Discovery Report Appendix P

Essex County Soil and Water Conservation District
2012 Stream Inventory Report
HUC 04150408

September 2016

Federal Emergency Management Agency
Department of Homeland Security
26 Federal Plaza
New York, NY

ESSEX COUNTY SOIL AND WATER CONSERVATION DISTRICT STREAM INVENTORY REPORT

FUNDED BY
AMERICA'S GREAT OUTDOORS PRESIDENTIAL INITIATIVE AND 2012 PART B PROJECT FUNDING NYSEPF
SUMMER 2012

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EXECUTIVE SUMMARY

Data was collected from individual streams to create an inventory of damage done by Hurricane Irene in Essex County. This data was used to create a scoring system to determine a ranking of the sites. Maps were also created to display the locations of the sites. The created maps show that areas located around Keene, Keene Valley, and Upper Jay experienced several sites of erosion, blockages, pile ups, side channels, combinations, and restoration. The streams that had the most sites were located in Keene. These streams are Styles Brook and its tributaries and Gulf Brook. Other streams with many sites include Sprucemill Brook and its tributaries, Lewis Brook, and Johns Brook. These streams originated at high elevations and experienced several grade changes that affected the velocity and carrying capacity of the streams flow.

There are two sets of scores however, they both work the same. Each requires a score to be given for each variable. The score is based on the descriptive categories each variable was broken up into. Once all of the variables have a score the mean was taken to provide an overall score for each site. These mean scores were split into high, medium, or low priority rating based on where they fell in the range of means. A site with a high priority ranking should receive attention before a site that received a low priority rating. The second type of score has proximity and accessibility factored in as two of the variables instead of just the variable associated with the problem site (erosion, blockage, etc.). An additional difference occurs between the combination scoring system and the other types of sites. Since combinations were not of all the same types, a sum was used instead of a mean. This allows us to compare the combination sites to one another based on how large there sum is despite one being a blockage/pile up and another being an erosion/pile up.

When individual sites were scored, several sites were listed as a high priority. These were general sites that were large in size, were formed by large materials, had undercut or steep banks, and other such attributes. Once proximity and accessibility were factored in, these sites received lower scores because the larger sites were generally located far from infrastructure and accessibility was poor. The reason for this is because these sites are located mainly in areas that see a grade change that is not located near anything to affect. These larger sites should still be addressed as several are prohibiting fish passage, are creating new channels through forested lands, inhibiting the streams flow, and, if broken (blockages, etc.) or eroded further, could dump tons of unwanted sediment and organic material downstream. On the other hand, smaller sites had low priority ratings prior to adding in proximity and accessibility. Once these two attributes were factored in, some of these sites received higher priority ratings. These smaller sites are likely visible to the public and although they are small in perspective are likely very large to those affected and act as good projects to get good publicity for less effort and money.

INTRODUCTION

Rivers, brooks and streams are important environmental features for several reasons, including supporting fish populations, providing clean drinking water, recreation opportunities and nutrient cycling and transport. The movement of water has drastic effects on the formation of land features and the characteristics of those features. Generally, a system in northern New York receives multiple flooding events throughout any given year. These annual floods can cause some issues within the watershed but are typically minimal due to their consistent presence. Five year and ten year floods can be more devastating to the system but are typically concentrated to areas that have been weakened and expedite the erosion process of the annuals. This expediting is what can create larger problems due to increased sediment and organic matter transport. Five and ten year floods can be problematic, but when they are scaled up to a 100 year or more flood event the result is typically catastrophic. Damages that occur include severe eroding, blockages, pile ups, side channels, and in many cases combinations of these. These damages are typically seen and occur naturally however, human activities in riparian areas can exponentially worsen the flood event effects. In addition to the human factors, naturally occurring factors such as slope, soil type and vegetation in the immediate area of the flood can dramatically worsen or limit the effects. Hurricane Irene, which affected the Adirondack region in New York State in August of 2011, was estimated to be between a 100 and 500 year flood event. The storm dropped anywhere from 10 to 15 inches of rain over a day and a half period on an already saturated system due to previous storm events in the two weeks prior. This created a tremendous run off event that broke many flood records across the New England. During the summer of 2012, a stream inventory was completed that shows the types and sizes of the damage, where these sites occurred and basic description so that data is available to compare and rank the current damages so that the more dire locations can be addressed and to identify future problem areas. The ability to expedite the remediation of the heavily affected areas will greatly improve the quality of the vast fresh water resource in Essex County.

STREAM DESCRIPTIONS

General Observations

Flat, open areas on the side brooks or a flood plain allows for water to slow in both velocity and force preventing the severe damage/ erosion found on steeper sites. The transitional areas from steep to flat are typically depositional as the water dissipates it's power it loses the ability to transport much of which it has eroded. The steepest parts of the brooks were able to funnel water quickly, so blockages were minimal, while erosion sites were generally appalling. In areas where the steepness levels out, many blockages occurred causing erosion or side channel formation due to the back up and diversion of water. Several areas near vital roadways or damaged property have already been restored. Maps of many of the most severe reaches described below are attached in appendix A as is an overall map of the area inventoried (Map 1).

Styles Brook

The brook is located in the towns of Keene and Jay in Essex County, New York (Map 2a and 2b). Styles Brook is approximately 6.6 miles in length which originates in the Jay Mountain Range and deposits into the East Branch of the Ausable River. Approximately 5 miles was inventoried for erosion, blockage, pile up, side channel, and restored sites. In most places, Styles Brook is within half a mile from County Route 52 (Styles Brook Road, Morrison Road).

Despite this short distance, the abundance of steep terrain and uneven ground makes accessibility to the brook very difficult for most heavy equipment Access was available in some locations, but most would require road construction. The brook is steep in most places, but flattens out from Jay Mountain Road to O'Connel Road. These flat areas saw minor damage, but are easier to access and restore. Erosion sites located in the flat areas are mostly on farm fields and are dropping sod from the fields directly into the stream. Blockages present in this area are mainly due to past or present beaver activity. These may become an issue due to proximity to farm fields and the bridge on O'Connel Road. In the steepest parts of the brook with high bank gradients and sharp turns, erosion sites were at their worst. The areas on Styles Brook that saw the worst damage were located where the steepness decreased and the flow of the brook decreased. Lots of sediment from upstream was deposited. The blockages located at these areas were generally large in size and consisted of trees starting the blockage and sediment of several different sizes piling up behind. Some of the blockages have forced the brook to change course or flow under the piled up sediment. Several culverts, bridges, and road sections had to be restored due to flooding. Also, the mouth of Styles Brook into the East Branch of the Ausable River had its banks reinforced with riprap and planted with winter rye and willow cuttings. Styles Brook and its tributaries, The Glen and Madden Brook were hit very hard by Hurricane Irene.

The Glen

The Glen is a tributary of Styles Brook and is approximately 2 miles in length (Map 2a). It originates at the summit of Saddleback Mountain and feeds into Styles Brook, with about half a mile located on state owned land. The Glen is difficult to get to at the mouth and origin, but the center is easy to get to. This is due to flatter terrain and existing road access on privately owned land. Approximately 1.5 miles of The Glen was inventoried.

The brooks channel is very steep from its origin and gradually gets less steep closer to Styles Brook. Due to the steepness of this stream, large areas of the banks experienced severe erosion. Some areas saw erosion on both banks for several hundred feet. Blockages are also present, one may have been intentionally made to block an overflow or side channel to protect personal property. One severe blockage is located on this brook that has affected about 3000 feet upstream. This blockage is accessible from private property and should be addressed to prevent further damage.

Madden Brook

Madden Brook is a tributary of Styles Brook that is approximately 2 miles in length, of which 1 mile was inventoried (Map 2a). The brook originates in a mountain valley wetland which can be seen from Jay Mountain Road and feeds into Styles Brook. Madden Brook has easy to access due to proximity to the road and gentle grade.

