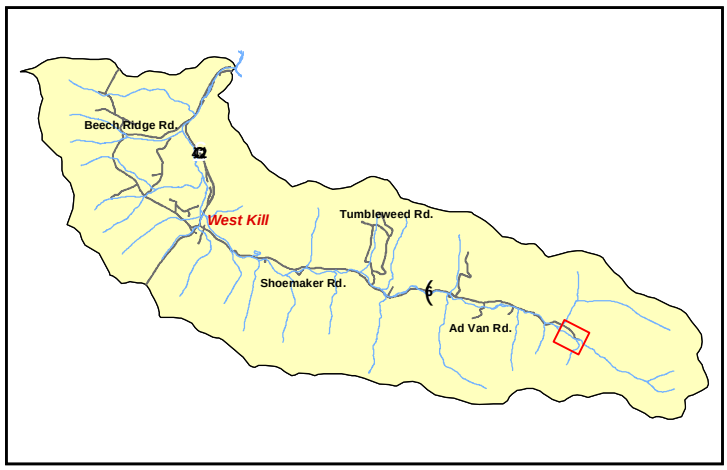



# West Kill Management Unit 1

*Stream Feature Statistics*

23% of stream length is experiencing erosion
0% of stream length has been stabilized
2.0 acres of inadequate vegetation within the 300 ft. buffer
792 ft. of stream is within 50 ft. of the road
0 houses located within the 100-year floodplain boundary

