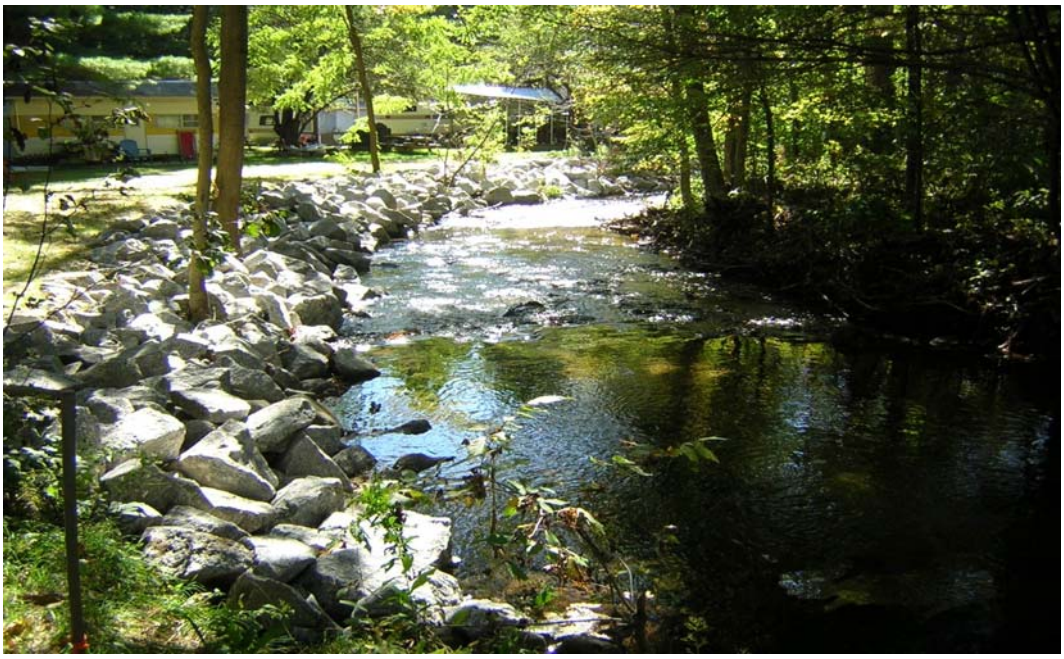
Hague Brook Restoration Project



Final Report

Town of Hague

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Community Center, 9793 Graphite Mountain Road, Hague, NY 12836

Warren County Soil and Water Conservation District

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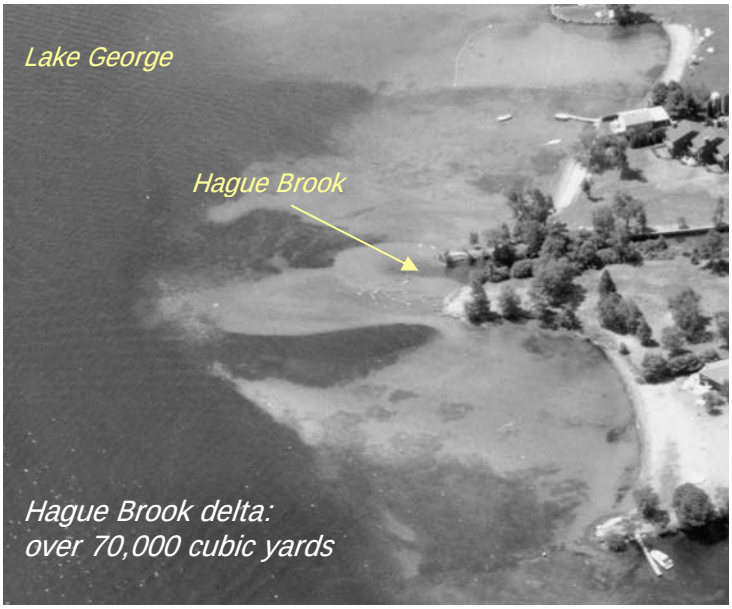
January 8, 2007