Compared to Styles Brook and The Glen, Madden Brook is not as steep with a gentler grade and has lower banks. The damage on this brook is at its worst as it gets closer to feeding into Styles Brook. Here blockages become a problem and are located closer to residencies. Pile ups in this area may also cause problems if they become loose and become part of the blockages. Several of the erosion sites located on Madden Brook could be less threatening if current materials are used to fortify banks. At the base of many of the eroded sites are large sediment deposits and trees that can be moved and strategically placed at the bank to protect it from future damages. Areas where the brook is near the road have been replaced where they were washed out. A dam that is near the intersection of Kiln Brook and Madden Brook was washed out and is in the process of being restored to a natural state.

Sprucemill Brook

Sprucemill Brook is the longest of the streams inventoried, with a length of approximately 13 miles. Approximately 6 miles was inventoried (Map 3). Sprucemill Brook originates from a mountain valley wetland and feeds into the Boquet River. This brook was broken into two sections; the east, which is flat with a large flood plain, and the west, which is much steeper gradient and faster current. The eastern portion of the brook is easier to access as it follows County Route 12 (Stowersville Road). The western portion of Sprucemill Brook is much more difficult to get to except at stream crossings and a few private properties. The eastern part of Sprucemill Brook is flat in most areas and has a large flood plain to help dissipate the streams energy. Because of this, damage done to this portion of the brook is minimal. The main damage done was the upheaval of bridges crossing the brook. Most have been repaired and are better than they were before.

The western portion of Sprucemill Brook saw extensive damage. The most western part of the brook that was inventoried had several turns in which the erosion banks were steep and tall. As a result, erosion damage was very effective here. In the area between Carlott Road, Wells Hill Road, and Goff Road, several blockages and erosion sites were present. This area is an example of the deposition in the transitional gradients. Not many areas on Sprucemill Brook have been restored except for bridges and culverts.

Derby Brook

Derby Brook is a tributary to Sprucemill Brook and is about 6 miles in length. Approximately 3 miles was inventoried (Map 3). Derby Brook originates near the summit of Saddleback Mountain and feeds into Sprucemill Brook. Lots of woody debris has caused flat areas of this brook to jam up. Derby Brook has several quick turns in the flat areas which may account for the large amount of stuck debris. Several blockages also occur, again at a gradient change, which will contribute to future problems. Many sites documented are easily accessible from NYCO Minerals property roads, private property, or town roads. Some areas are inaccessible because wetlands have formed.

Roaring Brook

Roaring Brook is approximately 6 miles in length and about 2 miles was inventoried (Map 4). The brook is located in New Russia in the town of Elizabethtown. The brook can be accessed from Roaring Brook Road off of County Route 9.

Most of the damage is located at grade changes and where quick turns in the brook occur. One noted site that is located near the upstream end of the inventory is a hillside that has washed out under the existing vegetation. This floating vegetation hangs like a fabric draped over the hillside for approximately a 30 by 50 ft area. Once the vegetative matter that is there loses hold, the erosion from the site will be even worse and a large amount of vegetative matter into the brook. Access to this brook will be difficult past the existing Roaring Brook Road. An old logging road is present near the brook; however, work would have to be done to reopen the logging road as it is narrow. A privately owned road on the north side of the brook may be a more feasible access point. The mouth of Roaring Brook has been rip-rapped, as well as a bank that had undercut the road. The restoration at the mouth of the brook could benefit from a planting and habitat restoration for fish and amphibians.

Lewis Brook

Lewis Brook is approximately 3 miles in length of which 2 miles were inventoried. The brook originates from the Seward Range and feeds into the Ausable River. Located in Upper Jay, NY, this brook can be accessed from County Route 12, Bartlett Road, and Crowningshield Road.

The most severe damage is located west of Bartlett Road. This area is flat and shows signs of past beaver activity. Much of the beaver dams seemed to have created a large blockage that is changing the course of the brook and depositing more debris behind it. Also, a reservoir which was removed after flooding smells strongly of sulfur. Access to this brook is decent on the west side of Bartlett Road using woods trails. Approximately 2,000 feet of the stream is located on state land east of Bartlett Road. Access to this part would be difficult. Past the state land, access is reasonable from County Route 12 and private property. Restored areas on this brook include two bridges and riprap at the mouth.

Gulf Brook

Gulf Brook is approximately 4 miles in length. About 2.5 miles of this brook was inventoried (Map 5). The brook originates at Weston Mountain and feeds into the Ausable River. Although a majority of the brook is located between Jackson and Hurricane Roads in Keene, NY, accessibility is difficult due to steep terrain.

Erosion was the worst damage inventoried on Gulf Brook. Steep, high banks were torn off. Some areas had water running over bare clay sediment. Although access is limited, it is advised that something as simple as a planting be done to reduce the amount of sediment being pulled away. Blockages were also a problem due to several grade changes. Several restored sites were inventoried near the mouth of this brook where it meets the Town of Keene.

Johns Brook

Johns Brook is approximately 8 miles in length and about 2 miles was inventoried. The brook originates between Mount Marcy and Haystack Mountain. Several parts are accessible by foot on hiking trails or an all terrain vehicle trail. A majority of land on the west side of Johns Brook is state land. Johns Brook is located in Keene Valley in the Town of Keene off of State Route 73 with trail access on Interbrook Road.

Erosion was the most noticed problem on Johns Brook. The brook was wide and is capable of holding large quantities of water, so blockages and pile ups were sparse. Areas near the town experienced some sides channel damages and erosion that will cause problems for home owners. Riprap was used at the mouth of the stream to stabilize the bank, but habitat restoration would be beneficial.

Stacey Brook

Stacey Brook is about 6 miles in length with 1.5 miles inventoried. Much of Stacey Brook flows through large land holdings. Access is limited unless near Spring Road or any road access points due to steep terrain. The brook can be found crossing County Route 44 and Spring Road. Areas along either of these roads and downstream form County Route 44 have easy access.

Due to the brooks curved nature and steep, wooded banks, blockages were a common occurrence. Most of the blockages are small and can be removed with hand tools as they are smaller trees. Two of the blockages recorded were larger and should be addressed as one is close to a culvert and the other is creating problems for a hardwood wetland.

Ausable River

Town of Keene

Pile ups were the most common problem with the East Branch of the Ausable River in the Town of Keene. Several are accessible from County Route 73 and State Highway 9N while others are not as accessible. In the southern portion of Keene, combinations of pile ups, erosion, and blockages occur. These combinations were generally large and should be addressed as soon as possible if near a road. Some of the pile ups are visually displeasing, but may not cause problems in the near future. A few of the larger points will cause problems and will need to be addressed, even if it is just removing a little at a time to keep costs down.

Erosion begins to be an issue in the northern portion of Keene. About half are easily accessible and are near houses or roads. One of the erosion sites that have less access will dump trees and sediment into the river near a current pile up.

Restored points were noticed on several private properties, such as sediment removal, grading, and toe wood structures. On town or state owned land, bridges and culverts with riprap were the most common repairs.

The steepness of Keene's southern portion attributed to severe damage. Once it flattened out in the Village of Keene Valley, less severe damage was noted. With over 15 tributaries entering into the river in Keene, sediment from these brooks may have causes more issues than other sections of the river.

Town of Jay

Jay has fewer sites than Keene; however pile ups were still the most common. These pile ups are smaller, but can cause future problems when located near roads or houses. Pile ups with trees on them may collect more sediment in the future and should be watched to prevent river congestion. When possible, some sediment or woody debris should be removed if located near infrastructure.

Restored sites were also common in Jay. Some still needed some habitat and additional stabilization work to be done, but it is better than nothing. Types of restoration included sediment removal, riprap, and erosion mats. All of the restored points were located near houses or roads.

Jay's river valley is not very steep and has a good floodplain for a majority of its length. This may have resulted in less damage seen in the area. Problems were commonly noticed where infrastructure was close to the river.

Town of Wilmington

Only one site is currently recorded for the Town of Wilmington. More inventory work should be completed for a better analysis of this section of the river.

The site that was inventoried was an erosion of the bank near County Route 86. Similar issues occurred at other parts of the road in other towns and should be repaired to prevent costly damages.

