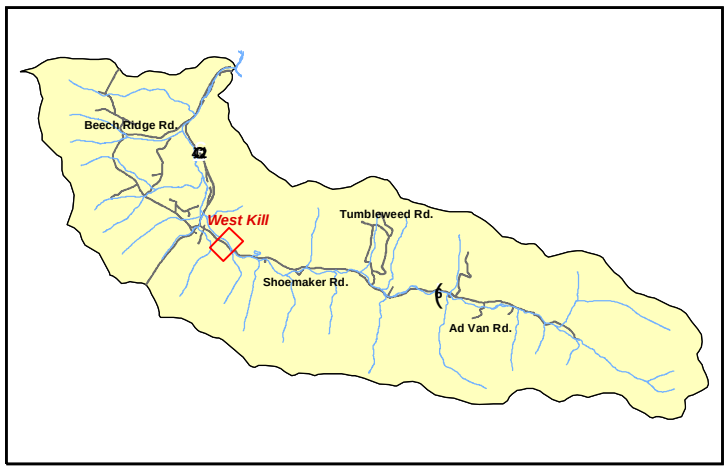


West Kill Management Unit 14

Stream Feature Statistics

0% of stream length is experiencing erosion
3% of stream length has been stabilized
6.6 acres of inadequate vegetation within the 300 ft. buffer
182 ft. of stream is within 50 ft. of the road
0 houses located within the 100-year floodplain boundary

