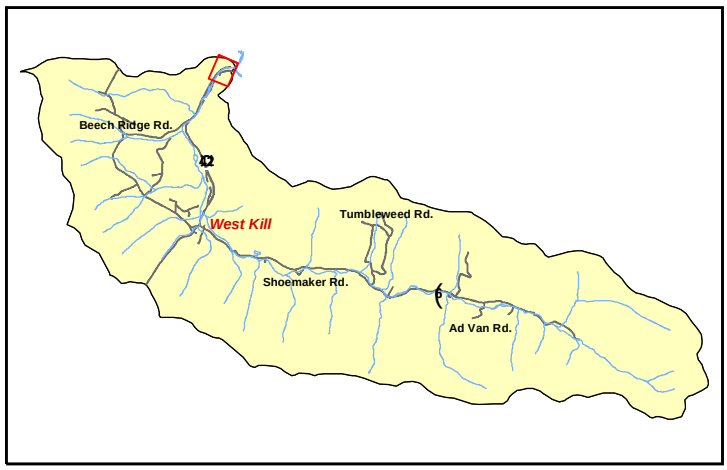



# West Kill Management Unit 21

*Stream Feature Statistics*

7% of stream length is experiencing erosion
12% of stream length has been stabilized
14.2 acres of inadequate vegetation within the 300 ft. buffer
139 ft. of stream is within 50 ft. of the road
10 houses located within the 100-year floodplain boundary