Final Report to NYS DEC

Project:	Hague Brook Restoration Project
Project Sponsor:	Town of Hague, Dan Belden, Supervisor 9793 Graphite Mountain Road, PO Box 509 Hague, NY 12836
Project Manager:	Warren County Soil and Water Conservation District (SWCD) 51 Elm Street, Warrensburg, NY 12885 (518) 623-3119.
Contact: (Report Preparer)	Dave Wick, District Manager, Warren County SWCD (518) 623-3119 district@nycap.rr.com
Report numbers:	Final
Project Timeframe:	June 2002 – December 2006
Date Report Submitted:	January 8, 2007
Contract #:	C301756
NYS DEC Grant:	$361,500
Local Match Provided:	$383,302
Total Project Cost:	$744,802

Introduction and Project History

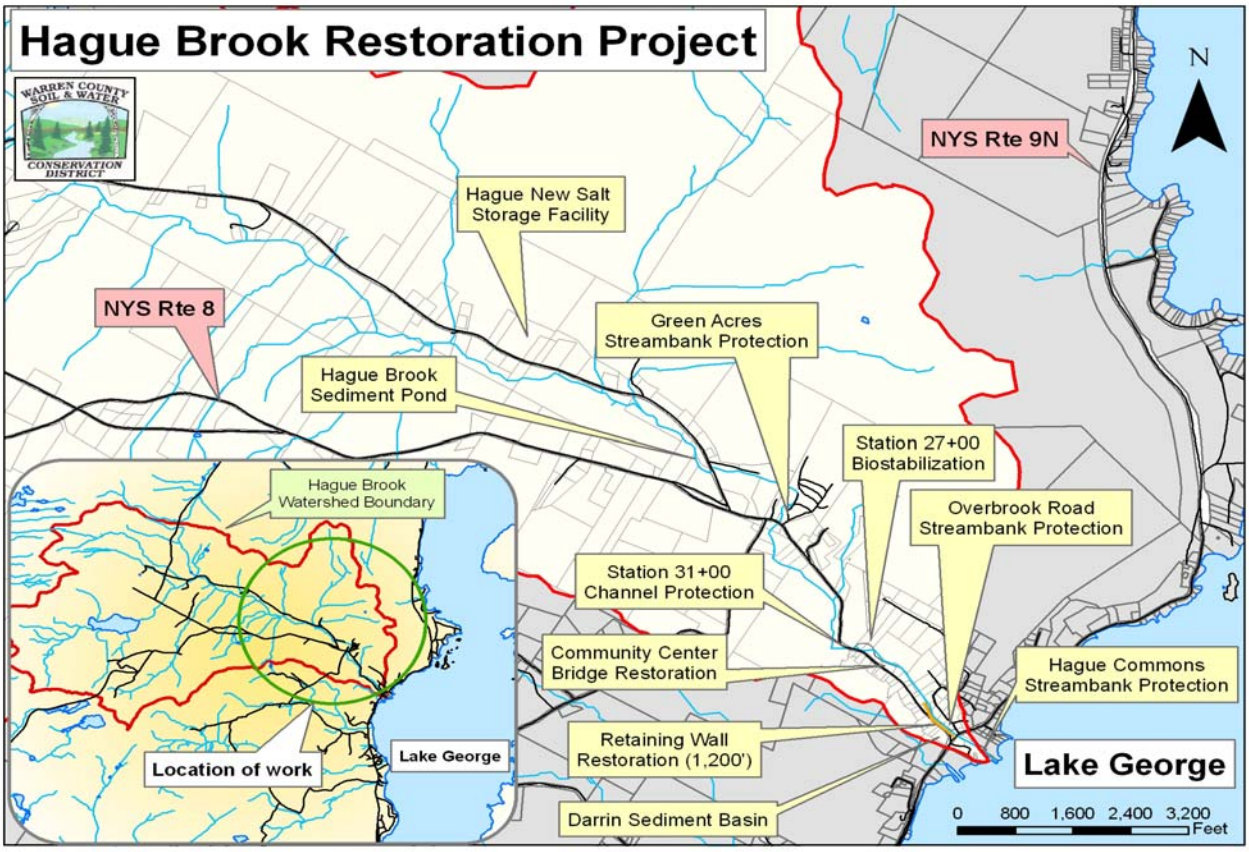
Hague Brook is one of the largest tributaries to Lake George. It exhibits a steep, primarily forested watershed, but also maintains a network of roads and developed properties. Over the years, Hague Brook has evidenced issues with excessive erosion and sedimentation, manifesting itself as a massive delta at its inlet into Lake George (see picture at right). This erosion and sedimentation has caused both water quality degradation and fish habitat issues on Hague Brook and in Lake George, significantly decreasing the well noted smelt run in Hague Brook.