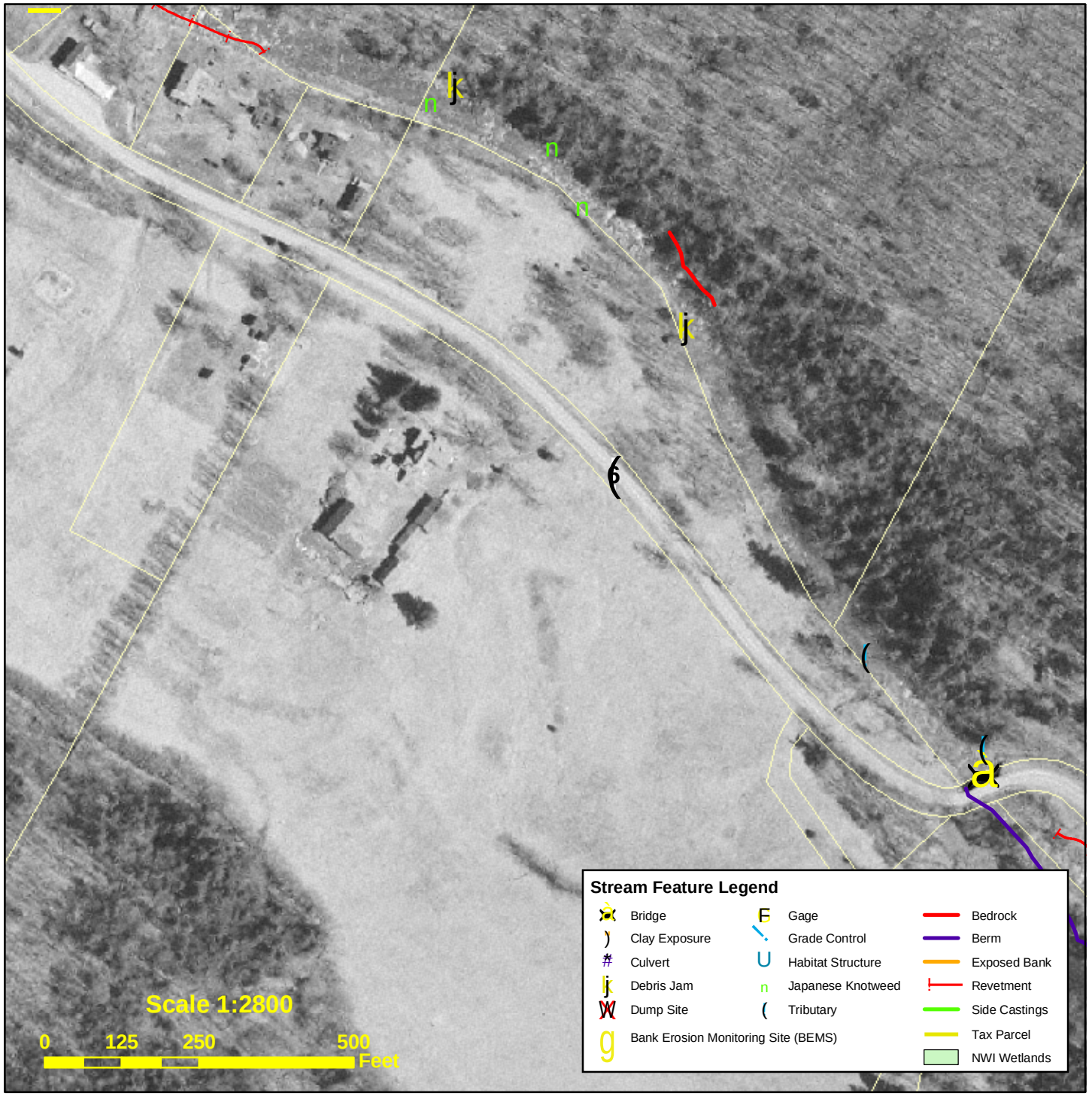


Figure 4.14.1 2004 aerial photography with stream feature inventory and tax parcels

Management Unit 14

Between Station 20415 and Station 18646

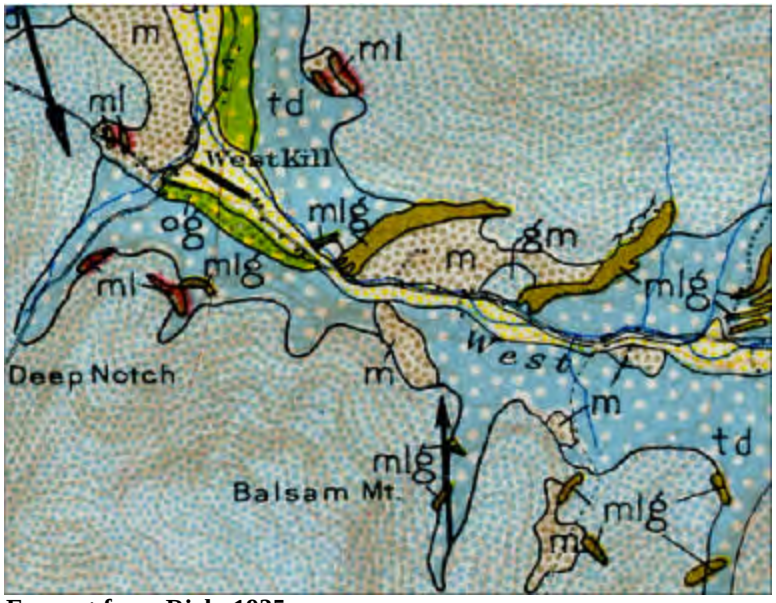
Management Unit Description

This management unit begins at the CR 6 bridge crossing, continuing approximately 1769 ft., and ending just upstream of the West Kill Community Center. The drainage area ranges from 19.6 mi^2 at the top of the management unit to 20.6 mi^2 at the bottom of the unit. The valley slope is 1.65%.