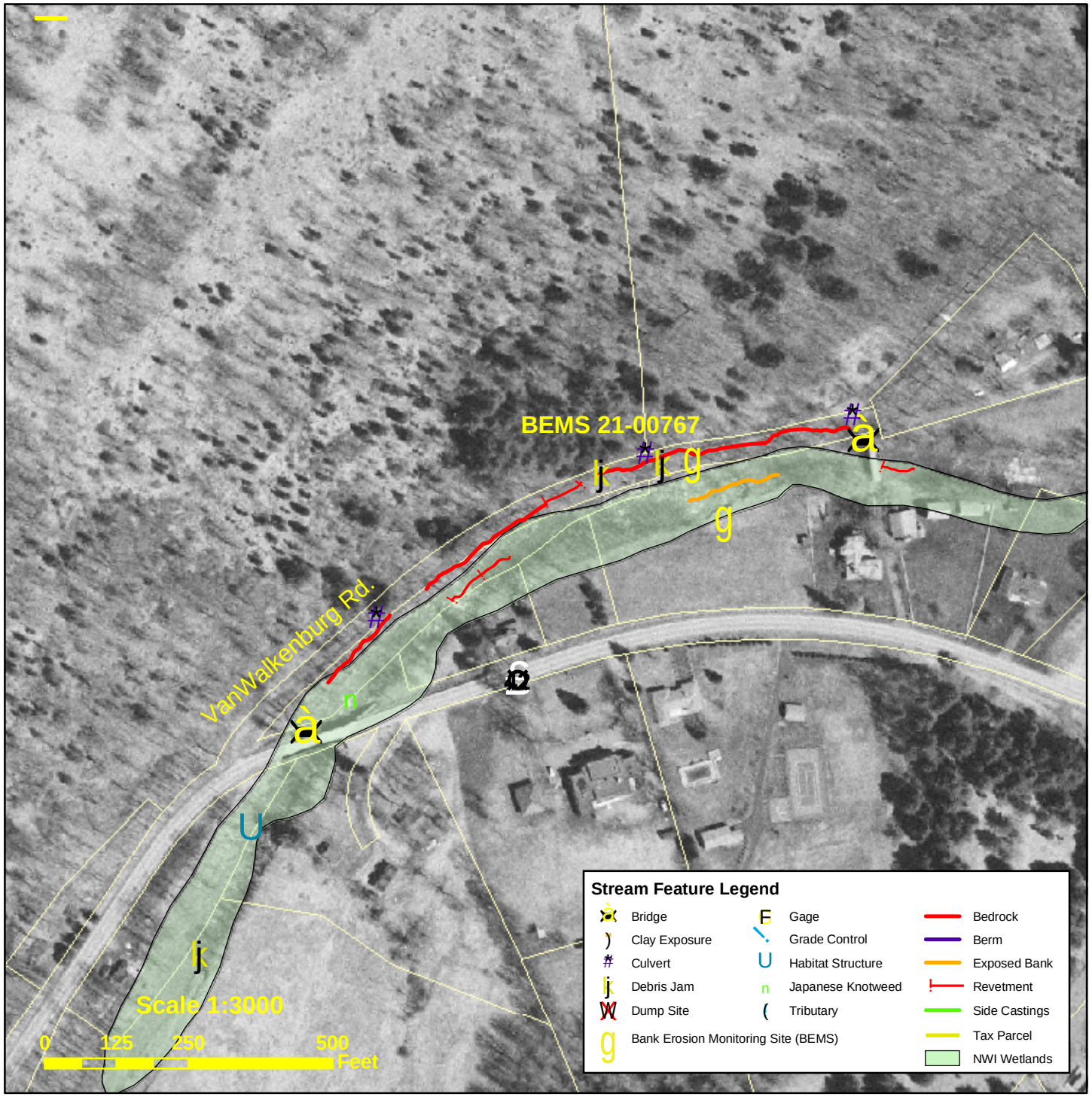



Figure 4.21.1 2004 aerial photography with stream feature inventory and tax parcels

# Management Unit 21

Between Station 2317 and Station 0

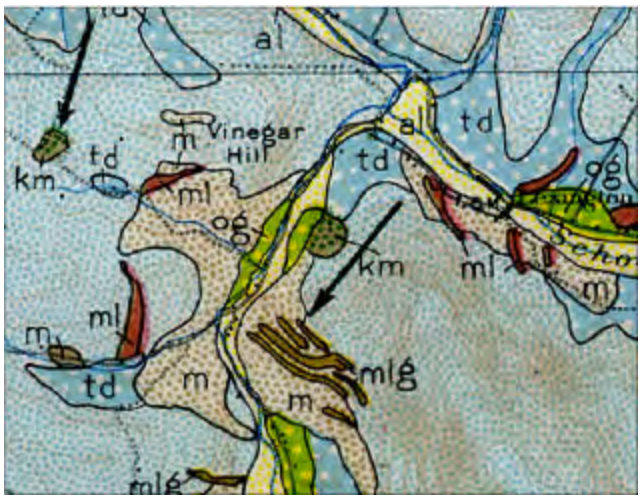
**Management Unit Description**

This management unit begins at the end of the braided reach upstream of the NYS Route 42 bridge crossing, continuing approximately 2317 ft. to the confluence at Schoharie Creek. The drainage area ranges from 31.1 $mi^2$ at the top of the management unit to 31.2 $mi^2$ at the bottom of the unit. The valley slope is 0.83%.

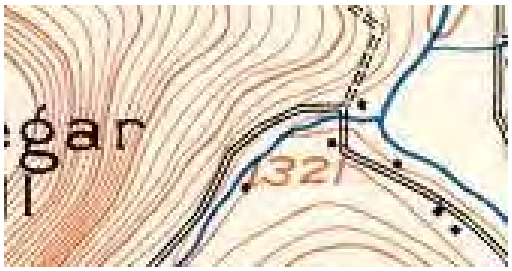
| Summary of Recommendations<br>Management Unit 21 | |
|---|---|
| Intervention Level | Assisted Self-Recovery / Passive restoration. |
| Stream Morphology | None |
| Riparian Vegetation | Improve riparian buffer at several erosion sites. Including BEMS 21-00767. |
| Infrastructure | Stabilize toe of rip-rap installation with stacked rock. |
| Aquatic Habitat | Watershed-wide study. |
| Flood Related Threats | None |
| Water Quality | None |
| Further Assessment | Ongoing monitoring at BEMS 21-00767. |