To help alleviate these problems, in 2002 the Town of Hague applied for and received a $361,500 grant from the NYS Department of Environmental Conservation. To plan and implement this grant, the Town of Hague

designated the Warren County Soil and Water Conservation District as the manager for this project. Included within the original project workplan were six specific projects on the brook where restorative work was to be conducted. However, when all was concluded in this project, ten large projects were completed, plus a large scale field assessment of the brook in general. In addition to this, many of the projects envisioned in the original Scope of Work were expanded upon and increased during its planning and construction.

This project has had a tremendously positive benefit versus cost, and the grant dollars provided by the NYS DEC were stretched much further than originally anticipated. The Town of Hague, the Warren County SWCD, the Lake George Association, and the many other partners in this project exceeded the required 50% local match, bringing the final project cost to almost $745,000. Each of the sub-projects on the Hague Brook Restoration Project is described in more detail in this report, and a location map of each project is provided below.



All sub-projects undertaken and completed within the Hague Brook Restoration Project.
Map provided by the Warren County Soil and Water Conservation District.

Sub-Project 1: Hague Commons Streambank Protection

At the outlet of Hague Brook into Lake George, there existed a large concrete retaining wall which had failed over the years, causing exposed streambanks, sedimentation, and safety hazards. To mitigate this, the District worked with the USDA Natural Resources Conservation Service to design a streambank protection project for over 250 linear feet of channel.

The District put together and obtained the necessary landowner access and construction permission, and construction was

undertaken by the Town of Hague highway department and the Warren County SWCD. This project took approximately three weeks to complete, including dewatering the site, wall cutting and removal, bank grading, footer installation, filter fabric installation, riprapping, final grading, and hydroseeding. When all was concluded, streambank protection measures were installed for over 280 feet of streambank, and over 50 feet of shoreline protection was conducted. In addition, a vegetated berm was created to eliminate the property's ongoing spring flooding issue.


After

This project protects this large section of Hague Brook from undue erosion and sedimentation, and now allows a better transition between the water and the land for improved aquatic and terrestrial habitat. The aesthetics of this highly visible section of brook has been dramatically improved, and the hazards of the large broken concrete wall have been eliminated.

Sub-Project 2: Overbrook Road Bank Protection


Sandbagging

This project took place approximately 200 feet above the intersection of NYS Routes 9N and 8, in the middle of the hamlet of Hague. This section of brook was significantly out of alignment, forcing Hague Brook to flow directly into the concrete retaining wall which supports NYS Route 8. This section of wall was being significantly undermined to the point of where future failure was a serious concern.

To remedy this situation, the project partners worked to design a channel modification to improve the channel alignment and protect the new streambank. The Lake George Association hired Meyers Engineering to evaluate and design the new channel and banks. When all permits and approvals were in place, the Town of Hague rented a large tracked excavator and trucking, and the project began.

Removal of the "point" of land which negatively affected the flow in the channel was the first task. This was completed in approximately 3 days time. Following the channel alignment came the bank protection efforts. Hague Brook has significant flow volume and velocity at this section, so NYS DOT large stone fill was used as the footer blocks, followed by medium stone fill above the ordinary high water mark. The original plans called for a bioengineering plan at two feet above the ordinary high water mark, but this was modified by the engineer during construction. Final construction included a layer of stone all the way up the bank up to the crest of the hill.


Nearing Completion

The channel at this location no longer threatens the NYS Route 8 retaining wall, and the banks have been stabilized for the future. The Hague highway department and the Warren County SWCD staff undertook all dewatering and construction efforts on this project.

Sub-Project 3: Station 27+00 Bio-stabilization

This bio-stabilization project, named "Station 27" is located 2,700 feet above the outlet of Hague Brook into Lake George, and consisted of a very steep and failing clay bank on Hague Brook. Due to the soil structure and steepness of the site, several springs and weeps are present which compromise the structure of the bank. The toe of slope in the stream is bedrock, and as such, left little opportunity for base protection. The solution to address the ongoing surficial and mass-wasting erosion events lay in bioengineering solutions.