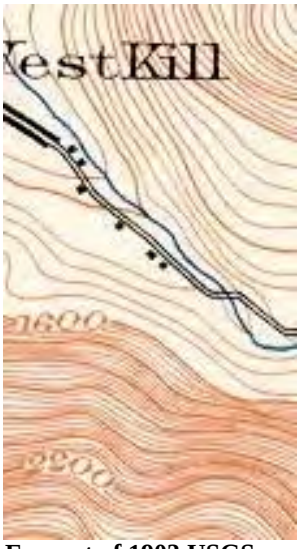
Summary of Recommendations Management Unit 14	
Intervention Level	Passive, Assisted Self-Recovery behind residential structures.
Stream Morphology	None
Riparian Vegetation	Interplanting of rip-rap and enhancement of riparian buffer behind residential structures. Watershed-wide Knotweed eradication program.
Infrastructure	Coordination with Greene County Highway Department on replacement of Greene County Route 6 bridge.
Aquatic Habitat	Watershed wide study.
Flood Related Threats	Investigation of bridge replacement impacts on flooding in the hamlet.
Water Quality	None
Further Assessment	Hydraulic modeling of replacement design for Greene County Route 6 bridge.

Historic Conditions

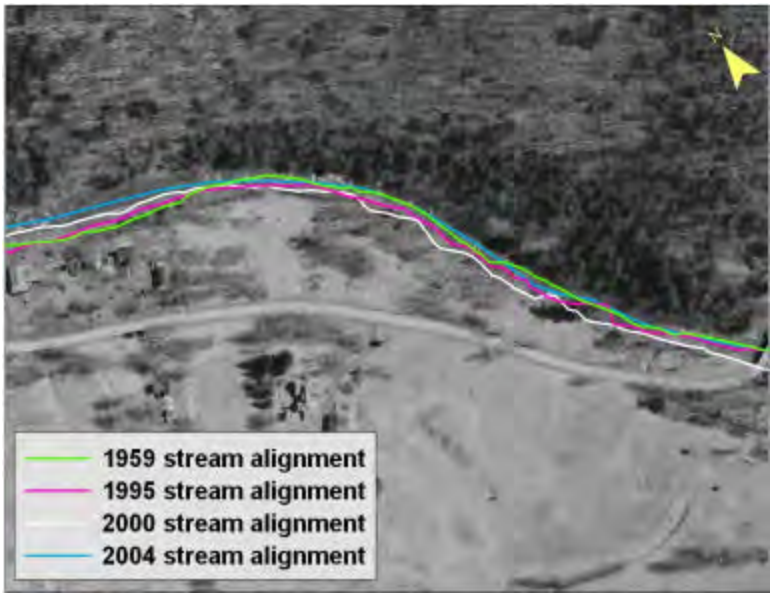
As the glaciers retreated about 12,000 years ago, they left their "tracks" in the Catskills. See Section 2.4 Geology of the West Kill Creek, for a description of these deposits.



Excerpt from Rich, 1935



Excerpt of 1903 USGS topographic map MU14



Historic Stream Channel Alignments in MU14

As seen from the historical stream alignments, the channel alignment has remained fairly consistent over the years. Minimal lateral channel adjustments are detectable from the aerial assessment. Vertical channel adjustments, however, cannot be assessed from aerial photography, and cannot be ruled out on the basis of the lateral stability evident from the historical channel alignments.