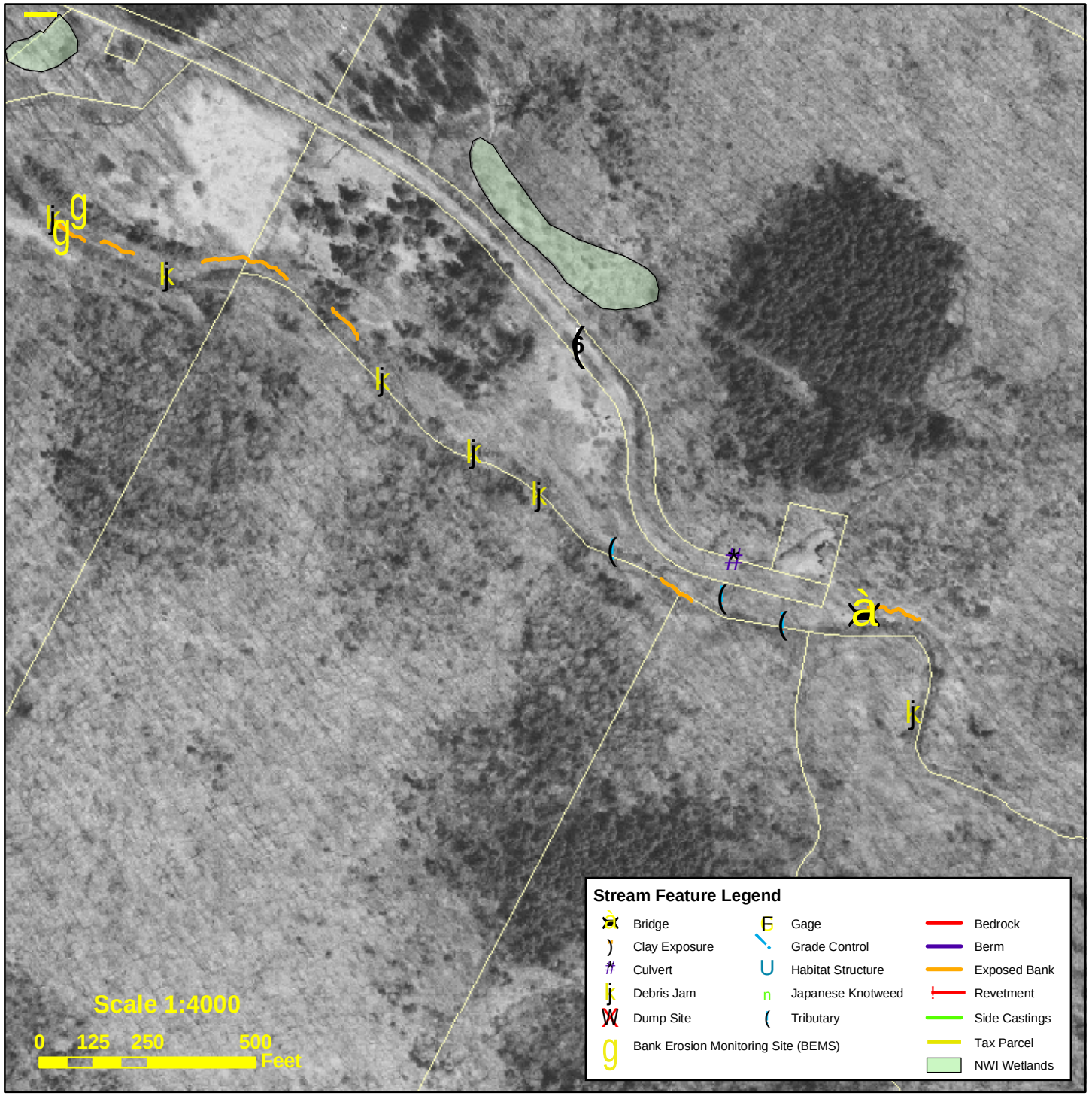



Figure 4.1.1 2004 aerial photography with stream feature inventory and tax parcels

# Management Unit 1

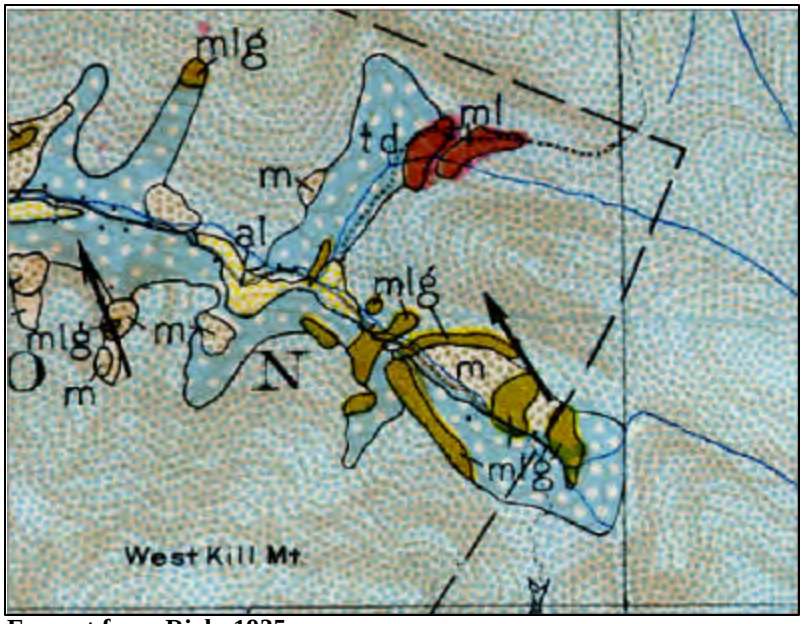
Between Station 56747 and Station 53971

This management unit begins on NYSDEC land in the West Kill Mountain Wilderness Area, near the boundary of the Hunter Mountain Wild Forest Area, continuing approximately 2776 feet to about 400 feet upstream of the confluence of Hunter Brook. The drainage area ranges from 2.15 $mi^2$ at the top of the management unit to 2.85 $mi^2$ at the bottom of the unit. The valley slope is 0.0338. Stations are in feet, beginning at the confluence with Schoharie Creek.