Town of North Elba

North Elba witnessed erosion and restored sites. Restored sites included bridges, culverts, riprap, and toe wood structures. Private landowners that had restored sites are helping to protect banks while the town and state owned land have focused on bridge and culvert repairs.

Recorded erosion sites on the river in North Elba are all easy to access by roads. These sites should be looked at for protection as they are dumping large quantities of sediment near the headwaters of the West Branch of the Ausable River. The inventoried sites are located either on state land or on large land holdings.

SITE TYPE DESCRIPTIONS

Overall

General

A scoring system was used to determine which sites will need attention sooner than others. Sites with a high score, usually around 75 to 100, are ones that should be attended to soon. With a lower score, the site may be smaller, farther from structures or harder to access and therefore does not need to be addressed immediately or may be too costly to attempt.

Proximity to Infrastructure

The description is included in each site. This measurement was recorded using ArcGIS 9 by measuring from the point to the nearest road, house, bridge, right of way, railroad, or similar structure. In most cases, the measurement was taken downstream of the site, but if it was possible that as structure upstream would be affected and was closer, then this structure was used. All measurements are recorded in feet and any structure 2500 feet away from the point was given a low score, as it would not cause an immediate affect or damage. If a point was close to a structure, it received a higher score.

Accessibility

The accessibility to sites is a judgment of how easy or difficult it is to get to a site. Requirements for accessibility were based on heavy machinery mobility to the site. Sites with smaller areas may be simpler to use hand tools for removal. Wetlands are taken into consideration as best as possible, as is the experience we had traversing the area. Descriptions of the four categories used to score the sites are provided in Table 1.

Table 1: Descriptions of the four categories and rational used to score sites in terms of their accessibility.

Accessibility	
Poor	Point of access over 500ft from stream with dense forest and or steep terrain
Moderate	Point of access less than 500ft from stream with dense forest or steep terrain
Good	Point access less than 500 ft from the stream with relatively flat or gradual terrain
Existing	Site present on access point such as trail, logging road, road or field.

Erosion

Erosion sites had four variables other than proximity and access that were used to score them. The variables and scores describe the sites Erodibility or how easily the site will release sediment. The variables are described below and can be seen in Appendix B (Table B1).

Area

The area is a basic measurement to show the size of the eroded bank. Height and length were estimated for this measurement. All units are in square feet.

Bank Slope

The slope of each erosion site was categorized as one of four categories, gradual, moderate, steep and undercut (Table 2). Undercut slopes were determined by vegetation sliding off the bank or those with an inverted slope. Several current and future problems exist with undercut slopes. They drop large chunks of sediment and trees into the stream, creating pile ups and blockages.

Banks with high slopes were those with a 2 to 1 or greater ratio, rise to run. These were very steep banks and very difficult to navigate. Generally, not much is holding the sediment on these banks.

Moderate slopes are those around a 1 to 1 ratio, rise to run. These slopes generally had some vegetation and more stability due to build up at the base of the slope.

Banks with a low slope were those with a 1 to 2 or less ratio, rise to run. These were only marked when vegetation was not present and sediment was visibly entering the water.

Table 2: Descriptions of slope categories used to score erosion sites.

Bank Slope	
Gradual	Approximately a 1 foot to 2 foot ratio rise to run
Moderate	Approximately a 1 foot to 1 foot ratio rise to run
Steep	Greater than a 1 foot to 1 foot ratio, usually 2 foot to 1 foot
Undercut	Typically a ratio similar to the steep ratio with an overhang present

Sediment Stability

Three categories were used to score erosion sites based on their sediment stability, loose, mild and firm (Table 3). Loose sediments were characterized as falling freely from the slope or those that sunk when pressure was applied. Generally, these were sandy soils, but occasionally they would be loamy soils with no vegetation or flooded clay.

Mild sediment stability was characterized as soil that could tolerate some pressure, but still gave way. These were soils that were generally a sand and clay mix or had vegetation present. Firm sediment stability was given to areas where sediment does not give way to pressure or water is flowing directly over with minimal erosion present. This is generally characterized by clay soils and those with a high percentage of vegetation.

Table 3: Descriptions of sediment stability categories used to score erosion sites.

Sediment Stability	
Firm	Solid, doesn't move when touched by hand and usually more clay type soils
Mild	Holds together but pieces fall when handled and usually a clay-sand mixture
Loose	Naturally slides and moves without touch and tends to be a sand-cobble mix

Percent Vegetation

This measurement shows how much a bank is vegetated. Those with a high score (70-100) are banks with little vegetation. This can be used to determine which sites need plantings to help protect the bank from future damage. A bank with more vegetation will be able to protect itself better than one without vegetation due to the increased structure the roots provide to the soil.

Blockage

Blockages have one less variable than erosion not including proximity and access. The criteria and possible scores can be seen in Appendix B (Table B2).

Volume

The volume is a basic measurement to represent the size of the blockage. The length, width, and height were estimated and multiplied to get the volume. All units are in cubic feet.

Extent

Blockage sites were classified as one of three categories, full, partial or expected (Table 4). Full blockages are those where water is backed up and flow is inhibited. Common characteristics are water in the flood plains, water higher on one side, and deep scour pools. These are problems now and in the future for fish passage, more material building up, and if the blockage breaks apart, lots of debris will move down stream.

Partial blockages are those where the flow is partially inhibited in one location. These generally were blockages located on part of the stream or were above the moving water allowing below bank full flows to pass underneath. Some of these are current problems, as the blockage directs water into banks and is eroding them. Others may be future problems if more material becomes part of the blockage or if the blockage is dislodged and added to others downstream.

Expected blockages are those that are not yet inhibiting flow, but may under the right conditions. These were marked if several trees were leaning, eroded banks had dropped trees to just above the stream height or a large tree that will catch other debris in future floods.

Table 4: Descriptions of extent categories used to score blockage sites.

Extent	
Expected	Typically trees or a sliding bank that are hanging over the water or beginning to break off into the channel
Partial	Part of the channel is blocked forcing water around the obstruction
Full	Channel is completely blocked, typically with backed up sediment and or water behind

Material

The material that each blockage was made of varied greatly as did the degree of difficulty to remove these materials. A buried tree is harder to remove then an exposed one and one buried in large boulders is harder to remove then one buried in pebbles. To account for this variation a multitude of categories were created to score the sites on (Table 5). Small timber had the lowest score, as this would be easy to remove with handsaw. Trees in this category are about 14” or less in diameter. Large timber was deemed as trees more than 12” in diameter. Some of these blockages might be a simple removal, but due to weight, may be more challenging with hand tools.

Small rock sizing was based on what type of equipment would be able to access the site. For example, if a site can only easily be accessed by foot, the rock size is only what can be removed by hand tools, while sites where heavy machinery can access, the small rock size is greatly increased but remains no larger than cobble or small boulders. A combination of small rock and exposed timber was used for rock blockages with timber that was laid on top of it. These were generally smaller blockages. Small rock with buried timber was one of the most common blockage types observed. Generally, trees were caught between two large rocks or other trees and rock piled up behind. Several of these sites were very large, and will cause future problems.

Large rock, similar to small rock, was based on the type of equipment available to access the site. Even in areas where heavy machinery could reach, the rocks in this category were very large and may not be easily moved. Large rock with exposed timber combinations were generally where trees had gotten caught up in large rock. These were mostly partial and expected blockages, as they have the potential to pile up large amount of debris behind and on top becoming large rock, buried timber. This was the most difficult to remove blockage simply because no part is easily removable without heavy machinery.

Table 5: Descriptions of material categories used to score blockage, pile up and combination sites.

Material	
Small Timber	Only timber less than 12in dbh.
Large Timber	Contains only timber, of which some is greater than 12in dbh.
Small Rock	Contains only rock and a majority is less than 10in x10in x10in or hand removal size. Occasionally the size was expanded a few inches if machinery had easy access.
Combination (Exposed Timber, Small Rock)	Timber of any size on top of rock or sediment described as small rock.
Combination (Buried Timber, Small Rock)	Timber of any size within and possibly on top of rock or sediment described as small rock.
Large Rock	Rock far greater than can be removed by hand and a majority of the time large enough that an excavator would have to remove each rock individually or were immovable.
Combination (Exposed Timber, Large Rock)	Timber of any size on top of a deposit of rock described as large rock.
Combination (Buried Timber, Large Rock)	Timber of any size under or within a deposit of large rock as described.