Stream Channel and Floodplain Current Conditions

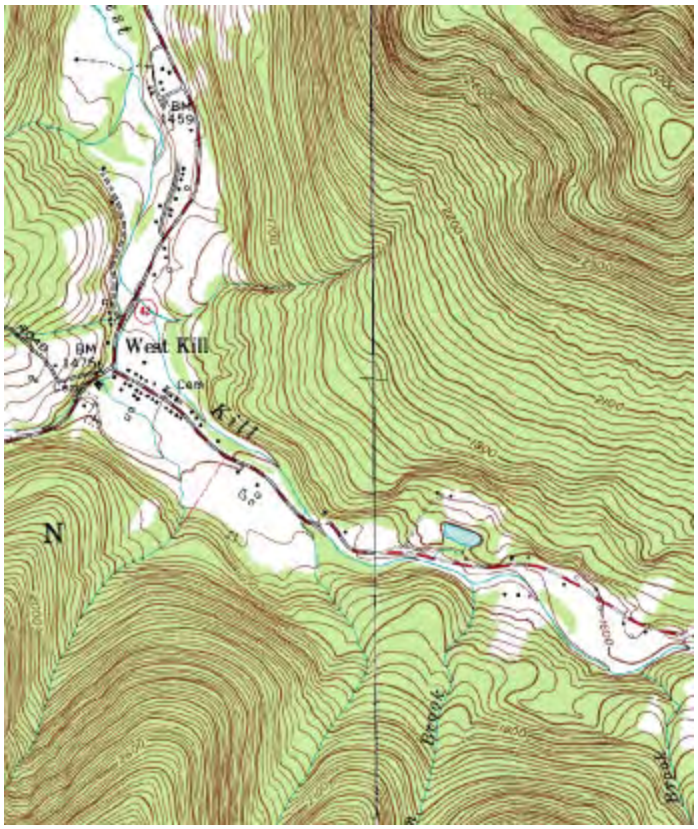
Revetment, Berms and Erosion

The 2004 stream feature inventory revealed that there were no signs of active erosion along 1769 ft. of total channel length (Fig. 4.14.1). Revetment has been installed on 3%

(61.4 ft.) of the stream length. 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 4.14.2. "Left" and "right" references are oriented looking downstream. Stationing references proceed upstream, in feet, from an origin (Station 0) at the confluence with the Schoharie Creek at Lexington. Italicized terms are defined in the glossary. This characterization is the result of surveys conducted in 2004 and 2005.



Excerpt of 1980 USGS topographic map

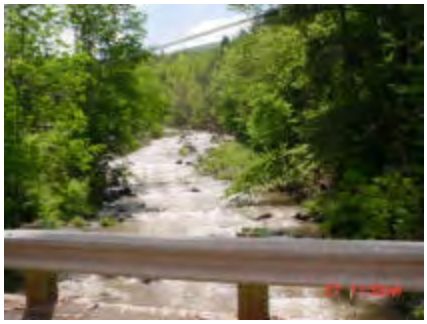
The channel in this Management Unit runs along the toe of the steep valley wall at the north for much of its length. The valley wall is very stable due to the shallow depth to bedrock observed during the walkover. The area to the south of the channel is characterized by a broad alluvial terrace. Evaluation of Aerial photography dating back to 1959 shows a very stable plan form over time in this unit. Meander scrolls that predate the aerial photography, however, are evident on the alluvial terrace to the south. These suggest that the sinuosity and belt width may have been reduced to facilitate agriculture and development. Stream slope would increase as a result of such channel modifications, and channel incision would be the likely response. Channel confinement increases through the unit, supporting the hypothesis that this area has been modified from its natural condition.

Stream morphology, or shape (i.e., slope, width and depth) changes several times in this unit (Fig. 5), creating small reaches with differing morphologic characteristics, which are classified as different *stream types* (See Section 3.2 for description of stream types)

Cross-sections and Rosgen stream types in Management Unit 14

Management Unit #14 begins with a 615 ft. reach of B3c stream type. The channel is moderately *entrenched*, or confined within the stream banks during high flood events. The channel slope is a very flat 0.7 % and the bed material is dominated by cobble.

Greene County Route 6 bridge



Route 6 bridge, looking upstream

Greene County Route 6 bridge (Inset H, Fig. 4.14.2) marks the upstream end of Management Unit 14. The bridge is old, but in fair condition. The span of this bridge is inadequate to convey bankfull flows without flow constriction and backwater. The bridge has no rock scour protection and significant abutment scour is evident. Increased water surface elevations upstream of this bridge have resulted in flooding of the hamlet during larger flood events, which flank the bridge to the south. This bridge is scheduled for replacement in 2006, and coordination with Greene County Highway Department is recommended to ensure application of appropriate channel dimensions to the bridge design. The bridge design should be evaluated from a hydraulic perspective to determine the impact it will have on flooding in the hamlet.

Route 6 bridge, looking downstream

Tributary, right

An unnamed tributary joins the West Kill from the right, just downstream of the bridge abutment. The tributary confluence is perched, but well vegetated and fairly stable.