| Summary of Recommendations<br>Management Unit 1 | |
|---|---|
| Intervention Level | Preservation. Reference conditions. |
| Stream Morphology | None |
| Riparian Vegetation | Predominantly functional reference young forest. |
| Infrastructure | Abandoned bridge abutments, no deck. Possibility of trail being undermined at station 562+00. |
| Aquatic Habitat | None |
| Flood Related Threats | None |
| Water Quality | None |
| Further Assessment | Ongoing monitoring of reference reaches. |

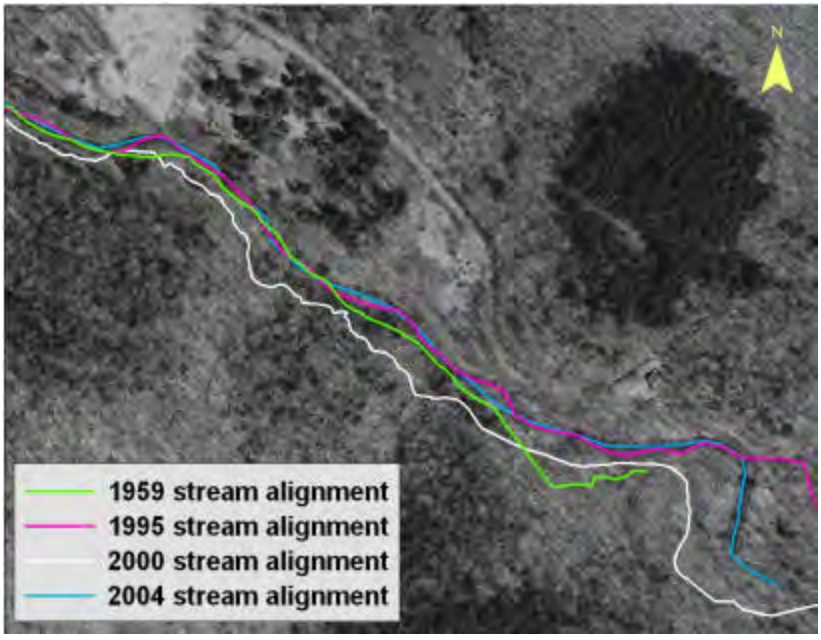
## Historic Conditions

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 MU1**




**Historic Stream Channel Alignments in MU1**

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

According to available NYS DEC Region 4 records, there have been no stream disturbance permits issued for work in this management unit.

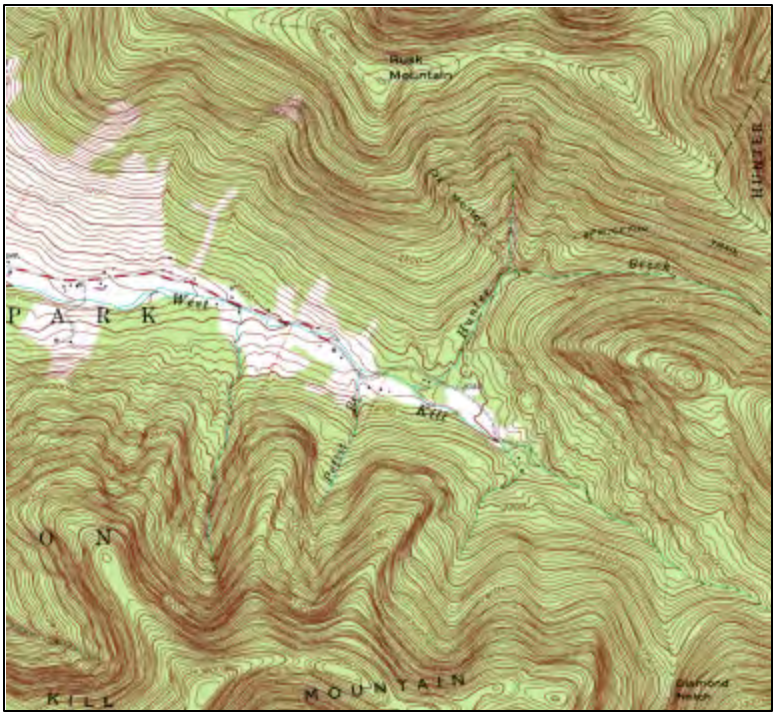
## Stream Channel and Floodplain Current Conditions

