

A total of 48 monumented cross sections were established and measured at various intervals between 1997 and 2000. In general, many of the stability problems in the segment appear to be related to anthropogenic (human) activities and influences, the lack of an effective riparian buffer over much of the segment, and compounded by severe flood events. Management segment 4 also includes two of the three demonstration projects constructed to date. The Brandywine Project is located in reach 4b, while the Maier Farm project is located in reach 4d.

## **Reach 4a** (CR 12 South Street to CR 19 Tuttle Farm)

Reach 4a begins at the South Street bridge and ends midway through the Valley View Farm (Tuttle) property. The length of reach 4a is approximately 4,800 feet and it ranges in drainage area from 40mi<sup>2</sup> to 43.1mi<sup>2</sup>, with the confluence of one small unnamed tributary at the bottom of the reach. The reach is located at the lower extent of Valley Zone 3 (**Figure V-11**), with an average valley slope of 0.7%, gradually flattening to an average slope of 0.3%. The valley floor is wide and flat through reach 4a, and there are essentially no infrastructure impacts in the reach.

### **Stream Morphology/Stability**

Compared to other reaches within management segment 4, reach 4a is fairly stable with some instability noted in the lower end of the reach. After the Phase I Inventory and Assessment in 1997, the GCSWCD did not undertake Phase III/IV assessments in reach 4a. Two cross sections were installed at the top of the reach for classification purposes, and some survey work was done at the bottom of the reach in preparing for a restoration project at Valley View Farm. Due to the relatively stable conditions, the GCSWCD concentrated its stability monitoring efforts in other sections of management segment 4. Assessment of reach 4a was limited to review of aerial photos combined with on-going observations and knowledge about past management activities. While the channel planform has clearly been modified over the years, the low entrenchment ratio and the presence of a broad floodplain have helped the reach remain in relatively good physical health. Streambank erosion was most pronounced at the bottom of the reach, with over 750 feet of stream channel experiencing lateral erosion. Reach 4a was characterized by an average of 1.4 ft<sup>2</sup> of exposed streambank per linear foot of stream length, with 17% of the streambanks experiencing some form of erosion.

The most pronounced feature of reach 4a involves the long straightened sections of the channel in the upper and center portions of the reach (**Figure VI-38**). Stream channel alignment is very straight, with an overall sinuosity of <1.2. A sinuosity value this low is not typical for C3/C4 stream types, especially when the valley morphology is characterized by a broad floodplain condition and the stream has adequate belt-width for stable meander geometry. Such low sinuosity is typical of stream reaches that have experienced extensive planform modification by direct channelization or hardening of streambanks.

Streambank hardening with rip rap or other methods reduces or eliminates natural channel adjustments and restricts the channel to an unnaturally low sinuosity. A review of aerial photographs from 1959 to 2000 (**Figure VI-38**) reveals that channel planform has remained essentially unchanged for over 40 years . While some minor adjustments have been noted on the Tuttle Farm, for the most part the channel has not moved during this period.



**Figure VI-38:** Aerial photograph progression of reach 4a, left to right 1959, 1967, 1980, 2000.

The floodplain in reach 4a is quite extensive and relatively flat and open. At the top of the reach, the channel morphology is characterized by a broad floodplain on the north side of the stream, with a narrower floodplain on the south. As the reach straightens, it runs along the steep slopes at the base of Cave Mountain, with no floodplain located on the south, but a broad floodplain on the north. As the channel reaches the bottom of the reach, the floodplain is once again located on both sides of the stream. The belt width in reach 4a ranges from 650 feet in width to nearly 1,000 feet, but has been restricted by channelization and streambank stabilization practices.

Several sections of streambank in reach 4a have been hardened for stabilization by rock rip-rap (**Figure VI-43 photo B**). In the past, flood-related streambank damage has occurred behind Christman's Golf Course, as well as at Valley View Farm on numerous occasions. In the 1959 aerial photo (**Figure VI-38, left photo**) an irregular shaped (lighter) area on the

right streambank appears to indicate a fairly recent streambank avulsion that has been returned to its prior condition. It is likely that this occurred in the August 1955 flood event which caused extensive damage in the Batavia Kill valley.

A Phase II assessment (stream classification) was conducted at the top of the reach in June 1998, and included two monumented cross sections as well as a survey of approximately 500 feet of longitudinal profile. The stream channel at the upper reach was classified as a B4c stream type (Rosgen 1996) and visually appeared to be stable. The cross section was typical of B channels, with a fairly low width to depth ratio. Conversely, cross sections surveyed at the Valley View Farm indicated a C stream type. The GCSWCD began to consider developing a restoration design for a section of the Valley View Farm including a badly eroding streambank. Prior to this effort, the GCSWCD installed four cross sections at the eroding bank, and approximately 700 feet of longitudinal profile were surveyed.