## Historic Conditions

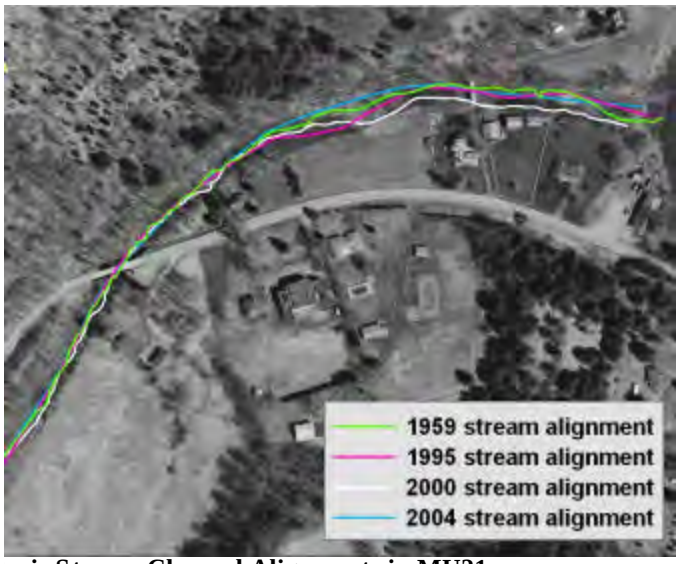
As the glaciers retreated about 12,000 years ago, they left their "tracks" in the Catskills. See Section 2.4 Geology of the West Kill Creek, for a description of these deposits.




**Excerpt from Rich, 1935**



**Excerpt of 1903 USGS topographic map MU21**




**oric Stream Channel Alignments in MU21**

As seen from the historical stream alignments, the channel alignment has not changed significantly over the years.

According to NYSDEC records, there were two stream disturbance permits issued following the 1996 floods. The first was to Varia Jarymoczy, to install 100 ft. of rip-rap on the streambank. The second was to the Town of Lexington; records did not include details of the work.

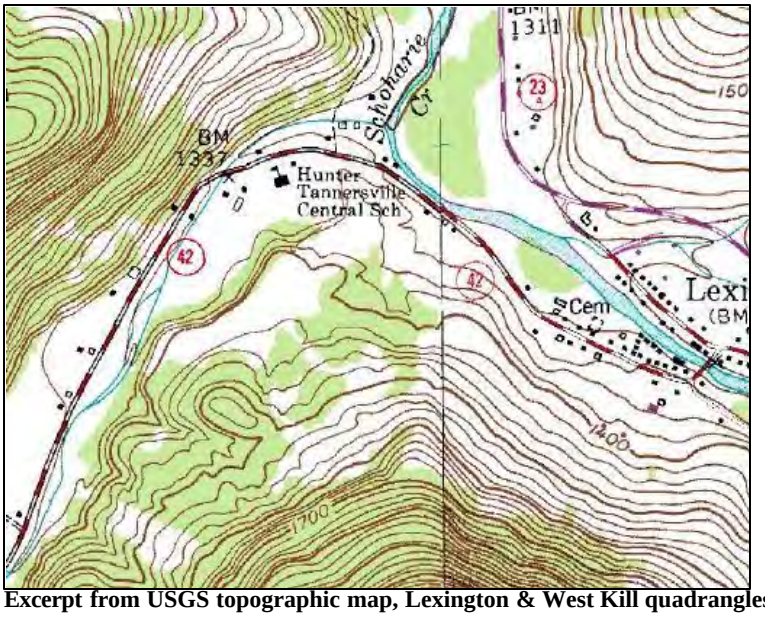
## Stream Channel and Floodplain Current Conditions

### Revetment, Berms and Erosion

The 2004 stream feature inventory revealed that 7% (168 ft.) of the stream exhibited signs of active erosion along 2317 ft. of total channel length (Fig. 4.21.1). Revetment has been installed on 12% (271 ft.) of the stream. No berms were identified in this management unit at the time of the stream feature inventory.

### Stream Morphology

The following description of stream morphology references insets in the foldout Figure 4.21.2. "Left" and "right" references are oriented looking downstream. Italicized terms are defined in the glossary. This characterization is the result of surveys conducted in 2004 and 2005.