Pile Up

Pile ups have the same number of variables as blockages with only one different variable. That variable is density instead of extent because a pile up is not necessarily within the channel but how tightly packed it is would affect the removal process. The criteria and scores can be seen in appendix B (Table B3).

Volume

The volume of the pile up was recorded to show its size. This measurement was gathered using estimates on the height, length, and width of the pile up. All units are in cubic feet.

Material

The material break up is the same as for blockages with small rock, large rock, small timber, and large timber combinations (Table 5). Instead of blocking the stream’s flow, however, the flow is not affected or is redistributed around the pile up. The materials for pile ups are important in relation to other nearby pile ups, blockages, and infrastructure. If a future flood is able to move these pile ups, they can combine with other pile ups to form new blockages or combine with existing blockages to create larger blockages.

Density

The density of each pile up was determined due to its effect on the removal. The density was classified in three categories, high, medium and low (Table 6). A pile up with high density represents sites that are tightly packed together. Most of these sites are sediment or rock pile ups, with a few high density timber pile ups. Medium density pile ups were those that were close together, but not tightly packed. These were generally sites with larger timber pile ups. Low density pile ups were those that were spread out. These generally consisted of scattered timber.

Table 6: Descriptions of density categories used to score pile up and combination sites.

Density	
Low	Scattered or very loosely packed rock or timber
Medium	Timber and/or rock packed together but some space between
High	Timber and/or rock packed tight together with little to no space between

Combination

Combination scores were based on the sum of all the variables' scores for each of the above site types that were part of the combination (Table B4). If a combination did not have a certain site type, it received all zeros for that category. Scores were then summed to create a total score. This site type had the greatest range of all site types. A percentage was also given to these scores to better understand the scoring.

Side Channel

Side channels were not included in the scoring system, however, they are noted. Most of the side channels would not be harmful in the future and will provide good relief channels. A few were a problem due to erosion, pile up and blockage sites that occur on the side channel. These sites may be visited once other sites are addressed or after future events to inspect for increase in severity.

Restored

Restored sites were noted for two purposes, to have a record of what has been done and to determine what extent the restoration was completed. Suggestions for additional work if needed were given and typically consisted of increasing the heterogeneity across the restored areas for better habitat in addition to increased stability. These sites were common near infrastructure and where roads had been washed out. The types of restoration inventoried included riprap, debris removal, toe wood structures, culvert replacement, plantings, bridge replacement, weirs, and log or rock veins. Each site was judged on the improvement of the site. This was a yes or no option, with most restored sites receiving a yes.

Completeness of a site represented what the site looked like, where it could be improved or if it was done. A site that needs works was either unfinished, done to suit emergency needs or will cause future problems. These restored sites should be readdressed as soon as possible to prevent further damage to the site. A site with a could use work rating is better, but still looks to have been done to fulfill needs as quickly as possible. These sites lack plantings, habitat improvement or contain exposed or weak areas that need more protection. Sites with moderate need were well put together, but lacked a good finished product. An example would be a site that had sediment moved onto the bank with a few plantings on one side, with the other bare and no habitat in the stream for fish. A site with a rating of okay as is will naturalize itself in a few years as growth was currently observed and the repairs looked good. Further plantings at these sites were recommended to help expedite the process. Restored sites with a rating of done were those where everything looked to be in place and was growing well. Done sites sometimes had additional plantings recommended just to ensure the site for the future.

ANALYSIS

Sites with large erosion banks, blockages, and/or pile ups may be located farther from infrastructure presently, but if nothing is done for these sites, more damage in the future may occur. If nothing is done with these sites, tons of debris will make its way down the stream and cause problems where they are not wanted. For example, sand was a very common soil type noticed on erosion banks. If enough force comes through an area with erosion banks of sand, this sediment will travel downstream and further fill in blockages, create new blockages, or take out infrastructure.

When comparing individual site type tables and those that included proximity and accessibility, differences were apparent. For example, sites that had a higher score in the site type table may have reduced scores once the proximity and access were added in (Tables B5-B8). This is due to these sites generally being in steeper terrains that are far from infrastructure. On the other end of the scale, sites with low priority scores may have been bumped up to medium priority or high priority because they are near infrastructure and can easily be accessed. Sites with a higher priority score are those that will be cost effective to restore or enhance the stream. These were sites that were generally located in towns or near private land holdings. Also, roads, logging trails, and flat lands were associated with high priority sites.

CONCLUSION

Many of the streams visited saw a wide variety of damages. Streams that flow through towns saw the most restored sites as they were affecting the general public. Private landholdings also saw a considerable amount of restoration if damage was directly affecting their land.

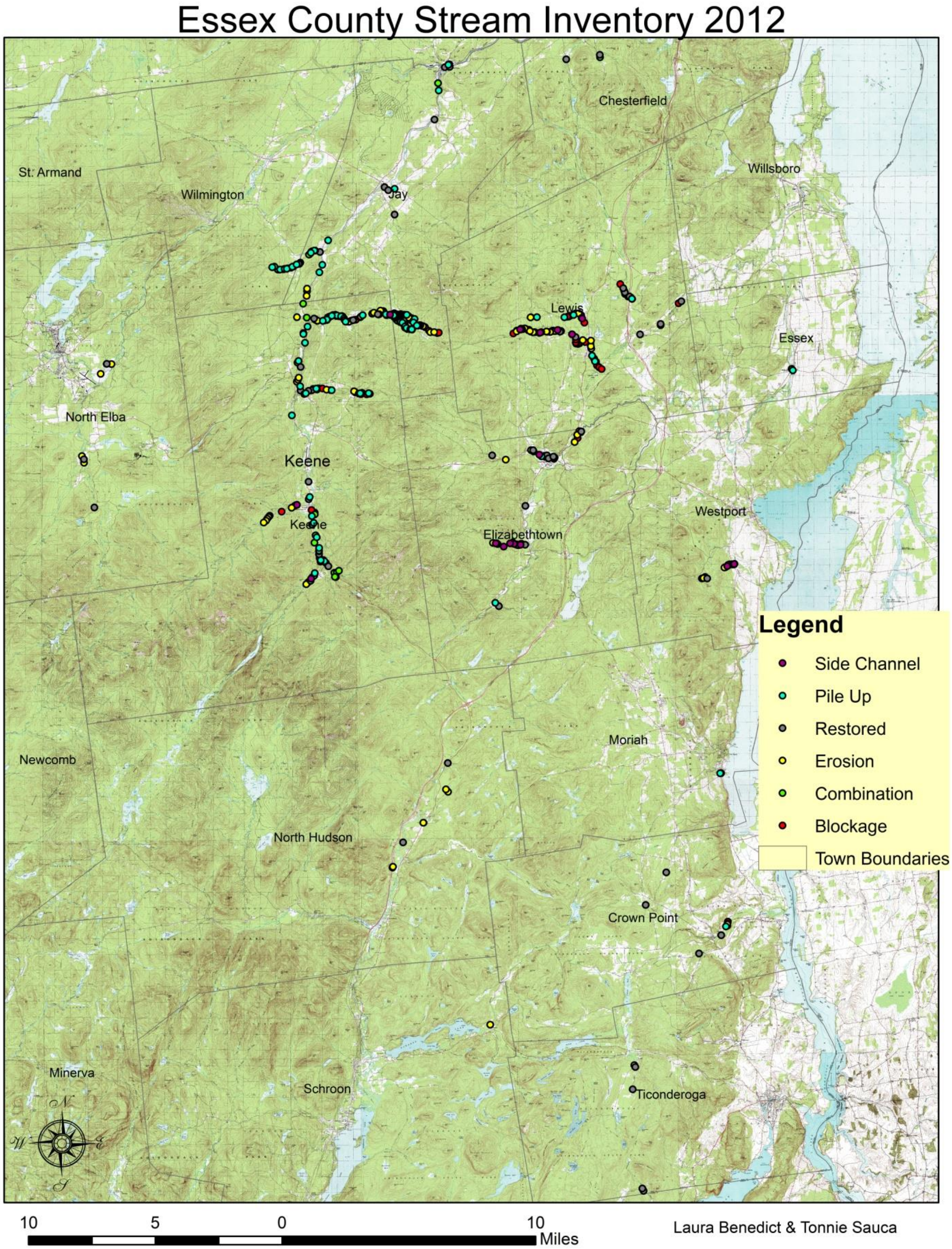
In future studies, consideration should be taken to reduce the amount of bias in erosion site types. Several of the scores under the erosion types were 100's due to many factors. One factor that needs to be addressed is that since Hurricane Irene hit one year before the inventory, not much vegetation had a chance to move in. Therefore, most of the sites received a high score for percent vegetation as most sites had little or no vegetation growing. Another factor that would need to be addressed would be the steepness of the bank. Most of the banks were undercut or steep, therefore nearly all sites received a high score for steepness. Erosion also received high scores in sediment stability due to sand type soils being prominent in the county and are usually loose. Other site types seemed to not be biased as much as erosion, and therefore saw a much wider range of scores. These site types are more beneficial for determining future restoration work than those of erosion sites.

