East Brook Watershed Assessment

Warren County Soil and Water Conservation District

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Introduction and Background

Picture 1: Headwaters of East Brook

A watershed can be defined as any land area that drains to a common point. In the aerial image on the cover, the entire land area within the yellow line will ultimately drain to East Brook, which then outlets into Lake George near Million Dollar Beach. When we begin to look at how land is managed and our impacts upon the landscape, it becomes increasingly clear that what we do up on the land will ultimately affect the waterbody below. In the field of watershed management, the concept is to look broadly at the multiple land uses to determine these impacts, and to find ways to mitigate them to protect these waterbodies.

The Warren County SWCD follows a specific process to help determine and outline upland issues which might affect water quality. This effort results in an assessment of the overall watershed, which then serves as the basis for finding funding to ultimately address sources of pollution within that watershed. Through a combination of field work, resource evaluation and mapping, a document is outlined which prioritizes the identified issues and recommends specific solutions to these issues.

In early 2007, the District began a study of the East Brook watershed, which is a major tributary in the south basin of Lake George. Utilizing a $15,000 grant from the NYS Department of State through the Lake George Watershed Conference, the District began the significant amount of work necessary to comprehensively identify where pollutants might be entering the brook. Issues such as stormwater runoff, streambank erosion, onsite septic system issues, forestry and logging practices and more were looked at. The outcome is a document which hopefully will serve as a guideline for restoration and improvements within this watershed, which will improve the water quality and ecology of the brook and ultimately Lake George.

Stream and Watershed Characteristics

Location

The East Brook watershed is approximately 3,000 acres and is a part of the Lake George Basin, which ultimately empties into Lake Champlain. East Brook flows north into the southern tip of Lake George in the lower Adirondack Mountains of New York. The stream, including its tributaries, is about 34,000 feet (six and a half miles) long. It

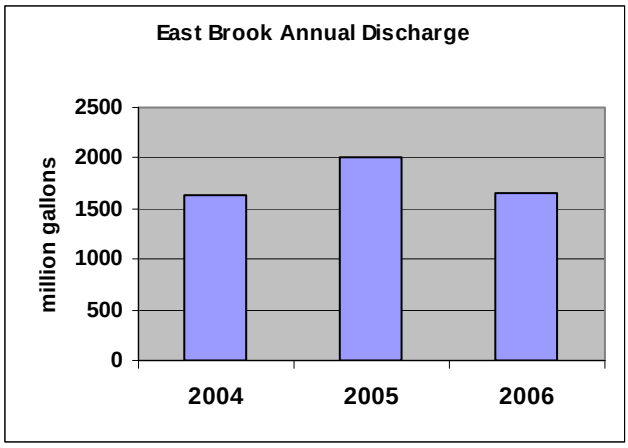

Figure 1: Annual discharge measurements for East Brook at the Route 9L sampling station in millions of gallons.

is bounded on the east by French Mountain (its steepest area at 1,500 feet), on the west by Route 9 and Interstate 87 near exit 21, to the south by the southerly portion of Bloody Pond Road and to the north, at its lowest elevation of 320 feet, Lake George's Million Dollar Beach.

Hydrology

District staff delineated the watershed on USGS 7.5 minute topographic maps. Using contour lines and the topography of the land the drainage boundaries were determined. This information was then digitized into the Geographic Information System program (GIS) for ease of querying information and producing maps.

East Brook is one of the larger sub-watersheds in the Lake George basin, although it contributes approximately four tenths of one percent (0.4%) of the water entering Lake George. Volumes calculated for 2004 through 2006 indicate an average of 1,770,000,000 gallons of water pass the Route 9L sampling station annually (Figure 1) (Eichler, 2007).