Research was conducted on the best plantings and methods for the site, given its heavy clay and wetness constraints. The USDA NRCS Plant Materials Center in New York was particularly helpful. Several plant species were identified which were suited to these soils, which had combinations of lateral and surficial root networks and deep tap root systems.

Crownvetch sprigs, joe-pye weed, dogwood, and many other species were purchased from nursery suppliers, and planting days were set up to address the site. In addition, over 200 willow live stakes were harvested from a site in Queensbury and installed at the project site that same day to ensure viability.

In both late spring and fall of 2004, over 1,000 plants were planted on this highly wet and unstable site. Staff from the Warren County SWCD spent over four days planting the site and surrounding area, with part-time staff assistance from the Lake Champlain Regional planning board and the Lake George Association.

It has been two years since the final plantings were installed, and the site is covered with vegetation and fully stabilized. The vegetative root network acts to stabilize the soils, both surface and subsurface, and the density of the plantings also minimizes direct rainfall impacts to the soils.

This was a good project on how to stabilize heavy clay soils on steep slopes in Warren County, and serves as a demonstration for similar sites in the county.

Sub-Project 4: Station 31+00 Channel Protection

The "Station 31" channel protection project is located on Hague Brook just upstream of the NYS Route 8 bridge, which is approximately 3,100 feet above the outlet with the lake. The stream at this location was experiencing a very large and steep bank failure, which was contributing significant amounts of sediment and debris into Hague Brook. Work had been done adjacent to this site in the late 1970's by the Hague highway department, but the bank failure migrated upstream of that previous stabilization work.

On this subproject, approximately 250 feet of channel was impacted and in need of restorative work.

To remediate this situation, the Warren County Soil and Water Conservation District put forth preliminary plans to dewater the channel, realign it, and provide hard armoring (heavy riprap) on the outside bend of the channel. However, as this project would be partially on state owned property, there were significant logistical hurdles to overcome. Over the period of 18 months, the NYS DEC and the Adirondack Park Agency reviewed and finally approved the workplan for this state funded project.


Access road restored

As the access to the stream at this location was also on state property, a tree removal tally was taken and an access restoration plan was developed. In the fall of 2006, construction began on this project.
The Town of Hague highway department and the staff of the Warren County Soil and Water Conservation District conducted all phases of dewatering and construction of this project. Step one was to remove trees and build a temporary access road to the impacted stream segment. Following this, the stream segment was dewatered down an overflow/secondary channel with the use of culverts and woven stabilization fabric.
With a dry channel, work began to realign the course of the stream and to armor its outside bank.


Armoring of the outside bend

The Town of Hague rented a large excavator, which was operated by Highway Superintendent Don Smith. It took approximately three days to realign the stream channel and relocate stream bed material, defining a more natural channel width. After this, over 300 tons of angular stone (24-36" diameter) was brought in from Peckham's quarry in Chestertown to armor the outside bend of the channel at the base of the large slide. This new stone acts to support the weight of the earth above it, and armor the bank against further lateral movement. The entire project was completed in three weeks.

In the spring of 2007, the face of the bank failure will be planted with similar plants which stabilized station 27+00, which will round out the project at this location.

Sub-Project 5: Community Center Bridge Rehabilitation

Old Concrete Removal

As seen in the photo on the left, the abutments of the Hague Community Center Bridge had been significantly undercut and scoured over the years. As a part of this overall Hague Brook restoration effort, a remediation effort was planned and executed to rehabilitate these abutments and protect it from future scour. The Town of Hague solicited the services of qualified engineers for this effort, settling on Clark Patterson Associates out of Albany (CPA). CPA surveyed and designed the restoration efforts, and put together a bid package for qualified contractors to bid on. A.P. Reale and Sons Construction Company out of Ticonderoga was the successful bidder, and work commenced on this effort in the fall of 2004.


Scour on the East Abutment

This project consisted of removing the old and compromised concrete and rebar to a minimum depth of six inches, drilling and posting new rebar, and pouring new footers and base of abutment walls.

To undertake this work, the project site needed to be dewatered, which was accomplished with the use of a sandbag cofferdam and hdpe pipe bypass system (see picture at right). This system had to be installed twice, once per side of the bridge.