**Excerpt from USGS topographic map, Lexington & West Kill quadrangles**

Valley morphology in the final management unit is relatively unconfined on the approach to the confluence of the West Kill with Schoharie Creek, with a broad glacial and alluvial valley flat. While the channel is well connected with its floodplain at the beginning of the unit, after crossing back under NYS Route 42, it comes up against the northwest valley wall, controlled in the bed and left bank by bedrock. From here to its mouth, where the grade is controlled by the elevation of the Schoharie, the West Kill remains entrenched. A private bridge in the middle of the unit also presents lateral controls.

Stream morphology, or shape (i.e., slope, width and depth) changes in this unit, creating reaches with differing morphologic characteristics, which are classified as different *stream types* (See Section 3.2, Introduction to Stream Processes, for a description of stream types).

Management Unit #21 begins with a 1117 ft. reach of B3c stream type. The channel is moderately *entrenched*, or somewhat confined within the stream banks during high flood events. The channel slope increases slightly to 1.29 % and the bed material is dominated by cobble. The reach remains somewhat aggradational as a result of excess sediment supply coming from the previous two units.

**Cross-sections and Rosgen stream types in Management Unit 21**

**Woody debris, right**

Proceeding downstream, low benches form on both banks, with abundant sedge on the right and mown lawn on the left. A substantial pile of woody debris has collected on the right bank against a line of mature trees, but does not obstruct low flows and may actually provide some bank protection in higher flows. A monumented cross-section at Station 1908 documents the B3c stream type at this long, straight riffle; the bank angles moderate significantly in the vicinity of the house on the left. The remains of a log sill habitat structure were observed (Station 1790) downstream of the classification cross-section, with remnants at the right bank only. A single line of trees buffers the channel on the right from a pasture on the terrace beyond.

**Habitat Structure**

**NYS Route 42 bridge**

Approaching the NYS Route 42 bridge, which crosses the stream at an oblique angle, the channel material becomes finer, and the entrenchment increases (Inset H, Fig.4.21.2).

The bridge has sufficiently long span to pass bankfull flows without significant obstruction. There is some evidence that larger flows backwater, but this may owe more to the hard bend in the channel just downstream of the bridge.

**Looking upstream**

**Looking downstream**

There is little evidence of abutment scour, however, and the wingwalls are protected with sufficient rip-rap. Abutments, wingwalls and deck appear to be in good condition.

**Knotweed, right**

During the 2004 inventory, one stand of Japanese knotweed (*Fallopia japonica*), an invasive, exotic shrub species that can grow rapidly to crowd out more appropriate streamside vegetation, was observed on the right bank just downstream of the bridge. In the 2005 inventory, however, the number had increased to four upstream and downstream of the bridge. A program for eradication of Japanese knotweed throughout the West Kill valley is recommended.

**Bed Rock**

Downstream of the bridge, the channel is turned abruptly by the valley wall. Stacked rock on the left ties the abutment into a bedrock ledge exposed on the bank and left half of the bed (Inset D, Fig. 4.21.2). This bedrock controls the grade to some degree both upstream and downstream in the management unit. A narrow dirt road runs along the left bank, and is the historic north/south road through the valley, with large mature trees on each side. A galvanized 2 ft. culvert, with no headwall and slightly perched, drains the road ditch and the adjacent hillslope, outfalling onto the rock ledge. Springs also seep from the bedrock fractures here.

**Culvert**

Across the channel, 135 ft. of rip-rap protects a low bank with a residential lawn beyond it, mowed to the edge of the stream (see Inset C, Fig. 4.21.2). The rip-rap also serves as outfall protection for a drainage swale that carries stormwater runoff from across the highway. In addition to exposed bedrock on the left channel bed and bank, abundant large native boulders throughout the channel mitigate bed scour.