By adding proximity and access to each site, a better representation of the sites is given. Without these two factors, sites that were far from infrastructure and not accessible had a high score and would show more need for restoration than sites closer, more accessible, and cheaper to repair. Tables B5-8 represents the relationship (if any) for each brook between the sets of scores with proximity and accessibility and those without. These should be used to determine costs, when applying for grants, and placing the site out to bid. The raw data and score tables without these two attributes can be used to determine how a site appears, and proper ways to address the site.

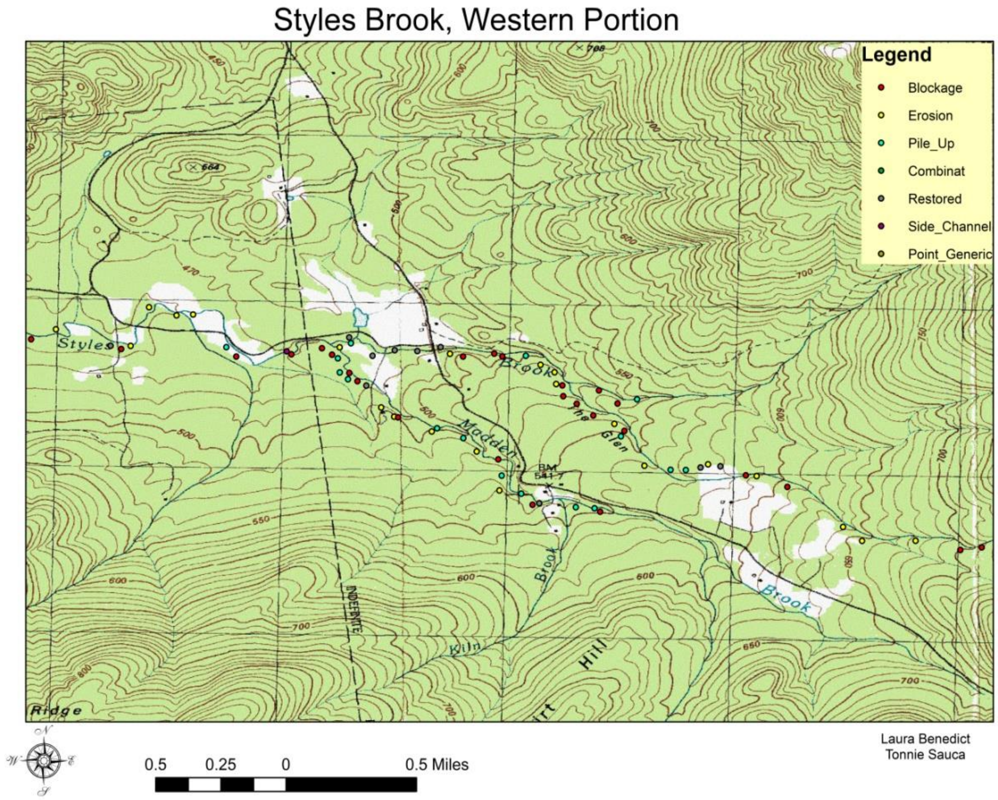
APPENDIX

Appendix A- Maps

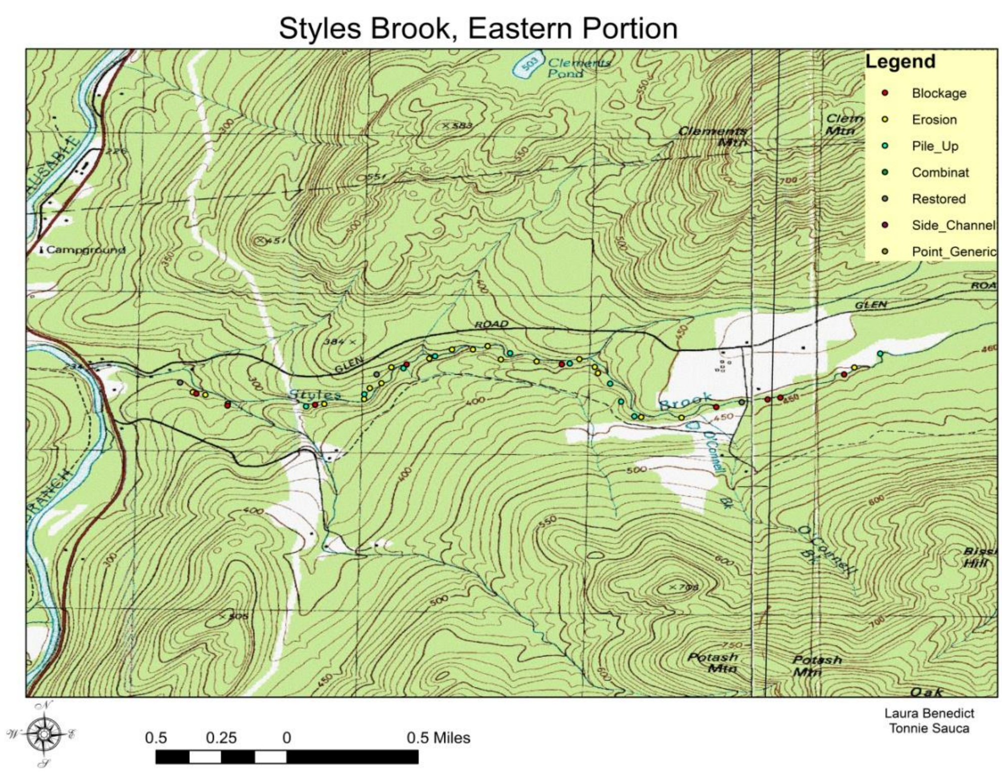
Map 1: Overall representation of the inventory.