Stream Morphology and Classification

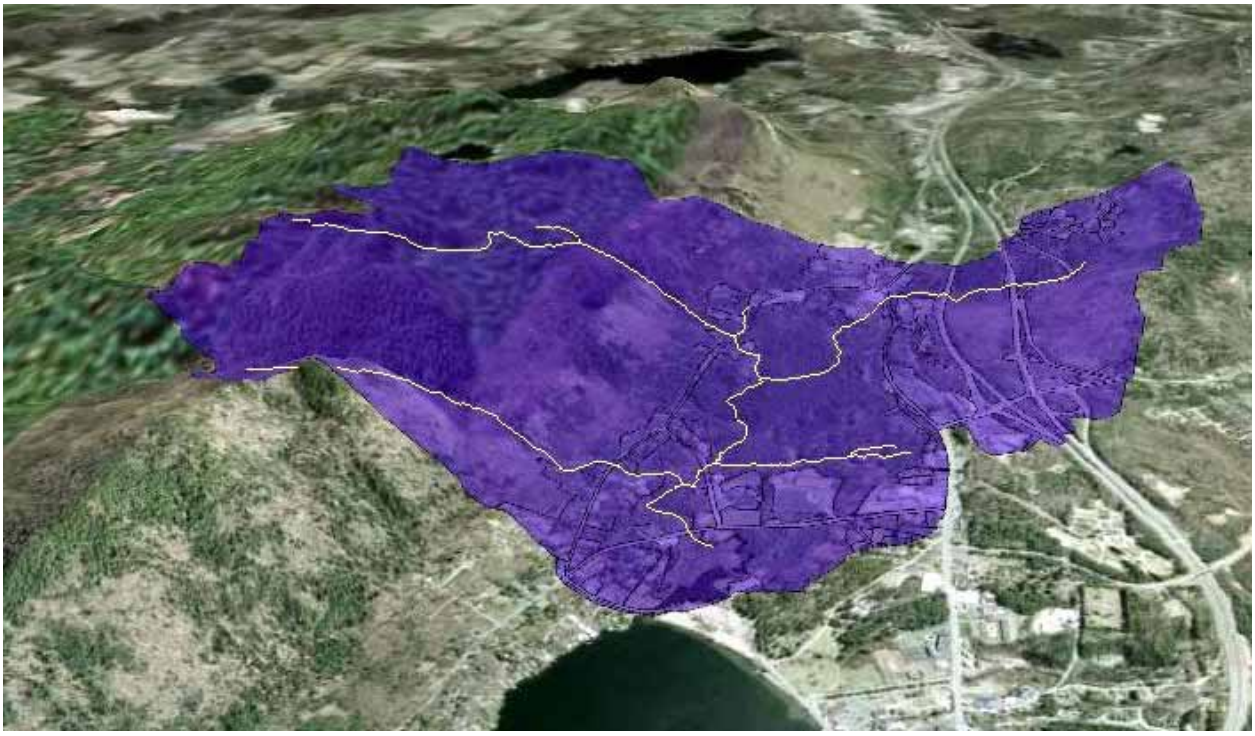

Figure 2: East Brook Watershed, looking south near Million Dollar Beach at the tip of Lake George

The main stem of East Brook is a second order stream with four main tributaries entering from both the east and west. Although no cross sectional or longitudinal profile data has been collected, based on observation during stream reconnaissance the stream itself ranges between 5 to 20 feet in width from bank to bank as it courses through the watershed. According to measurements derived from USGS 7.5 minute topographic maps, the tributaries on the east as they descend French Mountain area have about a 20% slope. Portions of the mainstem have a rather moderate slope (5% or less) for most of its length flowing primarily through forests and wetlands. The substrate is primarily sands and silts in the lower portions of the stream, with cobble and small boulders in the mid to headwaters sections. In certain locations clay is present (relatively rare in Lake George), mainly near exit 21 on the Northway.

Photo 2: Sediment deposit near Sun Valley Road.

As a tributary to Lake George, East Brook is classified by the New York State Department of Environmental Conservation (NYS DEC) in the most recent *2000 Lake Champlain Basin Waterbody Inventory and Priority Waterbodies List* as an AA Special stream, potentially suitable for drinking water. However, the tributaries on the southeast shore are listed as "threatened" with no designated source of the pollutants.

Water Quality

(Written by Lawrence Eichler, Darrin Freshwater Institute)

Stormwater runoff has been identified as the primary source of nutrient, bacterial contaminant and pollutant loading to Lake George (Sutherland et al, 1983; Hyatt et al, 1995; Stearns and Wheeler, 2001). Surface runoff contributes 83% of the phosphorus loading to the lake, with developed watersheds contributing 46% of the loading while comprising only 5% of the land area. Surface runoff also contributes large amounts of erosion-derived sediments to the lake.

The rapid growth of deltas at the outflow of major tributaries alter habitats for native plant and animal species, hinders navigation, and encourages the establishment of exotic invasive species including Eurasian watermilfoil and zebra mussels. A generic environmental impact statement has been developed for Lake George to address these issues and to consider options for remediation. Numerous stormwater remediation projects have been implemented in the basin surrounding Lake George over the past decade, with sediment capture a primary goal. These projects have focused on detention and infiltration of stormwater, stabilization of upland slopes with vegetative

cover and the control of stormwater runoff from new construction. A major shortfall of all these remediation efforts is the lack of assessment of the impact of human activities on sub-catchments within the Lake George basin. Little or no information exists on the effects of changing land use, urbanization, silviculture and infrastructure changes within individual sub-catchments. East Brook is located on the southeastern margin of Lake George. The brook flows into Green Pond, a deepwater marsh and wetland system, which acts as a detention structure, capturing sediments and nutrients before they reach Lake George (Figure 3).