**Rip-rap, right**

**Bedrock bench, left**

Proceeding downstream, the channel becomes increasingly pinched between the high bank on the left and the alluvial terrace on the right. Downstream of the pinch point, a monumented cross-section (Station 951) documents the transition to a 1200 ft. reach of F3 stream type. The channel slope flattens to 1.0%, and the bankfull channel widens and becomes entrenched. The bed remains

dominated by cobble, but due to the protection provided by abundant boulders and bedrock, the erosional power of large flows is displaced onto the streambanks. On the left, the dirt road embankment has washed out, and a 76 ft. section of dumped rip-rap was recently installed (Inset G, Fig. 4.21.2). The toe of this rip-rap has begun to fail, threatening the installation. Recommendations here include stabilization of the toe of the slope. If bedrock prevents the keying-in of the base of the rip-rap below the channel grade, then stacking rock revetment at least up to bankfull elevation is recommended. This will also reduce both the embankment slope and the narrowing of the channel.



**Erosion, left**

Downstream of the rip-rap on the left, the road embankment continues to erode, and mature trees are being undermined and introduced into the channel at several locations.

**Stacked rock culvert**

An old, hand-stacked rock culvert carries upslope stormwater drainage under the dirt road and, slightly perched, outfalls onto stacked outfall protection on the dirt road embankment (Inset F, Fig.4.21.2).

**Large woody debris, left**

**Lateral bar on outside of meander**

On the outside of this gentle bend to the right, debris jams may be providing some toe protection, as flows are obstructed and a lateral bar appears to be developing, aided by occasional outcroppings of bedrock on the bank and bed.

This may also be contributing to the erosion downstream on the right bank, as the thalweg shifts laterally across the stream. This site was not monumented as a Bank Erosion Monitoring Site. Recommendation for this site is Passive Restoration, allowing development of the bar on the left to stabilize the toe of the slope.

**Erosion at base of well-vegetated bank, right**

**Debris, headcut at eroding right bank**

Opposite and downstream of the debris jam on the left, a 168 ft. section of the bank is eroding at the edge of a mowed field at Bay Bridge Farm (Inset B, Fig. 4.21.2). At the upstream end of the erosion, the bank is well-vegetated with young trees, but the base of the slope begins to show signs of scour around Station 850. As the mature vegetation transitions to open field adjacent to the stream, erosion of the right bank has been monumented as a Bank Erosion Monitoring Site (BEMS 21-00767).

In a prioritization of twenty-one BEMS sites throughout the West Kill watershed (see Section 3.3, Watershed Inventory and Assessment), this site was ranked Low Priority. The *thalweg*, or deepest part of the stream channel flows up against the alluvial terrace here, causing toe erosion, and leaving sections of the stream bank unvegetated. Furthermore, most of the remaining trees have been undermined by a headcut that is migrating through the site, exacerbating the toe erosion. The channel slope steepens locally.

**Looking downstream**

**Debris jam**

Assisted Self-recovery is recommended for this site. Minor changes in the bed and bank could significantly shift erosive forces off the bank and eliminate the headcut. The toe of the bank should be protected with larger rock and a low bench should be established with plantings of sedge and willows. The bank and a buffer in the field adjacent to the stream should be replanted with ecologically appropriate trees and shrubs.

Downstream of the erosion on the right, the channel approaches the private bridge at Bay Bridge Farms. This bridge used to carry the main road, then on the left of the stream, across toward Lexington. The span is adequate to pass bankfull flows without obstruction, and the mortared stone abutments are in good condition, with no sign of scour despite a substantial pool under the bridge. The right abutment has rip-rap scour protection.

**Private bridge at Bay Bridge Farms**

**Looking upstream**

**Crib wall, downstream right**

Downstream on the right, a new cribwall with a well vegetated toe protects the bank against backeddy scour. Just upstream of the left abutment, a 16" galvanized culvert, dry at the time of the inventory, enters with no headwall or outfall protection.

**Aggradation downstream of**

Downstream of the bridge, aggradation is evident, probably the result of backwatering at the confluence of the Schoharie Creek just downstream.

A monumented cross-section (Station 320) documents the continuation of the F3 stream type. Entrenchment, channel width and slope, and bed material all remain nearly the same as the reach upstream of the Bay Bridge Farms bridge.