Dewatering

Dewatering and construction of the repairs took approximately one month's time, and all work was very satisfactorily completed with no complications. The Warren County SWCD oversaw all work as per the engineer's designs, with technical assistance provided three times per week from CPA. These abutment improvements are expected to have a 30 year minimum lifespan. When the abutment improvements were completed, the Town of Hague highway department re-graded the decking to keep precipitation from seeping from the decking into the substructure (which evidences signs of calcium leaching).

With all improvements completed, it is expected that this bridge should not need significant repairs or improvements for the next 20 years.

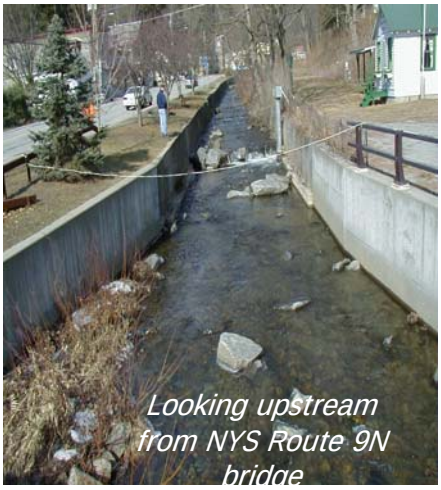
Sub-Project 6: Hague Brook/Route 8 Retaining Wall Rehabilitation


Dry packing the footer

For approximately 2,000 feet between NYS Route 9N and the Hague Community Center, Hague Brook is confined on the west side of the brook by a concrete retaining wall. Over time, this wall had become significantly undercut and in danger of failure at numerous points.

To remedy this situation, the Warren County SWCD and the Warren County Department of Public Works met with a number of contractors to discuss remedial measures to reinforce the wall. Ultimately, it was decided that the wall should be reinforced with concrete and a new footer along the majority of the length of the brook.

The Warren County DPW had selected a pumped concrete (shotcrete) contractor through their competitive bid process, and this company (Town and County Bridge and Rail) was hired to conduct this work.


Looking upstream from NYS Route 9N bridge

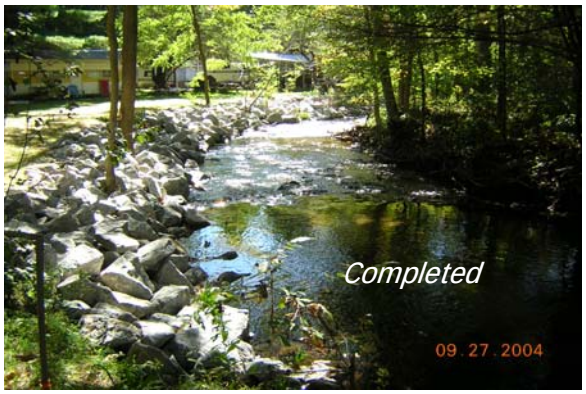
To undertake this work, the wall area was dewatered using hundreds of sandbags and pumps. Once dry, the contractor dry packed concrete mix under the undercut wall. When all voids were filled up, the entire face and base of the wall was covered with sprayed concrete to fill any remaining cracks and seams. Work on this effort took two summer low-flow construction seasons, and ultimately over 1,200 feet of retaining wall was fixed and reinforced under this contract.

Sub-Project 7: Green Acres Campground Stream Stabilization

As the overall Hague Brook restoration project was underway, a few other streambank erosion problems were identified and targeted for restoration. One such site was on the mainstem of Hague Brook adjacent to Green Acres Campground, approximately one mile above the outlet.

At this location, Hague Brook evidenced an unprotected outside bank which had eroded significantly over many years. During some large flow events, as much as five to six feet of bank were eroded away, moving the stream channel into the campground property. Small-scale attempts by the landowner over the years had not proven successful at preventing the lateral migration of the stream.

In early 2004, the landowner contacted Hague Town Supervisor Dan Belden regarding this issue, and a meeting was held to discuss solutions and costs. It was determined that this issue could be added to the Hague Brook project, and work progressed on planning and design.
The Warren County SWCD and the USDA Natural Resources Conservation Service worked jointly on a bank armoring solution to prevent further lateral movement of the brook.



In September of 2004, the Town of Hague Highway Department began work on this project. Primarily, this effort consisted of establishing an anchored toe of heavy angular stone (riprap), with angular rock above on a stable angle. Much of the larger vegetation on the bank was left in place, as the root network of these trees and shrubs work effectively to help stabilize the soils.