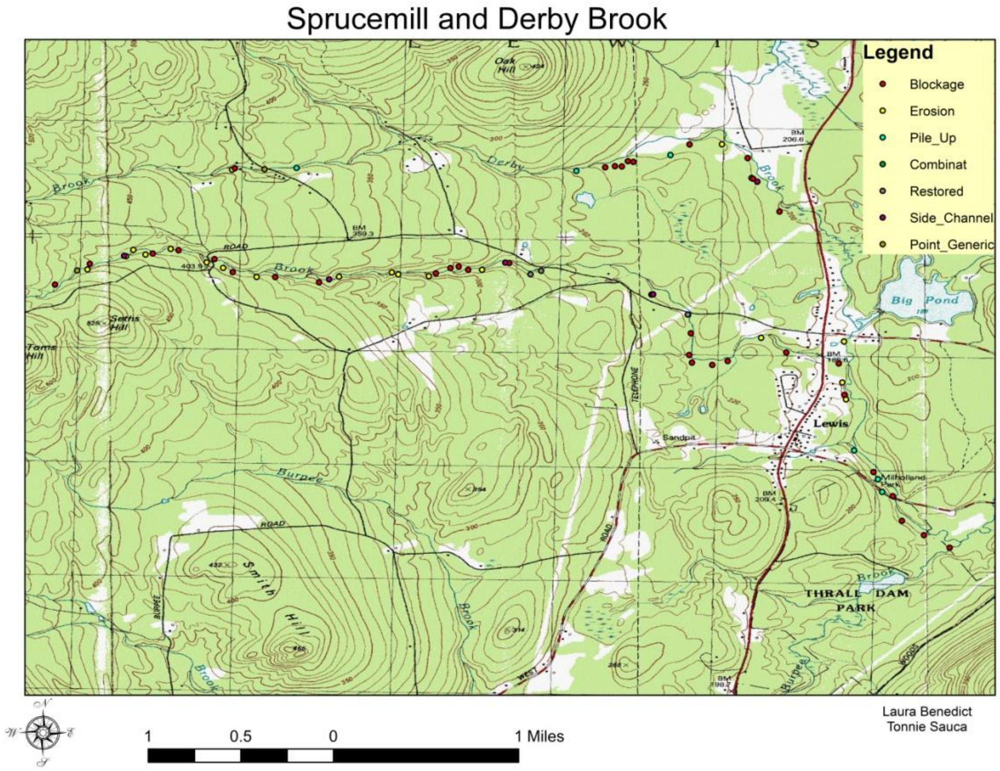
Map 2a: Representation of Styles Brook including its tributaries Madden brook and The Glen of the towns of Jay and Keene.



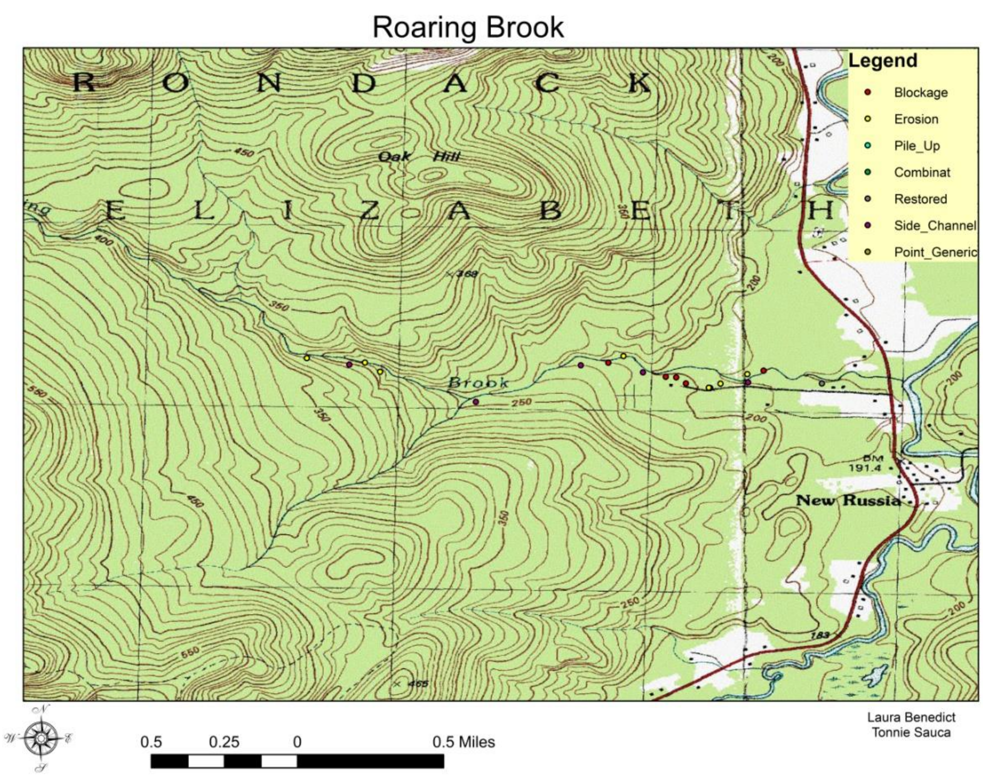
Map 2b: Representation of Styles brook in the town of Keene.



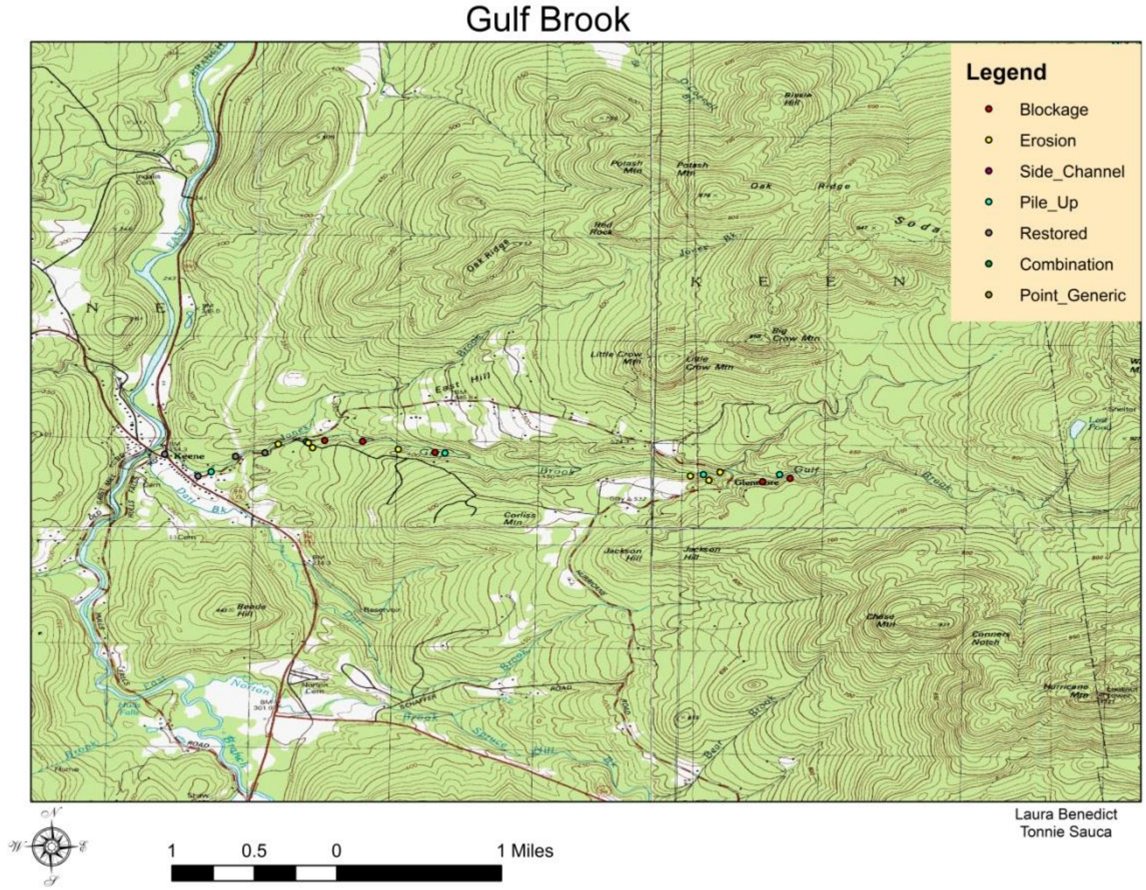
Map 3: Representation of Sprucemill and Derby brook in the town of Lewis.



Map 5: Representation of Roaring brook in the town of Elizabethtown.



Map 4: Representation of Gulf Brook in the town of Keene.



Appendix B- Tables

Table B1: Criteria to score erosion sites and the ranges of mean scores used to divide into priority levels.