**Small headcut**

Downstream of aggradation, aerial photography and cut benches suggest that a small headcut has migrated headward through the reach. The riparian buffer on both banks here is narrow, but the banks appear to remain stable.

**Confluence of West Kill and Schoharie Creek**

Management Unit 21 ends at the confluence of the West Kill with Schoharie Creek, where backwatering, typical at such settings, has produced aggradation and a deep junction pool.

## Sediment Transport

Streams move sediment as well as water. Channel and floodplain conditions determine whether the reach aggrades, degrades, or remains in balance over time. If more sediment enters than leaves, the reach aggrades. If more leaves than enters, the stream degrades (See Section 3.1 for more details on Stream Processes).

Management Unit 21 is predominantly a sediment transport unit, with most of the reach in stable but entrenched conditions, and very little bank erosion or stabilization relative to other management units. The few aggradational areas are local, and generally self-adjusting. These conditions are partly due to the bedrock control in the bed and left bank in the middle of the unit.

## Riparian Vegetation

One of the most cost-effective methods for landowners to protect streamside property is to maintain or replant a healthy buffer of trees and shrubs along the bank, especially within the first 30 to 50 ft. of the stream. A dense mat of roots under trees and shrubs bind the soil together, and makes it much less susceptible to erosion under flood flows. Mowed lawn does not provide adequate erosion protection on stream banks because it typically has a very shallow rooting system. Interplanting with native trees and shrubs can significantly increase the working life of existing rock rip-rap placed on streambanks for erosion protection. *Riparian*, or streamside, forest can buffer and filter contaminants coming from upland sources or overbank flows. Riparian plantings can include a great variety of flowering trees and shrubs, native to the Catskills, which are adapted to our regional climate and soil conditions and typically require less maintenance following planting and establishment.

Some plant species that are not native can create difficulties for stream management, particularly if they are invasive. Japanese knotweed (*Fallopia japonica*), for example, has become a widespread problem in recent years. Knotweed shades out other species with it's dense canopy structure (many large, overlapping leaves), but stands are sparse at ground level, with much bare space between narrow stems, and without adequate root structure to hold the soil of streambanks. The result can include rapid streambank erosion and increased surface runoff impacts.

An analysis of vegetation was conducted using aerial photography from 2005 and field inventories (Fig. 4.12.3). Japanese knotweed occurrences were documented as part of the stream feature inventory conducted during the summer of 2004, with additional occurrences identified in 2005.

In this management unit, the predominant vegetation type within the 300 ft. riparian buffer is Forest (38 %) followed by Herbaceous (35 %). *Impervious* area (7%) within this unit's buffer is primarily the Greene County Route 6, along with private residences and associated roads. One occurrence of Japanese knotweed was documented in this management unit during the 2004 stream inventory, and four occurrences in 2005.

**National Wetland Inventory wetlands in MU21**

There is 1 wetland within this management unit mapped in the National Wetland Inventory (see Section 2.5, Wetlands and Floodplains for more information on the National Wetland Inventory and wetlands in the West Kill watershed). Wetlands are important features in the landscape that provide numerous beneficial functions including protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, and maintaining

surface water flow during dry periods (See Section 2.6 for wetland type descriptions and regulations). The wetland in management unit 21 measures 49.2 acres in size and is designated *riverine, lower perennial, unconsolidated bottom, permanently flooded* (R2UBH).

Areas of herbaceous (non-woody) cover present opportunities to improve the riparian buffer with tree plantings, to promote a more mature vegetation community along the streambank and in the floodplain. In November 2005, suitable riparian improvement planting sites were identified through a watershed-wide remote evaluation of current riparian buffer conditions and existing stream channel morphology. These locations indicate where plantings of trees and shrubs on and near stream banks can help reduce the threat of serious bank erosion, and can help improve aquatic habitat as well. In some cases, eligible locations include stream banks where rock rip-rap has already been placed, but where additional plantings could significantly improve long-term stream channel stability, as well as biological integrity of the stream and floodplain. Areas with serious erosion problems where the stream channel requires extensive reconstruction to restore long-term stability have been eliminated from this effort. In many cases, these sites can not be effectively treated with riparian enhancement alone, and full restoration efforts would include channel restoration components in addition to vegetative treatments.