Additional plantings were conducted at the top of the bank to further enhance both bank stability and site aesthetics. Total project construction time was approximately two weeks. Work was conducted entirely by the Town of Hague and overseen by the staff of the Warren County SWCD.

Sub-Project 8: Darrin Sediment Basin

Directly adjacent to the outlet of Hague Brook is a small tributary which outlets into the Town of Hague Boat launch. The Town of Hague has needed to get into Lake George on many occasions over the past few decades to clean excess sediment out their public boat launch from this brook, disturbing the local lake ecology, water quality, and recreational activities.

To help resolve this situation, the Warren County SWCD recommended and designed a small in-stream sediment pond to settle sand and debris out of the stream before it reaches Lake George. The project is located on property owned by David Darrin, and thus was named the Darrin sediment basin. With plans, specs, and landowner approvals in place, the project moved forward.

In the late summer of 2006, the Town of Hague rented an excavator and provided manpower and trucking to create this sediment pond. Clearing and construction of the pond took approximately five days, and construction assistance and oversight was provided by the Warren County SWCD staff. The dimensions of the pond are approximately 25 feet wide by 40 feet long by 4 feet deep, which provides a long enough retention time to settle out sand, gravel, debris, and some silt. It is estimated that the basin will remove approximately 95% of sand and debris, and approximately 25-50% of any silt in the stream column. There is no clay to speak of in that stream corridor system, so fine particulates are not a large issue.

As can be seen from the picture, within only one month following completion the basin had already captured sediment. The Town of Hague highway department will maintain this basin annually with existing equipment, and the landowner has given permanent permission to the Town to undertake these maintenance efforts.

Sub-Project 9: Hague Brook Sediment Pond

Even with the numerous stream corridor improvement and sediment reduction projects completed within this grant, there will inevitably be additional sediments within Hague Brook that will add to the 70,000 cubic yard delta in Lake George. The source of these sediments is described in more detail in Sub-Project 11 described later in this document.

It has been shown on numerous occasions within the Lake George Basin that in-stream sediment ponds are a tremendously effective means to manage high sediment loads and delta growth without having to impact Lake George directly. These basins are designed to be easy to clean out, and very cost-effective, and have minimal if any impact on water quality during clean out efforts due to the ease of diverting the channel around the sites.

With these factors in mind, a large in-stream sediment pond was planned and designed on the mainstem of Hague Brook. The Lake George Association and the Town of Hague worked to secure a desirable location for this project, and over the period of more than two years, moved it through planning, design, and landowner easements. In the summer of 2006, the Town of Hague accepted a bid from Reale Construction, and the project was slated for construction.

In the fall of 2006, the contractor began construction of a basin which was adjacent to the stream channel (off-line). By constructing the basin in this fashion, the stream would not be impacted during construction. When the basin was complete, the contractor installed a permanent concrete flow diversion structure at the inlet to the basin. This structure allows the flow to be easily diverted back to the existing channel when it comes time to excavate the sediment from the basin (see picture). The existing stream flow is split between both the basin and the existing channel, with the majority of the stream flowing through the basin to settle out the sediment in the water.

In the picture on page 8, the in-stream sediment pond is to the right and the original channel is to the left. The permanent concrete structures allow the town to block the flow for the cleanout/excavation activities. The sediment pond is lined on both sides with angular stone to stabilize the soils, and the entire site was seeded and mulched upon completion to re-vegetate the site. This project took approximately three to four weeks to construct, and is now fully functional. It is estimated that this basin will need to cleaned out annually.

Sub-Project 10: Hague Salt Storage Facility

The Town of Hague Highway Department maintains winter time highway de-icing operations on roads owned not only by the Town, but also roads owned by the County and the State. To maintain these roads, the Town employs both sand as road traction material, plus a significant volume of salt that they purchase and store every year.


Old Salt Storage Building

The age and condition of their salt storage structure could best be described as non-functional and even a safety hazard (see picture at right). This structure was not physically sound, and lacked any real storage capacity. As such, much of the Town's salt was stored adjacent to the site, on the bare ground. Also, there was no pavement or concrete under the structure, giving way to potential groundwater contamination. Hague Brook is approximately 200 feet away from the site, and the depth to water table is less than 8 feet. With these issues, it became readily apparent that a new salt storage structure was necessary to protect not only Hague Brook but the aquifer feeding into it.