As the stream channel enters the meander bend just above the eroded bank on the Valley View Farm, the channel width to depth ratio is 18.2 (**Figure VI-39**), and basically appropriate for the valley setting and stream type. As the stream channel continues downstream and reaches a second eroded bank, the width to depth ratio jumps to 63.2 (**Figure VI-40**). This width to depth ratio is high, and is primarily the result of active mining of stream sediments from a point bar in this area. Mining of the streambed for gravel results in an over widened channel and the loss of sediment transport capacity (**Figure VI-43 photo A,B**). The stream's cross-sectional area above and below the proposed project location average 250 ft<sup>2</sup>, while the landowner maintains channel at the project reach location such that the cross sectional area is approximately 530 ft<sup>2</sup>. This change in width to depth ratio is primarily associated with recurring mining of stream gravel from the Batavia Kill in this area. The stream is unable to reestablish the channel dimensions that would enable it to transport its sediment load effectively and preclude any need for channel maintenance. (**Figure VI-41**).



**Figure VI-39:** Cross Section #3 at upper end of Valley View Farm indicating low width to depth ratio.



**Figure VI-40:** Cross section #4 at eroded bank on Valley View Farm, note the very high width to depth ratio.

A 1966 newspaper account shows repairs being made to a large channel avulsion that occurred in 1965 on the Valley View Farm. As recently as 1998, the same streambank at the bottom of the reach was still actively migrating (**Figure VI-41, Figure VI-43 photo B**). A restoration project was designed for the Valley View Farm by the GCSWCD following the January 1996 flood event. The project initially focused on re-shaping the streambank in its existing location, and installing 400 feet of rip rap along the left streambank. The rip rap was to be installed to the top of the bank.



**Figure VI-41:** View of eroding bank on Valley View Farms where channel is over widened.

After further evaluation, including a Phase III assessment, the project design was modified to include two rock vanes and one cross vane. The structures were incorporated in order to reduce the amount of rock material necessary to stabilize the bank. The height of the rip-rap was reduced to the bankfull stage with bioengineering designed to protect the upper bank zone. The project was modified a second time in July of 1997 to account for suggestions by the permitting agencies to use geomorphic stabilization techniques. Included within the final design were six rock vanes and one cross vane as substitutes for the rip-rap stabilization, and the construction of a low-maintenance farm crossing for access to the adjacent fields. While the project reached the final design and permitting stage, construction was cancelled in 1998. Since that time, the landowner has placed rock rip-rap along the streambank.

## Riparian Vegetation

The riparian buffer through the reach has remained very narrow and has been impacted by agricultural practices for many years; a condition that has been relatively constant between 1959 and 2000 (**Figure VI-37**). Currently the riparian area is dominated by moderately dense grasses along the golf course and farm fields, which provide minimal protection against streambank erosion. In some sections, primarily the south side of the stream where the high terrace is located, mixed hardwood/coniferous forest are critical to the stability of the steep slope. A large portion of the north streambank is characterized by little to no woody vegetation, which is critical for both long term bank stability and stream shading. The fields on the left bank as the stream passes through Valley View Farm also contain no woody vegetation as a stream protecting buffer.



**Figure VI-42:** June 1966 photograph of willows in Reach 4a. Valley View Farm barns are seen in the background.

Reach 4a exhibits signs of increasing colonization by Japanese knotweed. As discussed in other sections of this SMP, knotweed is an aggressive invasive species, which quickly out-competes the more beneficial native plant communities (**Figure VI-43 photo D,E,F,H**). Historically, many sections of the reach were dominated by thick stands of willow that provided much more effective bank stabilization. Evident in a June 1966 photograph (**Figure VI-42**), is an extensive willow dominated plant community along both streambanks as the stream approaches the area of Valley View Farm. While the buffer in 1966 did not indicate the presence of taller woody

vegetation (trees), which is better for shading, the willows were superior to plant communities found at the reach today. While some willow does currently exist in the reach, dense stands are infrequent.

## Water Quality

Based on the GCSWCD's assessment of the reach, water quality issues would include operation and maintenance procedures at the golf course, agricultural operations at the Valley View Farm, and stormwater runoff from NYS Route 23. The farm has been a participant in the Watershed Agricultural Program since the early 1990's, and is in the process of implementing a wide selection of Best Management Practices (BMPs) designed to protect water quality. When fully implemented, the Valley View Whole Farm Plan (WFP) will address manure handling (including storage and spreading), as well as crop rotations, milk house waste water, and barnyard runoff. The Valley View Farm will have state of the art BMPs implemented, and is expected to have a minimal impact on water quality.