Nineteen potential planting sites were documented within this management unit (Fig. 4.21.4).

Recommendations for this site include planting native trees and shrubs along the edge of the stream bank and the upland area. Buffer width should be increased by the greatest amount agreeable to the landowners, but increasing the buffer width by at least 35 feet will increase the buffer functionality and improve stream bank stability while still allowing a significant lawn area.

## Flood Threats

**100-year floodplain boundary in Management Unit 21**

### Inundation

As part of its National Flood Insurance Program (NFIP), the Federal Emergency Management Agency (FEMA) performs hydrologic and hydraulic studies to produce Flood Insurance Rate Maps (FIRM), which identify areas prone to flooding. The NYS DEC Bureau of Flood Protection is currently developing new floodplain maps for the West Kill on the

basis of recent surveys. These maps should be completed for the West Kill watershed in 2006.

According to this existing floodplain maps, there are ten houses and municipal structures located within the 100-year floodplain boundary in this management unit. The 100-year floodplain is that area predicted to be inundated by floods of a magnitude that is expected to occur once in any 100 year period, on the basis of a statistical analysis of the local flood record. Most communities regulate the type of development that can occur in areas subject to these flood risks. The current NFIP maps are available for review at the Greene County Soil & Water Conservation District office.

**Bank Erosion**

Most of the stream banks within the management unit are considered stable, but 7% (168 ft.) of the stream is experiencing significant erosion. There is one Bank Erosion Monitoring site in MU21 (BEMS 21-00767), rated as a Low Priority.

**Infrastructure**

Twelve percent of the stream length in this management unit has been treated with some form of revetment. One section of revetment is failing, and this could ultimately threaten a private road which serves as the primary egress for a residence. Stabilization of the toe of this rip-rap installation is recommended.

**Aquatic Habitat**

It is recommended that a habitat study be conducted on the West Kill Creek, with particular attention paid to possible temperature barriers in aggrading sections, to the frequency of disturbance of the bed due to incision at numerous points in the system, and to embeddedness resulting from excessive entrainment of fine sediment.

Habitat was quite good throughout this management unit, with abundant woody debris, better than average canopy cover and relatively high diversity of bedform. Abundant emergent groundwater seeps contribute cold water to the system, moderating summer thermal impacts

**Water Quality**

Clay exposures and sediment from stream bank and channel erosion pose a potential threat to water quality in West Kill Creek. Clay and sediment inputs into a stream may increase *turbidity* and act as a carrier for other pollutants and pathogens. There were no significant clay exposures identified in the 2004 or 2005 stream inventories in this management unit.

Stormwater runoff can also have a considerable impact on water quality. When it rains, water falls on roadways and flows untreated directly into West Kill Creek. The cumulative impact of oil, grease, sediment, salt, litter and other unseen pollutants found in road runoff can significantly degrade water quality. There are three stormwater culverts in this management unit, but all drain the private dirt road, which carries very little traffic.

Nutrient loading from failing septic systems is another potential source of water pollution. Leaking septic systems can contaminate water making it unhealthy for swimming or wading. There are numerous houses located in close proximity to the stream channel in this management unit. These homeowners should inspect their septic systems annually to make sure they are functioning properly. Each household should be on a regular septic service schedule to prevent over-accumulation of solids in their system. Servicing frequency varies per household and is determined by the following factors: household size, tank size, and presence of a garbage disposal. Pumping the septic system out every three to five years is recommended for a three-bedroom house with a 1,000-gallon tank; smaller tanks should be pumped more often.

The New York City Watershed Memorandum of Agreement (MOA) allocated 13.6 million dollars for residential septic system repair and replacement in the West-of-Hudson Watershed through 2002. Eligible systems included those that were less than 1,000-gallon capacity serving one- or two-family residences, or home and business combinations. No homeowners in this management unit made use of this program to replace or repair a septic system.