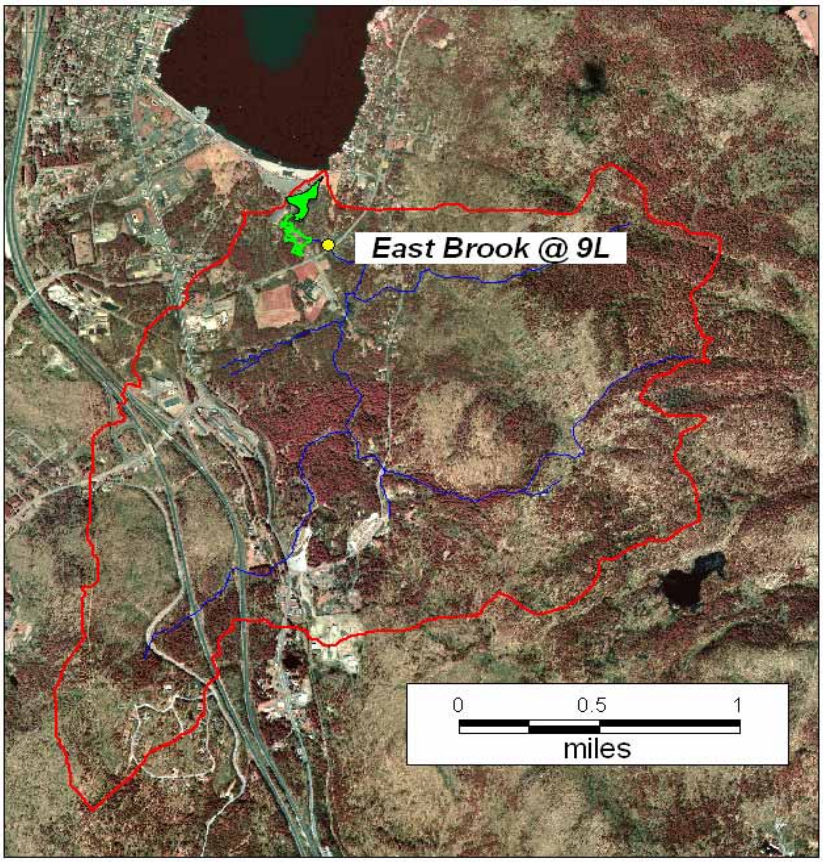

Figure 3: Map of East Brook drainage (red line) with sample collection site at East Brook at 9L (yellow circle). Green Pond and its associated wetlands are highlighted in green.

Historical water quality data for East Brook is limited. Two sampling stations in the East Brook area have been monitored in the past. One station was located on Cedar Lane and captured drainage into Green Pond near Beach Road. This station recorded flow and water quality between 1981 and 1983 as part of the National Urban Runoff Program (Sutherland et al., 1983).

The Cedar Lane drainage (0.3 km^2) is peripheral to the East Brook drainage (8.7 km^2), however they merge in Green Pond prior to entering Lake George. Combining the two sub-watersheds, Cedar Lane would constitute about 3% of the total drainage area to Green Pond (9.1 km^2). Both baseflow and storm event based data collection was included in this program. In June of 2002 thru 2004, the main channel of East Brook at Route 9L was instrumented with a level recorder to generate a continuous flow record and periodic baseflow and stormflow water quality samples were collected. Samples were analyzed for pH, conductivity, suspended solids, nitrate, sulfate, calcium and chloride.

This project was underwritten by the FUND for Lake George and conducted by the NYSDEC. In 2005 and 2006, the station was maintained by NYSDEC for flow only with no water chemistry samples collected. In 2007, the Lake George Watershed

Conference through a Department of State grant to the Darrin Fresh Water Institute continued the operation of this station with semi-monthly baseflow water quality testing and stormwater runoff event based data collections during major runoff events. All samples are analyzed for pH, conductivity, suspended solids, soluble reactive phosphorus, total soluble phosphorus, total phosphorus, total nitrogen, nitrate, sulfate, chloride, soluble reactive silica, and major cations (calcium, magnesium, sodium and potassium).

The water chemistry of East Brook is characteristic of tributaries draining developed areas with the Lake George basin (Figure 4).

	pH (s.u.)	Conductivity (umhos/cm)	Total Suspended Solids (mg/L)	Nitrate-N (mg/L)	Sulfate-S (mg/L)	Calcium (mg/L)	Chloride (mg/L)
Mean	7.72	384.7	3.6	0.471	3.51	30.3	67.4
SD	0.16	93.1	6.3	0.109	0.39	8.5	15.0

Figure 4: East Brook baseflow mean values for 2002 – 2004 for selected analytes.