Criteria for Erosion Ranking	
Area (ft^2)	Points
0-160	10
161-400	20
401-800	30
801-1600	40
1601-3000	50
3001-6400	60
6401-12000	70
12001-30000	80
30001-50000	90
50001-80000	100
Bank Slope	
Gradual	25
Moderate	50
Steep	75
Undercut	100
Sediment Stability	
Firm	33
Mild	67
Loose	100
Percent Vegetation (%)	
91-100	10
81-90	20
71-80	30
61-70	40
51-60	50
41-50	60
31-40	70
21-30	80
11-20	90
0-10	100
Proximity to Infrastructure (ft)	
2501<	20
1001-2500	40
501-1000	60
251-500	80
0-250	100
Accessibility	
Poor	25
Moderate	50
Good	75
Existing	100

Criteria for Erodibility	
Area (ft^2)	Points
30-160	10
161-400	20
401-800	30
801-1600	40
1601-3000	50
3001-6400	60
6401-12000	70
12001-30000	80
30001-50000	90
50001-80000	100
Bank Slope	
Gradual	25
Moderate	50
Steep	75
Undercut	100
Sediment Stability	
Firm	33
Mild	67
Loose	100
Percent Vegetation (%)	
91-100	10
81-90	20
71-80	30
61-70	40
51-60	50
41-50	60
31-40	70
21-30	80
11-20	90
0-10	100

Erodibility Ranges	
Level	Range of Mean Scores
Total	49.5 to 100
Low	49.5 to 66.33
Medium	66.34 to 83.16
High	83.17 to 100

Erosion Overall Ranges	
Level	Range of Mean Scores
Total	40.5 to 96.66
Low	40.5 to 59.22
Medium	59.23 to 77.94
High	77.95 to 96.66

Table B2: Criteria to score blockage sites and the ranges of mean scores used to divide into priority levels.

Criteria for Blockage Overall Ranking	
Estimated Volume (ft^3)	Points
0 – 200	10
201 -400	20
401-800	30
801-1600	40
1601-3000	50
3001-6400	60
6401-12000	70
12001-30000	80
30001-50000	90
50001<	100
Material	
Small Timber	12
Large Timber	25
Small Rock	37
Combination (Exposed Timber, Small Rock)	50
Combination (Buried Timber, Small Rock)	62
Large Rock	75
Combination (Exposed Timber, Large Rock)	87
Combination (Buried Timber, Large Rock)	100
Extent	
Expected	33
Partial	67
Full	100
Proximity to Infrastructure (ft)	
2501<	20
1001-2500	40
501-1000	60
251-500	80
0-250	100
Accessibility	
Poor	25
Moderate	50
Good	75
Existing	100

Criteria for Blockage Ranking	
Estimated Volume (ft^3)	Points
0 – 200	10
201 -400	20
401-800	30
801-1600	40
1601-3000	50
3001-6400	60
6401-12000	70
12001-30000	80
30001-50000	90
50001<	100
Material	
Small Timber	12
Large Timber	25
Small Rock	37
Combination (Exposed Timber, Small Rock)	50
Combination (Buried Timber, Small Rock)	62
Large Rock	75
Combination (Exposed Timber, Large Rock)	87
Combination (Buried Timber, Large Rock)	100
Extent	
Expected	33
Partial	67
Full	100

Blockage W/o Proximity Ranges	
Level	Range of Mean Scores
Total	18.33 to 100
Low	18.33 to 45.55
Medium	45.56 to 72.78
High	72.79 to 100

Blockage Overall Ranges	
Level	Range of Mean Scores
Total	29.4 to 86.4
Low	29.4 to 48.40
Medium	48.41 to 67.40
High	67.41 to 86.4

Table B3: Criteria to score pile up sites and the ranges of mean scores used to divide into priority levels.

Criteria for Pile Up Overall Ranking	
Estimated Volume (ft^3)	Points
0 – 200	10
201 -400	20
401-800	30
801-1600	40
1601-3000	50
3001-6400	60
6401-12000	70
12001-30000	80
30001-50000	90
50001<	100
Material	
Small Timber	12
Large Timber	25
Small Rock	37
Combination (Exposed Timber, Small Rock)	50
Combination (Buried Timber, Small Rock)	62
Large Rock	75
Combination (Exposed Timber, Large Rock)	87
Combination (Buried Timber, Large Rock)	100
Density	
Low	33
Medium	67
High	100
Proximity to Infrastructure (ft)	
2501<	20
1001-2500	40
501-1000	60
251-500	80
0-250	100
Accessibility	
Poor	25
Moderate	50
Good	75
Existing	100

Criteria for Pile Up Ranking	
Estimated Volume (ft^3)	Points
0 – 200	10
201 -400	20
401-800	30
801-1600	40
1601-3000	50
3001-6400	60
6401-12000	70
12001-30000	80
30001-50000	90
50001<	100
Material	
Small Timber	12
Large Timber	25
Small Rock	37
Combination (Exposed Timber, Small Rock)	50
Combination (Buried Timber, Small Rock)	62
Large Rock	75
Combination (Exposed Timber, Large Rock)	87
Combination (Buried Timber, Large Rock)	100
Density	
Low	33
Medium	67
High	100

Pile W/o Proximity Ranges	
Level	Range of Mean Scores
Total	18.33 to 100
Low	18.33 to 45.55
Medium	45.56 to 72.77
High	72.78 to 100

Pile Up Overall Ranges	
Level	Range of Mean Scores
Total	20 to 100
Low	20 to 46.66
Medium	46.67 to 73.33
High	73.34 to 100

Table B4: Criteria to score Combination sites and the range of sums used to divide into priority levels.

Combination Criteria for Erosion	
Area (ft^2)	Points
0-160	10
161-400	20
401-800	30
801-1600	40
1601-3000	50
3001-6400	60
6401-12000	70
12001-30000	80
30001-50000	90
50001-80000	100
Bank Slope	
Gradual	25
Moderate	50
Steep	75
Undercut	100
Sediment Stability	
Firm	33
Mild	67
Loose	100
Percent Vegetation (%)	
91-100	10
81-90	20
71-80	30
61-70	40
51-60	50
41-50	60
31-40	70
21-30	80
11-20	90
0-10	100

Combination Criteria for Pile Up/Blockage	
Estimated Volume (ft^3)	Points
0 – 200	10
201 -400	20
401-800	30
801-1600	40
1601-3000	50
3001-6400	60
6401-12000	70
12001-30000	80
30001-50000	90
50001<	100
Material	
Small Timber	12
Large Timber	25
Small Rock	37
Combination (Exposed Timber, Small Rock)	50
Combination (Buried Timber, Small Rock)	62
Large Rock	75
Combination (Exposed Timber, Large Rock)	87
Combination (Buried Timber, Large Rock)	100
Density	
Low	33
Medium	67
High	100
Extent	
Expected	33
Partial	67
Full	100

Combination Proximity and Access Criteria	
Proximity to Infrastructure (ft)	
2501<	20
1001-2500	40
501-1000	60
251-500	80
0-250	100
Accessibility	
Poor	25
Moderate	50
Good	75
Existing	100

Combination Proximity Ranges	
Level	Range of Sums
Total	288 to 794
Low	288 to 456.66
Medium	456.67 to 625.33
High	625.33 to 794

Combination Overall Ranges	
Level	Range of Sums
Total	448 to 929
Low	448 to 608.33
Medium	608.34 to 768.66
High	768.67 to 929

Table B5: The total number of erosion sites for each level based on an even splitting of the range into levels (High, Medium and Low). The number was counted twice, once for the range of means without proximity and access factored in (Erodibility) and once with them factored in (Overall). Erodibility was used to describe this set of sites because only the variables associated with the sites' erosive properties were used. Changes in the allocation of sites between the Overall and Erodibility rankings show the effect of proximity and access on each brook.