Tributary, left

A larger unnamed tributary (Inset D, Fig. 4.14.2) finds its confluence approximately 250 ft. downstream of the bridge. The tributary flows from the left, delivering flow and sediment from a 0.6 mi^2 catchment. The mouth is well connected and stable, with vigorous vegetation on both banks. A monumented cross-section (Station 20135) has been established immediately downstream of the mouth of the tributary to verify the B3c stream type.

As confinement increases, the stream type shifts to F3, documented by a monumented cross-section at Station 19735. The slope increases to 1.3% here while cobble remains the dominant bed material.

Debris Jam, left

A debris jam (Inset G, Fig. 4.14.2) is observed on the left bank near station 19550. The jam is clear of the low flow channel, creating an obstruction only during high flows.

Bedrock, right

Bedrock (Inset C, Fig. 4.14.2) lines 43 feet of the right bank near Station 19500. The bedrock provides lateral control, and abundant boulders form grade control.

Knotweed

During the 2004 and 2005 inventory, three stands of Japanese knotweed (Fallopia japonica), an invasive, exotic shrub species that can grow rapidly to crowd out more appropriate streamside vegetation, were observed between Stations 18975 and 19300 (see Inset E and F, Fig.4.14.2). A program for eradication of Japanese knotweed throughout the West Kill valley is recommended.

A monumented cross-section (Station 19010) documents an F2 stream type. While slope and entrenchment show minor variation from the F3 stream type found upstream, boulders become the dominant bed material.

Debris jam, right

Large trees form a debris jam on the right bank. The jam presents an obstruction at high flow (see Inset B, Fig. 4.14.2).

As Management Unit 14 ends, 214 ft. rip-rap is found on the left bank behind residential structures. The rip-rap continues into Management Unit 15. The riparian buffer beyond the rip rap installation is in poor condition, with mown grass to the edge of the bank. The risk to bank stability can be minimized by maintaining mature trees along the stream margin, including a critical buffer zone extending approximately 75 ft. from the centerline of the stream (Fig. 4.14.4). The risks and benefits associated with management of streamside vegetation will depend partly on the current channel conditions, and local channel surveys are recommended at each site. Recommendations for this area include interplanting of the rip rap, and enhancement of the riparian buffer with planting of ecologically appropriate tree and shrub species in the adjacent mown lawn.

Rip Rap, left

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).

Sediment transport appears to be relatively stable in the upstream half of this management unit. This portion of the unit appears to benefit from abundant sediment storage areas in Management Unit 13. As confinement increases in the downstream half of the unit, sediment transport becomes somewhat over-efficient, resulting in channel incision. As incisional processes migrate headward through the unit, stability may be compromised in the upstream reaches. Much of Management Unit 15 shows indications of active aggradational processes, and sediment exported from this unit as a result of incision may have detrimental impacts on the recovery potential of the downstream 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. 4.14.3). 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 (59 %) followed by Herbaceous (24 %). *Impervious* area (4%) within this unit's buffer is primarily the Greene County Route 6, along with private residences and associated roads. Three occurrences of Japanese knotweed were documented in this management unit during the stream 2004 and 2005 stream inventories.

There are no wetlands 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).

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.

Six potential planting sites were documented within this management unit (Fig. 4.14.4).

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

Inundation

100-year floodplain boundary in Management Unit 14

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 no houses located within the 100-year floodplain boundary in this management. 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

All of the stream banks within the management unit are considered stable, with none of the stream banks experiencing major erosion.

Infrastructure

Only three percent of the stream length in this management unit has been treated with some form of revetment.

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 fairly good throughout this management unit, with a moderate volume of woody debris. However, the reach behind the residential structures appears somewhat impaired, with inadequate canopy cover and low diversity of bedform.

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 Inventory, and 1 clay exposure identified in 2005,

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 no stormwater culverts in this management unit,

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.

