heat, which is often transferred to the main channel.

Flooding Issues

Flooding issues in reach 4g are limited to erosional damage. No structural flooding or major floodplain fills were noted in the reach.

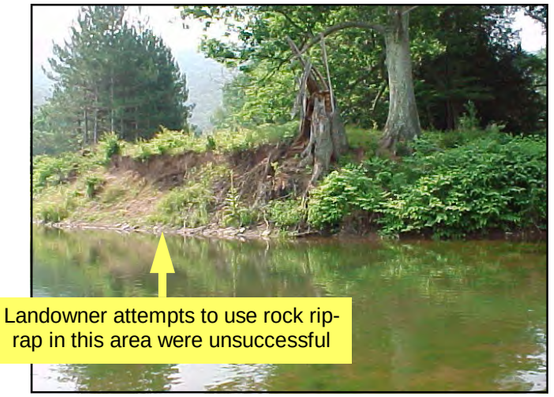
Reach 4g Summary

Based on the GCSWCD's assessment of the monitoring cross sections and the historical aerial photos, it is evident that reach 4g should be characterized as being highly unstable, a condition that has been ongoing for many years. Throughout most of the reach, active streambank erosion has been noted, with lateral meander adjustments appearing to be the primary instability problem. Instability is likely a combination of several factors including past management practices, poor riparian conditions, valley morphology, and road impacts. The reach appears to be struggling to regain stability, with recent flood events acting to keep the reach in an unstable state. The presence of large colonies of Japanese knotweed is suspected of being a limitation on natural recovery of the reach.

Table VI-17: Management Recommendations Reach 4g.

Reach 4g: Holden Property to Vogiatz Property	
Intervention Level	Full Restoration (most of the reach)
Stream Morphology	An unstable planform has been documented in both the upper and lower sections of the reach. Stability is unlikely without major intervention, and the reconstruction of an appropriate stream type (C4). Restoration activities should restore both a stable stream form and natural function.
Riparian Buffers	1. On most of the reach, establishment of riparian buffers will require restoration of a stable form. New buffer plantings will not be expected to restore stability on their own. 2. Segments at the top of the reach would benefit from riparian plantings. Work with landowners on the right bank (north) to establish buffer plantings. 3. Reach 4g will require extensive knotweed control if any future restoration work is to be successful.
Water Quality	See General Recommendations
Infrastructure	1. Work with NYSDOT to insure future maintenance activities along NYS Route 23 do not impact stream stability. 2. Work with owner on developing access across the stream. In the absence of developing a bridge, educate landowner on correct grading methods to minimize future impacts.
Habitat	See General Recommendations
Flooding	1. Avoid new development within the floodplain limits. Prohibit fill and additional construction in flood vulnerable areas.
Future Assessments	1. Continue Phase IV monitoring of Holden site.