### Revetment, Berms and Erosion

The 2004 stream feature inventory revealed five eroding banks. Twenty-six percent (725 ft.) of the total channel length (2585 ft.) exhibited signs of active erosion on one or both banks (Fig. 4.1.1). None of these areas were significant enough to warrant documentation as a Bank Erosion Monitoring Site (BEMS), and there was no evidence of clay exposures in the unit. No revetment or berms were identified in this management unit at the time of the stream feature inventory.

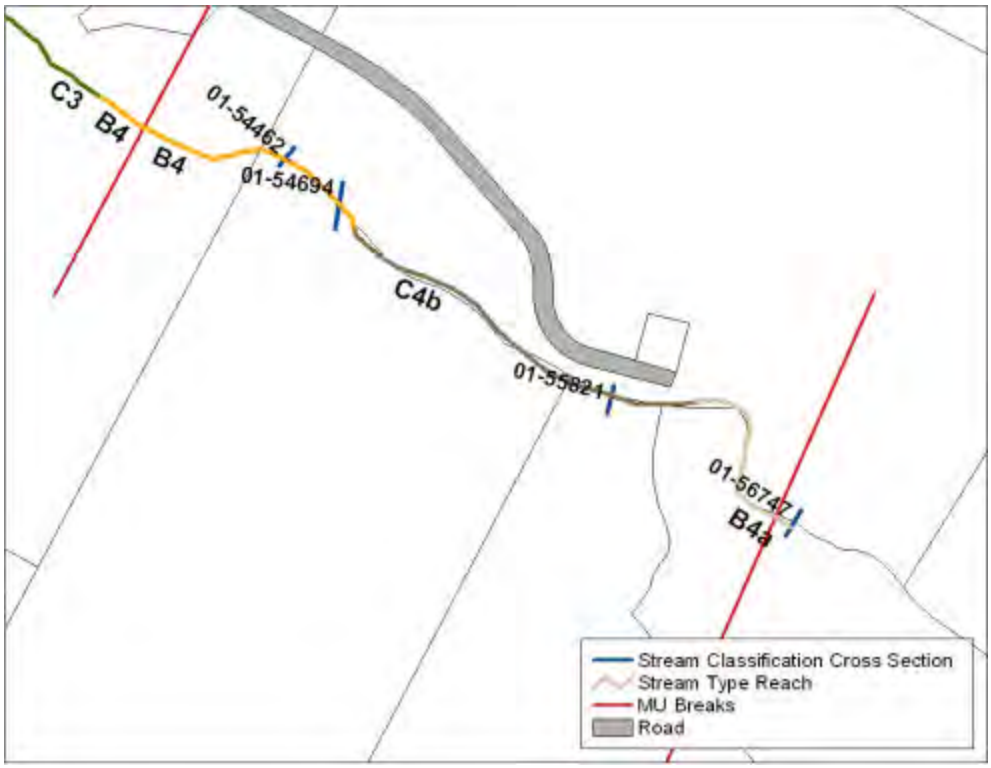
### Stream Morphology

The following description of stream morphology references insets in the foldout Figure 4.1.2. "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 of 1980 USGS topographic map**

This management unit is laterally controlled at the top of the unit by entrenched valley morphology, but opens in the middle as it reaches the beginning of an alluvial valley floor. The last reach of the unit becomes increasingly entrenched. Stream morphology, or shape (i.e., slope, width and depth) changes several times in this unit, creating small reaches with differing morphologic characteristics, which are classified as different *stream types* (See Section 3.2 for description of stream types).