In regard to on-site waste water treatment, the GCSWCD is not aware of any problems in reach 4a. All existing structures are placed an adequate distance from the creek, and the gravel soils generally provide satisfactory conditions for percolation. Approximately half of the reach will be included in the upcoming Windham sewer project, with the treatment plant located on the north floodplain at the top of the reach. While the GCSWCD did not observe any significant stormwater impacts within the reach, NYSDOT has undertaken past work to address a water quality problem related to stormwater runoff. At the Valley View Farm, the NYSDOT worked with the Whole Farm Plan planning team to implement significant upgrades to a stormwater outfall that previously emptied onto the farm property, and flowed via surface channel to the creek. The drainageway was experiencing erosion, and larger flows resulted in out-of-channel flows that washed across the pasture as heavy sheet flow. The DOT installed a closed pipe system that carries all flows from NYS Route 23 to a small pond on the floodplain. The pond acts as a sediment settling basin for the stormwater

outfall.

While the GCSWCD has not observed any water quality impacts related to the golf course located on reach 4a, there may be opportunities to work with the owners on the development of management practices that will protect water quality. This could include investigation of fertilizer/pesticide strategies, stormwater retrofits, and various other practices. The GCSWCD also proposes that the golf course property would benefit by establishment of an enhanced riparian buffer along the stream channel. The buffer would increase streambank stability, help buffer upland runoff, and could, if well designed, even offer an enhanced recreational experience for visitors to the resort.

## **Infrastructure**

There is no infrastructure in reach 4a. Other than the bridge at the top of the reach, the stream is not near any roadways or other improvements. In 2003, the Town of Windham will be initiating construction of its waste water treatment plant, which will be located within the limits of reach 4a. The treatment plant is scheduled to be constructed on the north floodplain just below the South Street bridge. The plant will be constructed to meet current standards and will not have an impact on the stream corridor in this reach. The GCSWCD will work with the Town of Windham to protect and enhance buffers in this area upon completion of the project.

## **Habitat**

As noted earlier in this report, the GCSWCD did not conduct a detailed habitat assessment of the Batavia Kill. Observations in reach 4a show habitat to be poor to fair, with the absence of adequate pool structure and lack of stream shading the primary limiting factors. Additional assessments should be conducted if habitat restoration is found to be a priority. Opportunities for habitat improvements may prove to be a benefit for Christman's Windham House, which could promote fishing access to their guests.

## **Flooding Issues**

Based on the GCSWCD's knowledge of the project reach, and reports of damage after recent floods, reach 4a does not appear to have any significant issues related to flooding. While flood flows appear to play a role in streambank stability, there are no homes or infrastructure in the project reach that are impacted by flooding. Large floodplain areas may experience development pressure and the Town of Windham should avoid issuing permits for new construction or fill in the floodplain.

## **Reach 4a Summary**

In general, reach 4a currently exhibits signs of relative stability. As the channel has been extensively modified over the years, it can be expected that future disturbances will most likely be attributed to adjustments in planform. Whether through a slow process, or a large flood related event, it is reasonable to expect the stream to continue to respond by attempting to increase its sinuosity. Areas especially prone to these actions are the straightened reach running along the mountain, as well as the meander bend through the Valley View Farm.

Caution must be taken during future stream management activities to avoid any changes in the stream corridor that may promote degradation. Activities such as regrading the stream profile (gravel removal) or placing floodplain fills are examples of changes that could increase local entrenchment and impact long range stability. In general, many sections of reach 4a would benefit from enhancements to the riparian buffer. The GCSWCD will further evaluate the reach for participation in a pilot riparian buffer program.

**Table VI-11: Management Recommendations Reach 4a.**

<b>Reach 4a: South Street to Valley View Farm.</b>	
<b>Intervention Level</b>	Protection (upper) Assisted Self Recovery (lower)
<b>Stream Morphology</b>	<p>1. Majority of stream reach is fairly stable; assisted recovery required on lower end to restore channel morphology. Landowner management practices (gravel management) are not consistent with maintaining a naturally functioning channel. Little opportunity exists for modifying planform or other channel features on most of the reach.</p> <p>2. Future management activities should be undertaken so as to avoid channel entrenchment by floodplain fills, as well as to avoid setting a condition that will result in channel degradation.</p>
<b>Riparian Buffers</b>	<p>1. Evaluate feasibility of developing non-agricultural buffers on those properties where riparian condition is poor.</p> <p>2. Request Watershed Agricultural Program to seek CREP buffers at Valley View Farm.</p> <p>3. Monitor invasive species, consider vegetation control plan.</p>
<b>Water Quality</b>	<p>1. The GCSWCD will continue to work with Valley View Farm to assist in implementation of the farm's Whole Farm Plan.</p> <p>2. The GCSWCD will investigate Best Management Practices for operation of golf courses in a "stream friendly" manner.</p> <p>3. Evaluate potential stormwater retrofit projects in conjunction with NYS DOT roadway drainage.</p> <p>4. Prevent streambed degradation into potential clay underlying the existing streambed elevation.</p>
<b>Infrastructure</b>	See General Recommendations
<b>Habitat</b>	See General Recommendations
<b>Flooding</b>	See General Recommendations
<b>Future Assessments</b>	<p>1. Continue to monitor for reach stability.</p> <p>2. Investigate potential recreational uses of stream corridor. Hiking/biking path may be feasible, and may fit with current resort land use.</p>