A

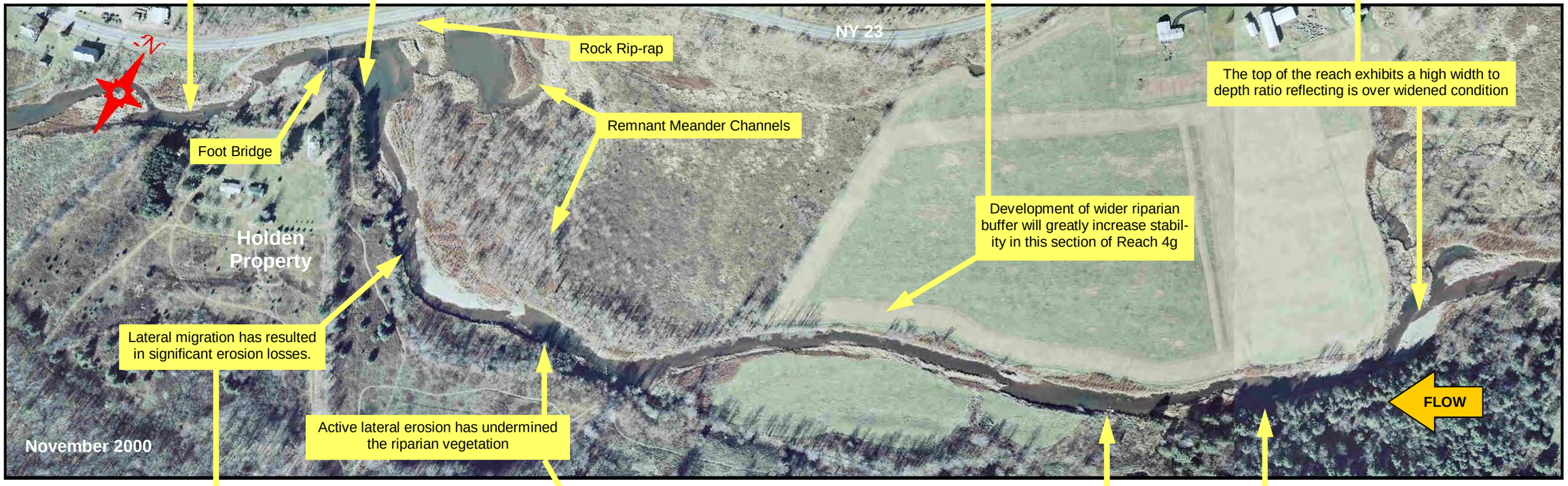


B

C

D

Batavia Kill Stream Management Plan



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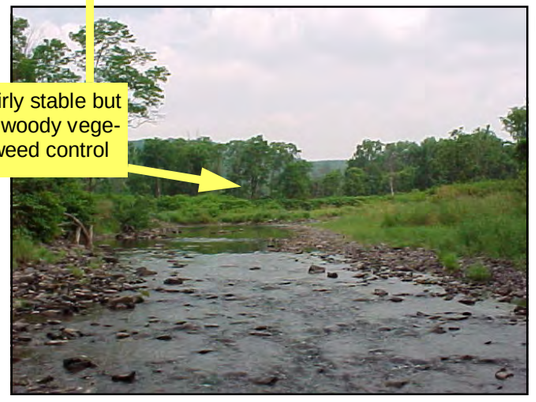
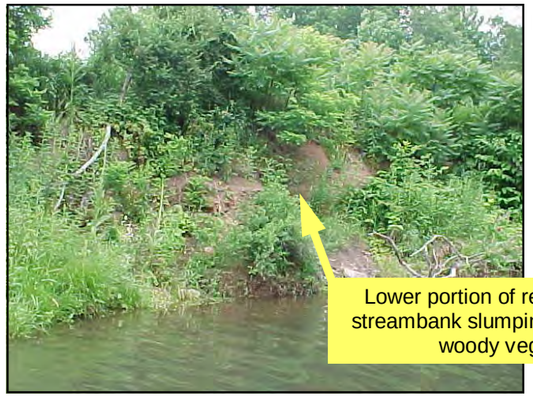