**Cross-section and Rosgen stream types in Management Unit 1**

Management Unit 1 begins with a 650 ft. section of B4a stream type, as determined from a monumented survey cross-section at the origin of our Stream Feature Inventory (Station 56747). The channel is moderately *entrenched*, or confined within the stream banks during high flood events. The channel slope is 4.02 %, and the bed material is dominated by gravel, but with abundant cobble and boulders. This reach appears exceptionally stable and should be monitored as a reference reach, for potential future use in design.

**Reference Reach – looking upstream, abundant boulders,**

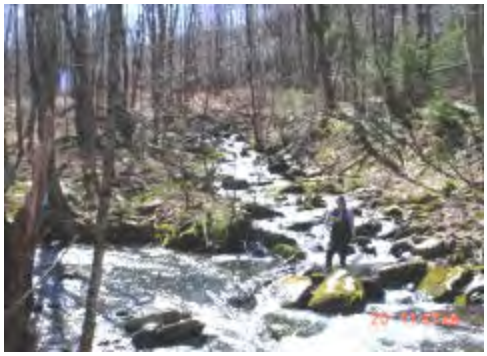
As the channel bends to the right, the channel is somewhat blocked by woody debris, creating a low obstruction potential to the channel just above bankfull stage. As the channel bends back to the left, the *thalweg*, or deepest part of the stream channel, flows up against the right valley wall, adjacent to the NYSDEC hiking trail. The hillslope is being undermined somewhat by toe erosion. This erosion may be the result of backwatering caused by an abandoned bridge abutment just downstream, but is minor and has high potential for recovery without intervention.

**Debris Blockage**

**Bank Erosion – embankment, DEC trail at top of bank**

**Abandoned bridge abutments, no deck**

The channel straightens as it approaches the abandoned bridge abutments, and becomes constricted. The floodplain is obstructed by the bridge approaches, and there is evidence of aggradation upstream of the crossing. Gravel deposits upstream of bridges are commonly caused by inadequate sizing of the bridge opening. An undersized bridge opening causes water to back up upstream of the bridge, reducing stream velocity, which results in sediment deposition. In high stage, the floodwater may seek conveyance through alternative paths, forming new channels around the bridge constriction. Even bankfull flows appear to backwater at this bridge, resulting in the upstream aggradation. Additional *floodplain drainage*, using culverts set at the floodplain elevation under the south bridge approach, or removal of the abutments altogether, may help mitigate this problem.

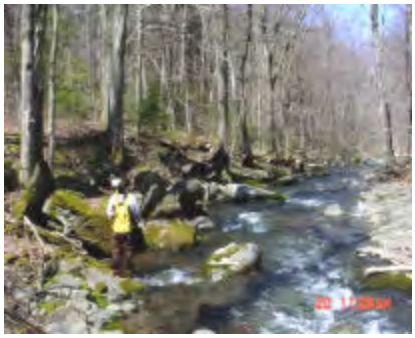


**Tributary**

Downstream of the abutments, an unnamed tributary enters from the left (Inset H, Fig. 4.1.2). Approximately 100 ft. downstream of the confluence, a monumented cross-section has been established (Station 55821). This 1300 ft. reach becomes a less entrenched C4b stream type, with slope diminishing to 2.49 %. Gravel still dominates the substrate.

Downstream, an unnamed tributary enters from the right (Inset C, Fig. 4.1.2). This tributary is conveyed under the adjacent dirt road on the right by a culvert (approximate diameter 30”), and becomes *braided*, with several distinct channels, at the confluence with the West Kill.

**Culverted tributary, looking**



**Minor bank erosion, left bank**

Continuing downstream, some minor erosion is evident on the left lower bank (Inset G, Fig. 4.1.2). The toe is protected by natural boulders, and has high potential for recovery without intervention. Downstream, an unnamed tributary enters from the left. The tributary appears stable and well connected at its confluence.