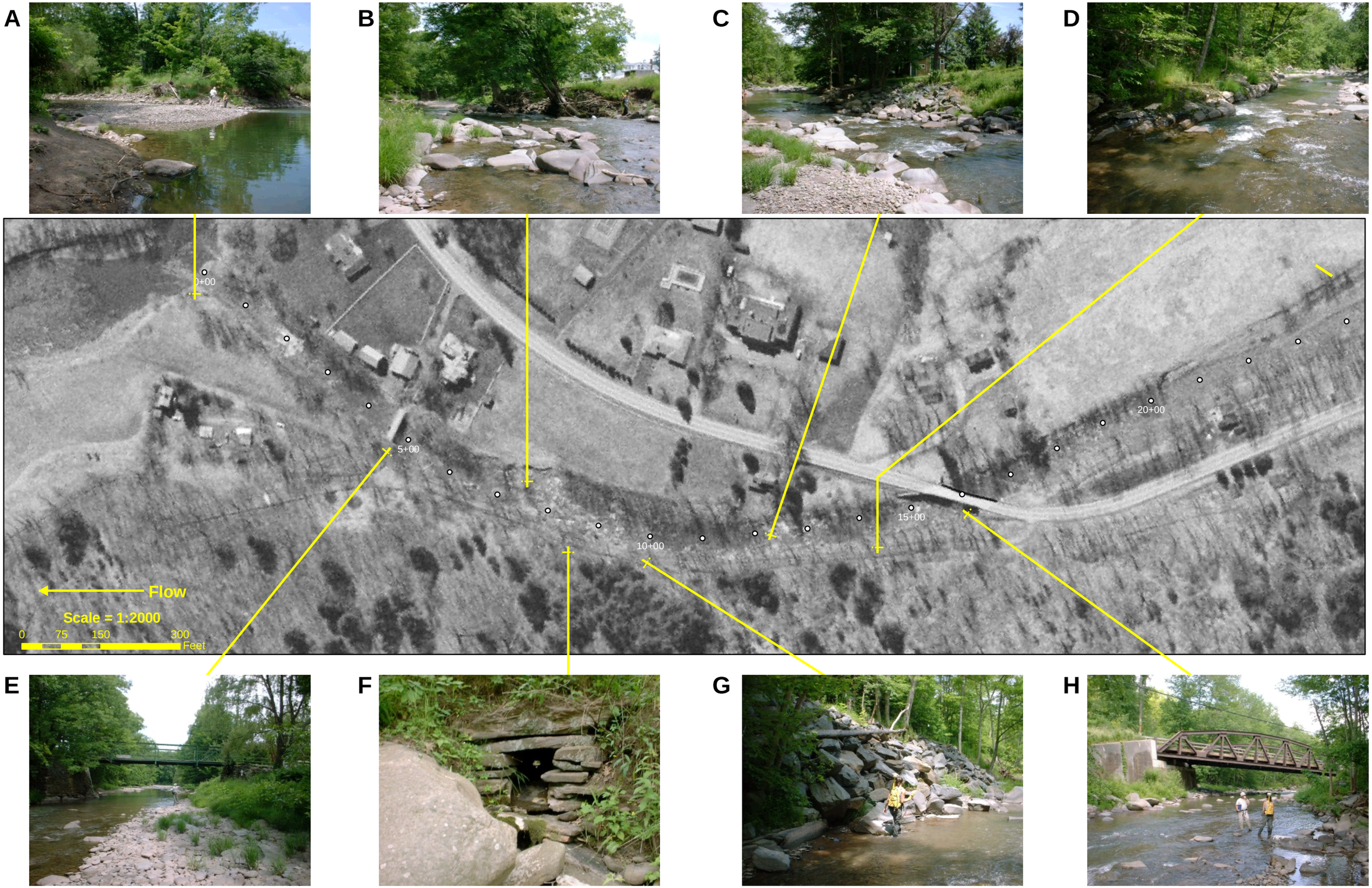



Figure 4.21.2 Management Unit 21 - 2004 aerial photography