Waterway	Ranking	Problem Type	High	Medium	Low	Total
Derby Brook	Erodibility	Erosion	1	1	4	6
	Overall	Erosion	1	5	0	6
Gulf Brook	Erodibility	Erosion	0	6	2	8
	Overall	Erosion	2	6	0	8
Johns Brook	Erodibility	Erosion	0	3	4	7
	Overall	Erosion	1	3	3	7
Madden Brook	Erodibility	Erosion	2	3	0	5
	Overall	Erosion	1	4	0	5
Marcy Brook	Erodibility	Erosion	0	3	0	3
	Overall	Erosion	2	1	0	3
Putnam Brook	Erodibility	Erosion	0	1	0	1
	Overall	Erosion	1	0	0	1
Roaring Brook (New Russia)	Erodibility	Erosion	1	6	0	7
	Overall	Erosion	3	3	1	7
Schroon River	Erodibility	Erosion	1	4	0	5
	Overall	Erosion	3	2	0	5
Spruce Mill Brook	Erodibility	Erosion	1	13	1	15
	Overall	Erosion	2	8	5	15
Styles Brook	Erodibility	Erosion	7	18	5	30
	Overall	Erosion	6	20	4	30
The Glen	Erodibility	Erosion	2	4	1	7
	Overall	Erosion	5	2	0	7
Lewis Brook	Erodibility	Erosion	0	1	0	1
	Overall	Erosion	1	0	0	1
The Branch	Erodibility	Erosion	0	3	1	4
	Overall	Erosion	3	1	0	4
Paradox Brook	Erodibility	Erosion	0	1	0	1
	Overall	Erosion	1	0	0	1
Stacey Brook	Erodibility	Erosion	1	2	0	3
	Overall	Erosion	1	2	0	3
Putnam Creek Unnamed Tributary (Ticonderoga –Armstrong Rd)	Erodibility	Erosion	0	0	1	1
	Overall	Erosion	0	1	0	1

Boquet River	Erodibility	Erosion	1	4	0	5
	Overall	Erosion	3	2	0	5
East Branch Ausable River	Erodibility	Erosion	5	2	1	8
	Overall	Erosion	7	0	1	8
North Branch Boquet River	Erodibility	Erosion	2	0	0	2
	Overall	Erosion	2	0	0	2
Recycle Circle Unnamed Tributory (Lake Placid)	Erodibility	Erosion	0	1	0	1
	Overall	Erosion	1	0	0	1
West Branch Ausable River	Erodibility	Erosion	0	4	0	4
	Overall	Erosion	2	2	0	4

Table B6: The total number of blockage sites for each level based on an even splitting of the range into levels (High, Medium and Low). The number was counted twice, once for the range of means without proximity and access factored in (W/o Proximity) and once with them factored in (Overall). W/o Proximity was used to describe this set of sites because only the variables associated with the blockage properties were used. Changes in the allocation of sites between the Overall and W/o Proximity rankings show the effect of proximity and access on each brook.

Waterway	Ranking	Problem Type	High	Medium	Low	Total
Derby Brook	W/o Proximity	Blockage	0	11	5	16
	Overall	Blockage	1	13	2	16
Gulf Brook	W/o Proximity	Blockage	2	1	2	5
	Overall	Blockage	1	3	1	5
Johns Brook	W/o Proximity	Blockage	0	2	1	3
	Overall	Blockage	0	2	1	3
Madden Brook	W/o Proximity	Blockage	3	3	1	7
	Overall	Blockage	5	1	1	7
Putnam Brook	W/o Proximity	Blockage	0	2	1	3
	Overall	Blockage	2	1	0	3
Roaring Brook (New Russia)	W/o Proximity	Blockage	0	5	0	5
	Overall	Blockage	4	1	0	5
Schroon River	W/o Proximity	Blockage	1	0	0	1
	Overall	Blockage	1	0	0	1
Spruce Mill Brook	W/o Proximity	Blockage	3	16	4	23
	Overall	Blockage	3	14	6	23
Styles Brook	W/o Proximity	Blockage	4	6	10	20
	Overall	Blockage	5	10	5	20
The Glen	W/o Proximity	Blockage	4	3	1	8
	Overall	Blockage	3	3	2	8
Lewis Brook	W/o Proximity	Blockage	2	2	1	5
	Overall	Blockage	2	2	1	5
Trout Brook	W/o Proximity	Blockage	0	1	0	1
	Overall	Blockage	1	0	0	1
Stacey Brook	W/o Proximity	Blockage	1	0	6	7
	Overall	Blockage	0	3	4	7
Boquet River	W/o Proximity	Blockage	0	2	0	2
	Overall	Blockage	2	0	0	2
North Branch Boquet River	W/o Proximity	Blockage	0	2	0	2
	Overall	Blockage	2	0	0	2
Ausable River	W/o Proximity	Blockage	0	1	2	3
	Overall	Blockage	0	2	1	3

Table B7: The total number of pile up sites for each level based on an even splitting of the range into levels (High, Medium and Low). The number was counted twice, once for the range of means without proximity and access factored in (W/o Proximity) and once with them factored in (Overall). W/o Proximity was used to describe this set of sites because only the variables associated with the pile up properties were used. Changes in the allocation of sites between the Overall and W/o Proximity rankings show the effect of proximity and access on each brook

Waterway	**Ranking**	**Problem Type**	**High**	**Medium**	**Low**	**Total**
Derby Brook	W/o Proximity	Pile up	3	2	1	6
	Overall	Pile up	3	2	1	6
Gulf Brook	W/o Proximity	Pile up	2	1	2	5
	Overall	Pile up	2	1	2	5
Madden Brook	W/o Proximity	Pile up	0	9	0	9
	Overall	Pile up	0	9	0	9
Mckenzie Brook	W/o Proximity	Pile up	2	0	0	2
	Overall	Pile up	2	0	0	2
Putnam Brook	W/o Proximity	Pile up	0	1	0	1
	Overall	Pile up	1	0	0	1
Styles Brook	W/o Proximity	Pile up	7	6	2	15
	Overall	Pile up	7	6	2	15
The Glen	W/o Proximity	Pile up	0	2	0	2
	Overall	Pile up	0	2	0	2
Lewis Brook	W/o Proximity	Pile up	2	4	2	8
	Overall	Pile up	2	4	2	8
The Branch	W/o Proximity	Pile up	1	0	0	1
	Overall	Pile up	1	0	0	1
Rocky Branch	W/o Proximity	Pile up	0	0	1	1
	Overall	Pile up	1	0	0	1
Boquet River	W/o Proximity	Pile up	1	1	0	2
	Overall	Pile up	1	1	0	2
East Branch Ausable River	W/o Proximity	Pile up	13	5	0	18
	Overall	Pile up	13	5	0	18
North Branch Boquet River	W/o Proximity	Pile up	1	0	0	1
	Overall	Pile up	1	0	0	1
Beede Brook	W/o Proximity	Pile up	1	0	0	1
	Overall	Pile up	1	0	0	1
Ausable River	W/o Proximity	Pile up	1	4	3	8
	Overall	Pile up	1	4	3	8

Table B8: The total number of combination sites for each level based on an even splitting of the range into levels (High, Medium and Low). The number was counted twice, once for the range of means without proximity and access factored in (W/o Proximity) and once with them factored in (Overall). W/o Proximity was used to describe this set of sites because only the variables associated with the combination properties were used. Changes in the allocation of sites between the Overall and W/o Proximity rankings show the effect of proximity and access on each brook

Waterway	**Ranking**	**Problem Type**	**High**	**Medium**	**Low**	**Total**
Gulf Brook	W/o Proximity	Combination	0	2	0	2
	Overall	Combination	0	2	0	2
Putnam Brook	W/o Proximity	Combination	1	2	0	3
	Overall	Combination	1	2	0	3
Lewis Brook	W/o Proximity	Combination	0	4	3	7
	Overall	Combination	0	2	5	7
Gay Brook	W/o Proximity	Combination	1	0	0	1
	Overall	Combination	1	0	0	1
East Branch Ausable River	W/o Proximity	Combination	2	5	3	10
	Overall	Combination	2	5	3	10
North Branch Boquet River	W/o Proximity	Combination	1	1	0	2
	Overall	Combination	1	1	0	2
Beede Brook	W/o Proximity	Combination	0	0	1	1
	Overall	Combination	0	1	0	1
Roaring Brook(St. Huberts)	W/o Proximity	Combination	1	0	1	2
	Overall	Combination	1	0	1	2