**Unnamed tributary, left bank**

**Debris blockage**

As the stream runs adjacent to the NYSDEC pullout, the gradient drops, as does the floodplain elevation on the right. Evidence of aggradation begins here, with a lateral bar on the left. Exacerbating the aggradational setting is a series of woody debris blockages, which result in backwatering at low flows. Higher flows can access the floodplain on the right. The valley broadens here, with an extensive alluvial terrace on the right.

Significant channel management appears to have taken place in this reach over the years. A large gravel bar has formed along the left stream bank. Gravel bars, especially point bars, can help maintain channel stability during flood events. In stable streams the bars will erode away while the channel is in flood stage. The bars then are rebuilt as flow decreases, helping the stream maintain its stability by reestablishing its pools and riffles. If gravel bars are removed, these processes do not occur and instead, the flood water often dissipates its energy by eroding banks and scouring the stream bed.

**Woody debris blockage, obstructing and extensive lateral cobble bar with an associated headcut at the downstream end**

**Inset F, Fig. 4.1.2**

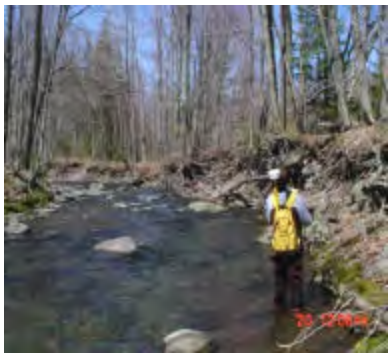
**Debris blockage – low flow obstructions**

At the downstream end of the aggradational reach, a minor head-cut is evident, and the stream type changes with the increasing entrenchment. Two monumented cross-sections in this reach (Stations 54694, 54462) classify the stream as B4, with slopes ranging from 2.11% to 3.50%. Gravel still dominates this 1000 ft. reach, but several short sections within it contain abundant boulders.

**Bank Erosion – Inset B, Fig. 4.1.2**

Throughout this reach there are headcuts and undercut banks, indicating a recent history of incision. A headcut near the upstream end of the reach appears to have stabilized, with large boulders armoring the bed. Downstream, the right bank is undercut extensively, with some loss of trees from the stream bank.

**Naturally stabilized headcut**



**Bank Erosion**

As the channel bends to the left, there is increasing toe scour on the right. Historic channel maintenance is evident, with stone walls and side castings. The inside of the meander bend (left) maintains some floodplain connection at higher flows.

**Pasture on right bank**

Downstream on the right bank, riparian vegetation narrows at a cleared field used as a horse pasture (Inset E, Fig. 4.1.2). Also on the right bank there is an inactive rubbish heap, with cans and bottles.

As the channel bends back to the right, woody debris on the left bank presents minimal flow obstruction.

**Bank Erosion – right bank**

Continuing downstream, toe scour is eroding the right bank (Inset A, Fig. 4.1.2). As the channel enters Management Unit 2, it bends to the right, with toe scour and associated bank erosion on the left bank continuing into the next management unit.

**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 3.2 for more details on Stream Processes).

The uppermost reach appears to be conveying its sediment load effectively, with the exception of the minor backwatering and deposition upstream of the bridge. The C4b reach appears to be slightly aggradational, perhaps due to recent woody debris blockages. Moderately entrenched conditions in the downstream reaches of this management unit have apparently resulted in channel incision as the channel bed is scoured deeper than it is refilled during high flows.