Footer Pilings of New Structure

To provide environmentally proper facilities, the Town of Hague and the Warren County SWCD received DEC approval to add a new salt storage facility within this grant. Thanks to a pre-developed and very cost effective design provided by the Warren County Department of Public Works, there were no engineering costs to the project. In addition, as this same structure was recently completed in the Town of Bolton, the bid packets were already largely developed which minimized those costs as well.

In the early fall of 2006, the Town of Hague solicited bids for a new salt storage structure, and awarded the bid to S&R Construction out of Corinth. The Warren County SWCD administered this project and acted as project manager. With some assistance from the Town of Hague highway department, the project was completed within a timeframe of less than one month. When the structure was complete, the Town laid six inches of asphalt in the base of the facility, meeting current salt storage structure recommendations.

This facility now stores up to 300 cubic yards of salt for the winter road de-icing operations. All salt is stored within this facility, leaving none exposed to the elements. With the new asphalt base, any chance for groundwater contamination has been eliminated. This very important project was planned, designed, bid, and constructed for less than $100,000. Given that costs of similar state designed facilities were double and even triple the cost of this project, the Town of Hague and local environmental organizations are tremendously pleased at the outcome.

Completed Structure

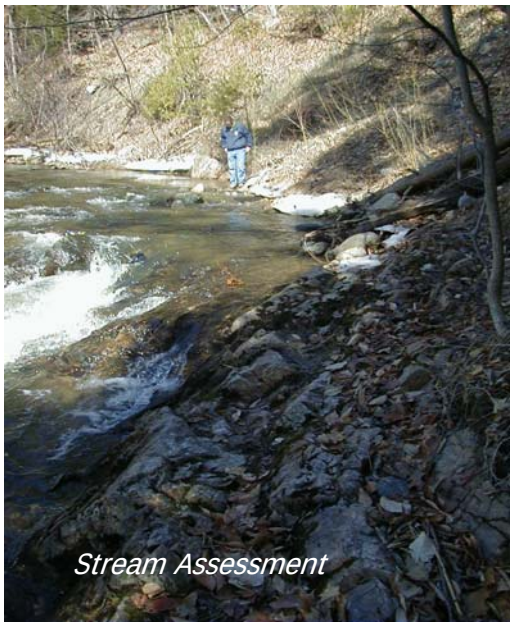
Sub-Project 11: Overall Stream Corridor Assessment

When this project was originally envisioned, it encompassed six major subprojects to protect Hague Brook. However, upon further examination it became apparent that a larger assessment of the smaller tributaries of the brook might reveal other sources of erosion and sedimentation to the brook.

This subproject encompassed a walking of many miles of Hague Brook and its tributaries to discern whether other significant and solvable problems existed. If new issues were found, and cost-effective solutions were available, they were added to this overall stream restoration effort.

Over the period of three field seasons, staff from the Warren County SWCD walked more than 8 miles of Hague Brook and its tributaries, logging any issues as noted above. Surprisingly, within these sections of stream, there were very few large sources of sediment or other pollutant identified which are currently impacting Hague Brook.

What was found, however, were significant stretches of stream which had relatively low banks which appeared to be eroding at a very slow rate. Many hundreds (if not thousands) of feet of channel exhibit near vertical banks, minor undercutting and soil loss. Based upon field observations, these sections of channel likely account for a significant portion of the sediment load exhibited within the stream system and ultimately the delta in Lake George.



Stream Assessment

The question then becomes one of management. Are these sources of sediment of "natural" processes or are they somehow human induced through development of the watershed? As watersheds become developed and more impervious surfaces exist, the rate of runoff to streams increases. To accommodate this new flow volume and peak, the channel responds by altering its dimensions. This usually means that the bankfull discharge volume is seen more often, thereby increasing the rate of channel erosion.

Is this the case in Hague Brook? Has it reached a threshold whereby the stream channel is overwidening due to upland development pressures? To our knowledge, no study to date has been conducted to determine the answer to this question. However, given the relatively low level of development in the upland sections of the watershed (where many undercut banks exist), it would appear that the process is more natural than human induced. It would be a valuable exercise to undertake such a study for the future, not only for Hague Brook but for other major streams within the Lake George Basin.