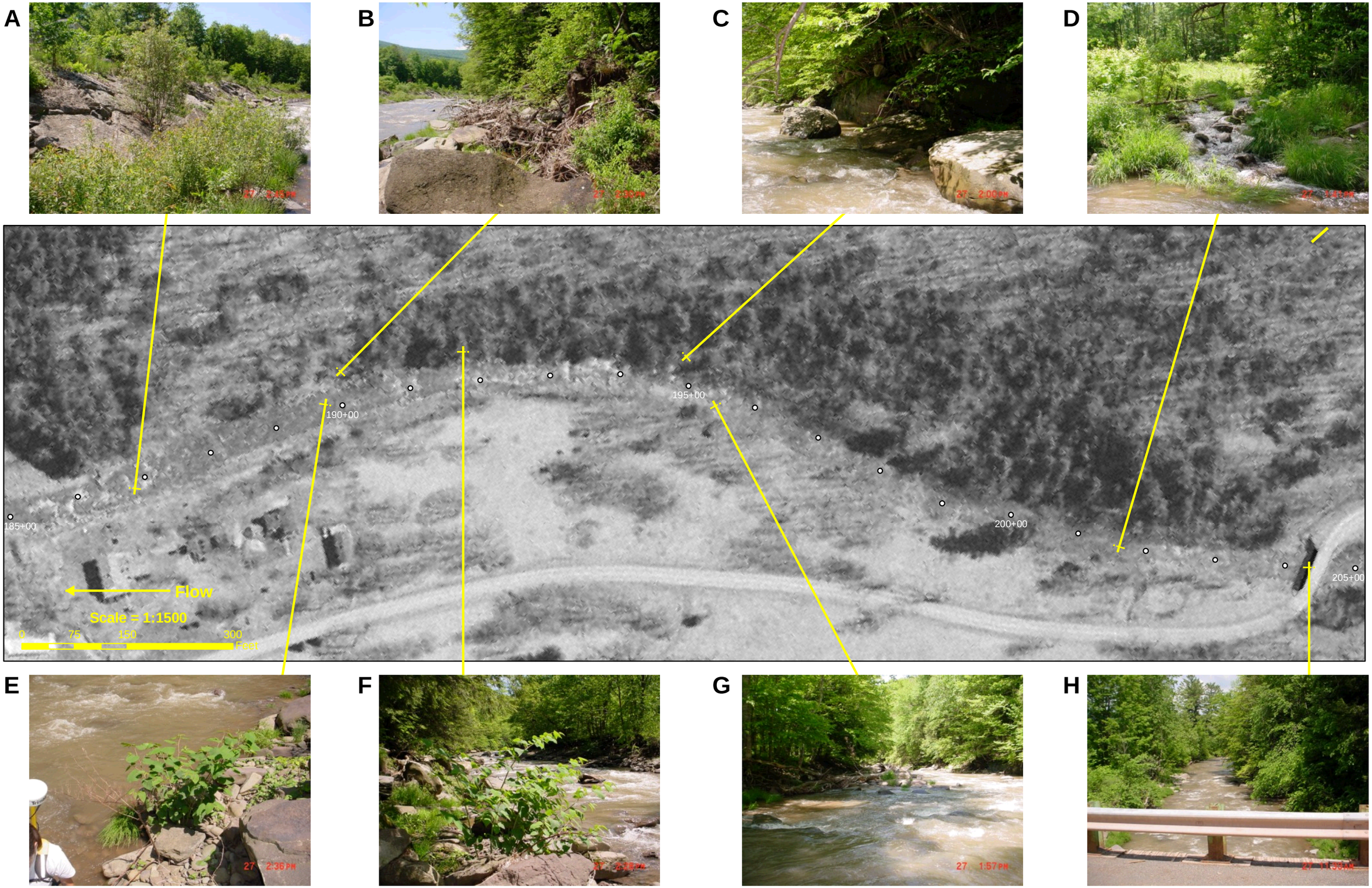


Figure 4.14.2 Management Unit 14 - 2004 aerial photography