**Riparian Vegetation**

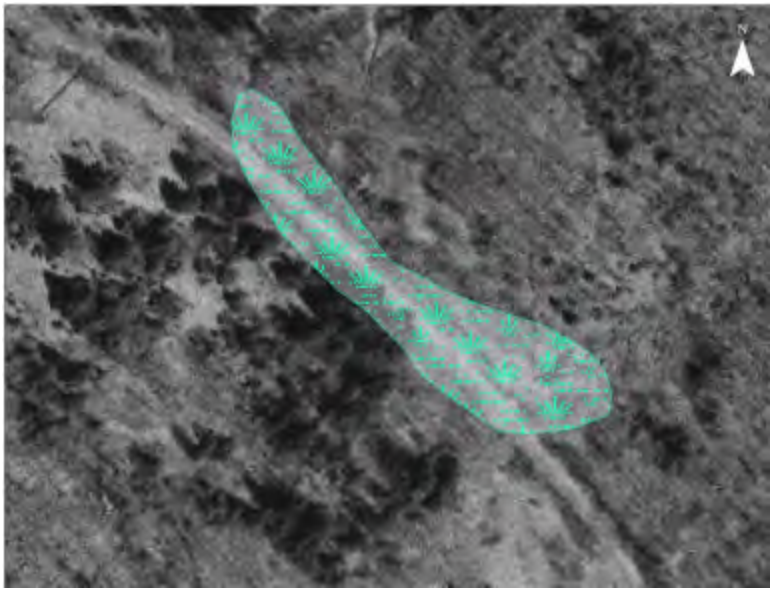
One of the most cost-effective methods for landowners to protect streamside property is to maintain or replant a healthy buffer of trees and shrubs along the bank, especially within the first 30 to 50 ft. of the stream. A dense mat of roots under trees and shrubs bind the soil together, and makes it 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 2001 and field inventories (Fig. 4.1.3). 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 (90%) followed by Herbaceous (1%). *Impervious* area (0.05 %) within this unit's buffer is primarily the Greene County Route 6, along with private residences and associated roads. No occurrences of Japanese knotweed were documented in this management unit during the 2004 or 2005 inventory. However, Japanese knotweed does occur downstream and a program for eradication of Japanese knotweed throughout the West Kill valley is recommended.



**National Wetland Inventory wetlands in MU1**

There is one wetland in the mainstem corridor within this management unit (Fig. 4.1.1) 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,

which is 1.1 acres in size, is classified as *palustrine forest, broad-leaf deciduous, and temporarily flooded* (PFO1A).

Areas of herbaceous (non-woody) cover may 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, potential riparian improvement planting sites were identified through a watershed-wide remote evaluation of current riparian vegetation conditions. These are sites where plantings of trees and shrubs on and near stream banks would likely reduce the threat of serious bank erosion, and can improve aquatic habitat as well. In some cases, these sites 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.

In many cases, these sites can not be effectively treated with riparian enhancement alone, and full restoration efforts would include bank and/or channel restoration components in addition to vegetative buffer plantings. The risk associated with the decision whether or not to invest in streamside vegetation improvements will depend partly on the current channel conditions, and local channel surveys are recommended at each site. No planting sites were identified within this management unit (Fig. 4.1.4).

## Flood Threats

### 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 analysis, which is still being reviewed for final approval, there are no houses 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. However, no maps are available for this section of the West Kill.

**Bank Erosion**

Most of the stream banks within the management unit are considered stable, and 26% of the stream length is experiencing minor erosion. None were selected for more detailed study as Bank Erosion Monitoring Sites (BEMS).

**Infrastructure**

None of the stream banks in this management unit have been treated with any form of revetment. However, there is the possibility of a threat to the hiking trail at one location in this management unit.

## 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 generally excellent throughout this management unit, with no apparent temperature or physical barriers, good canopy cover, abundant woody debris and high 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 are no significant clay exposures which need to be addressed 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 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. 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.

There is one seasonally occupied residence located in close proximity to the stream channel in this management unit.

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.

There is one minimally-used horse pasture adjacent to the stream, which does not appear to represent a nutrient or pathogen problem.