H

Figure VI-71a: Reach 4g Upper


A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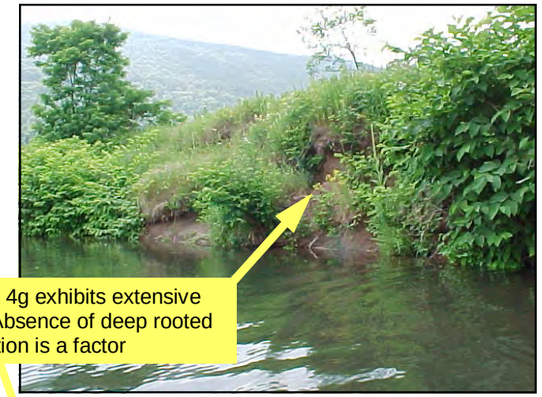
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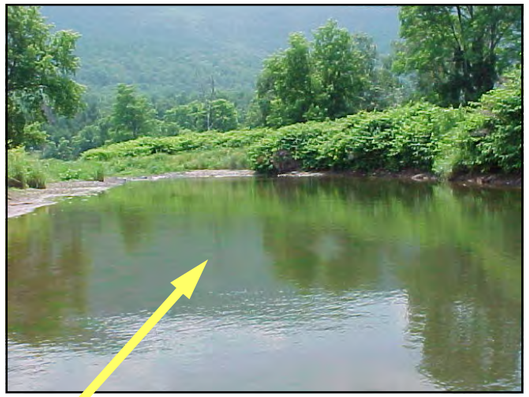
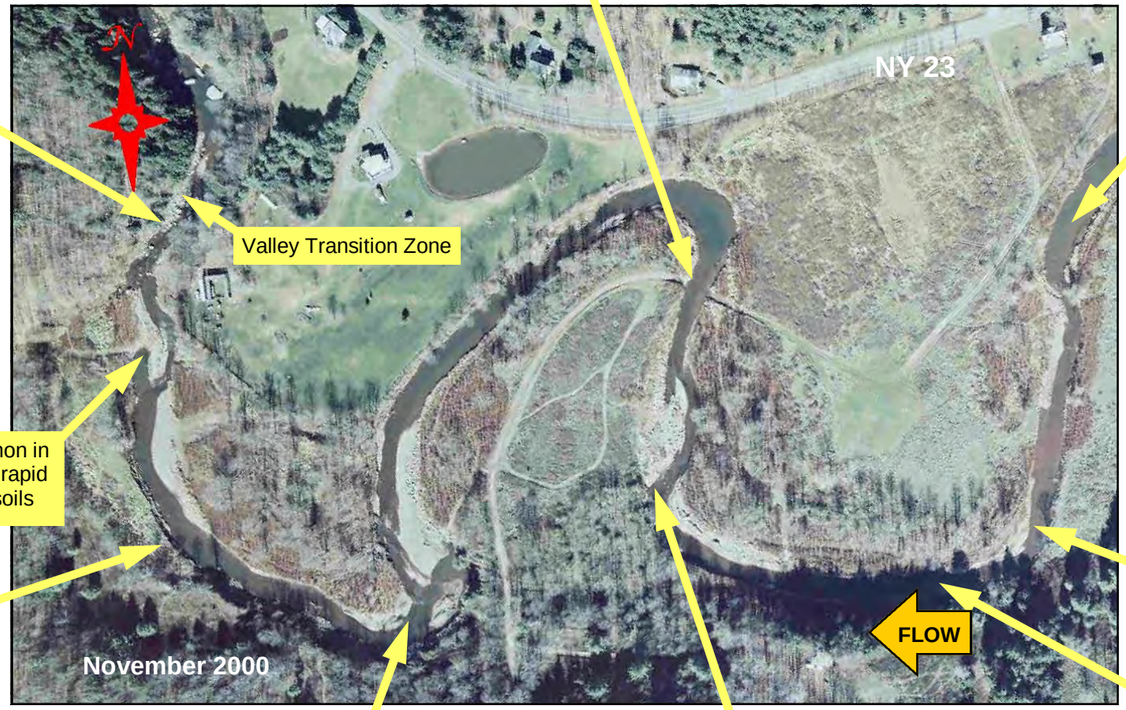

D

Lower portion of reach 4g exhibits extensive streambank slumping. Absence of deep rooted woody vegetation is a factor

Reach becomes more stable as it Transitions to Reach 5a


E

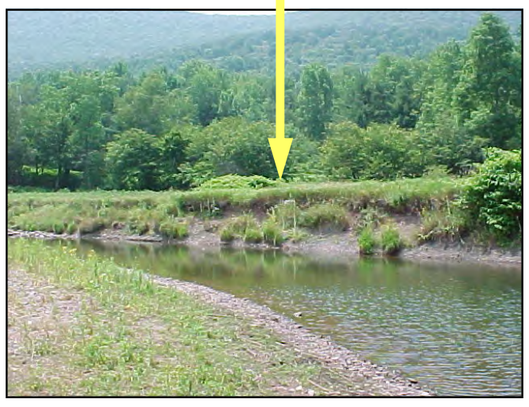
Japanese knotweed is common in aggradation areas due to its rapid growth rate and disturbed soils




F

Japanese knotweed is common in aggradation areas due to its rapid growth rate and disturbed soils

Poor riparian vegetation is not adequate to resist active meander migration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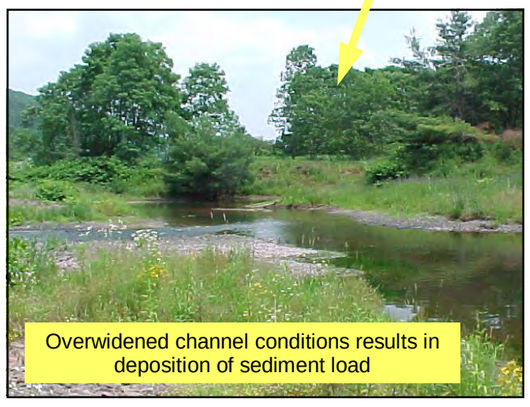
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Overwidened channel conditions results in deposition of sediment load


I


J

Batavia Kill Stream Management Plan

Figure VI-71b: Reach 4g Lower