Project Summary and Conclusions:

The Hague Brook Restoration Project was tremendously successful in achieving its stated deliverables. The original workplan called for the completion of six major initiatives to protect Hague Brook. In fact, there were ten major projects completed, plus a much more detailed field review of Hague Brook. The intent of this project was to reduce sedimentation to Hague Brook as much as practicable through the use of Best Management Practices and stream corridor protection initiatives. At the close of this project, it can be stated with some confidence that all practical measures have now been completed to minimize excess sedimentation and associated phosphorus loading to Hague Brook.

This project was a successful collaboration between the Town of Hague, the Warren County Soil and Water Conservation District, the NYS Department of Environmental Conservation, the Lake George Association, and

the Warren County Department of Public Works. With all involved parties working to address these issues, much was achieved to improve the Hague Brook stream corridor and protect its receiving waterbody Lake George.

Financial Summary For This Project

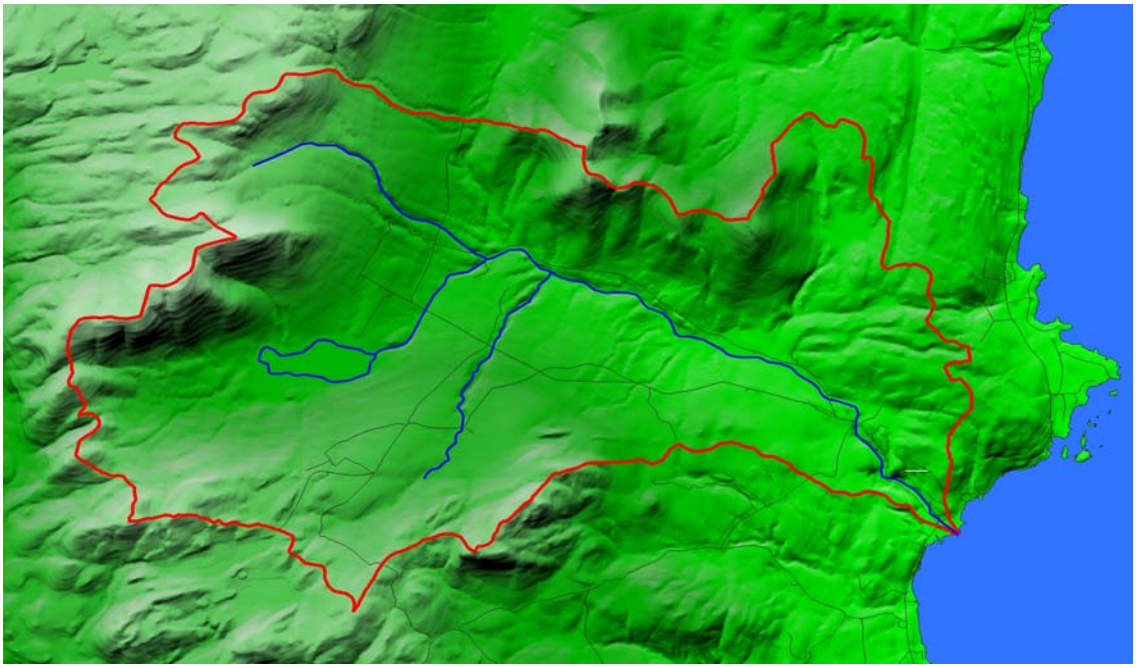
This project was funded through the Environmental Protection Fund as a $361,500 grant to the Town of Hague, with a $361,500 local match requirement. As the project concludes, the local match provided for this project was $21,802 in excess of its requirement. In terms of percentages, the local share of this project was approximately 52% of the project total cost, and the state share of the project was 48%.

Grant Amount: $361,500

Local Match Provided: $383,302

Total Project Cost: $744,802

Item	***Budgeted $***	***Actual $***
Personal Services	197,730	173,506
Travel	11,315	7,603
Equipment	81,280	58,940
Supplies and Materials	52,675	34,657
Construction Contracts	318,000	416,214
Engineering Contracts	57,000	53,882
Legal and Miscellaneous Contracts	5,000	0
Totals	$723,000	$744,802



Digital Elevation Model of Hague Brook Watershed. Image courtesy of the Lake George Association.