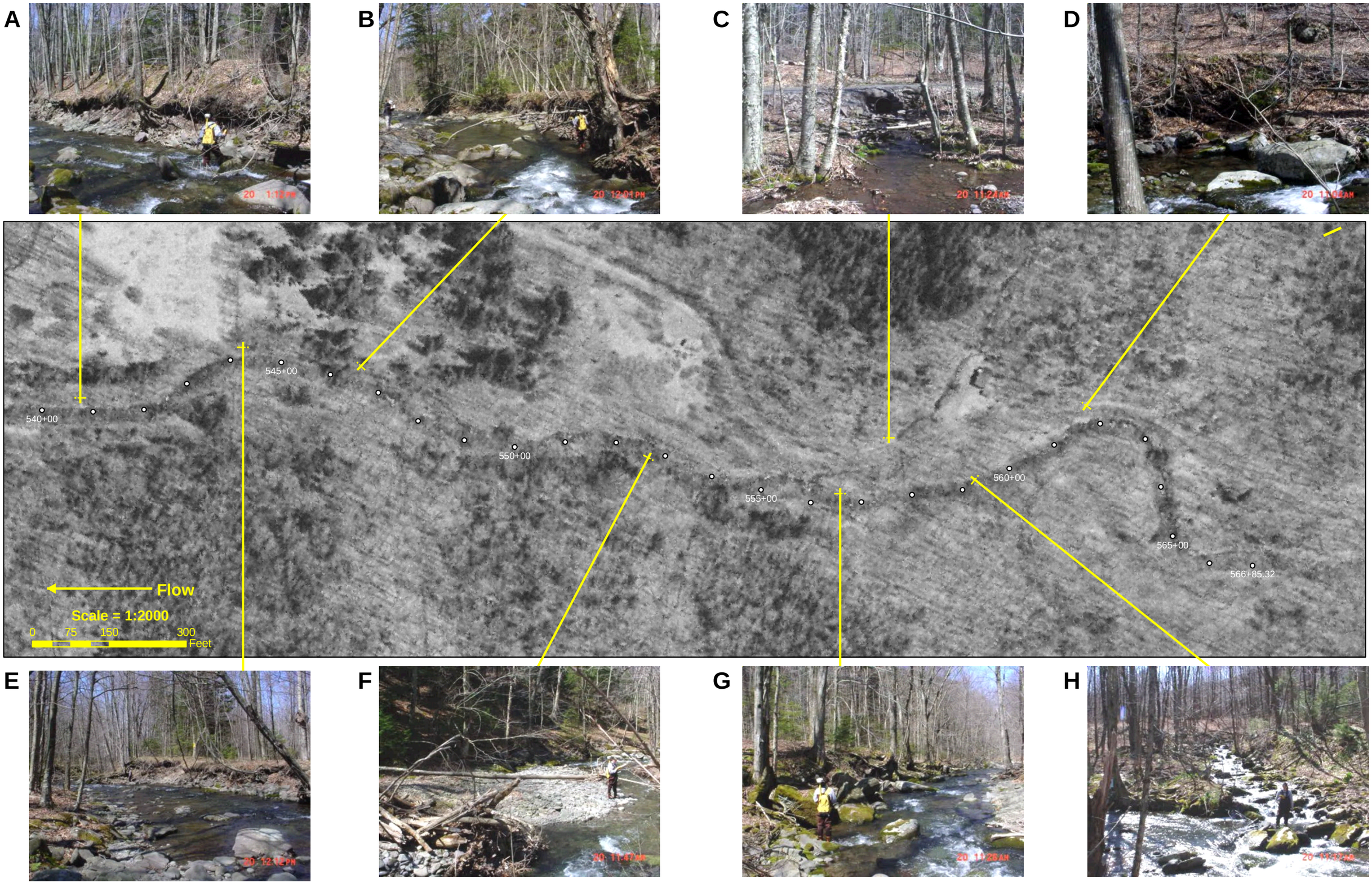



Figure 4.1.2 Management Unit 1 - 2004 aerial photography