East Brook carries approximately 21 metric tons (45,100 pounds) annually of suspended sediment to Green Pond, where the majority of this loading is captured prior to discharge to Lake George. Average suspended solids levels for baseflow in 2002 through 2004 were 3.6 ± 6.3 (SD) mg/l. Chemically, East Brook is more alkaline (higher pH) and has more dissolved minerals than are typically observed in streams draining into Lake George. Chloride concentration and specific conductance of East Brook waters average 4 times the levels present in Lake George. Nitrate levels are also substantially higher in East Brook than in most streams entering Lake George, and exceed lake levels by a factor of ten. The Green Pond wetland may capture a substantial portion of the nitrate before it is discharged to Lake George. Analysis of the discharge of this wetland to Lake George has merit.

East Brook has also been identified as one of the tributaries to Lake George with elevated levels of calcium (mean concentration 30 mg/l). Elevated levels are based on comparison to the concentration of calcium in the waters of Lake George (11.5 mg/l). This group of tributaries may create “microzones” where they mix with the waters of Lake George, creating conditions where calcium levels are high enough to support zebra mussel colonization. Sources of calcium may include weathering of naturally occurring mineral deposits within the watershed or anthropogenic (human induced) sources. Human sources include sites for deicing salt storage or application, concrete production or storage operations, wastewater discharges, mining or mineral extraction, etc. Longitudinal testing of specific conductance in East Brook may identify potential sources of calcium, salts and specific conductance.

Soils in the Watershed

The soils lay the framework that all land uses are based upon and have a direct correlation with the types of land use that are suited to a particular location. Very sandy soils may pose serious problems with siting a septic system for a house, whereas soils with high clay content may cause difficulties with house foundations and construction.

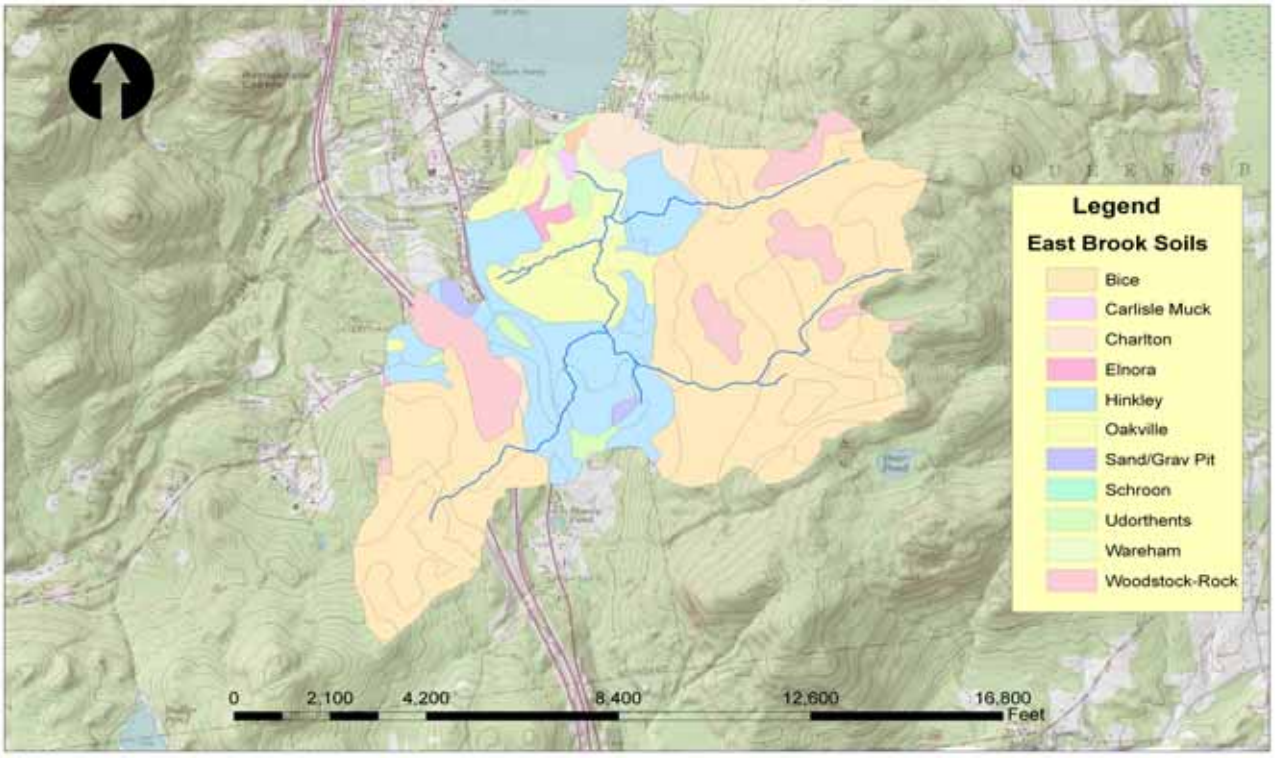

Figure 5: East Brook Watershed delineated by soil type.

This section briefly defines the major soil types within the East Brook watershed to summarize what some of the potential concerns might be with land uses and water quality. Please note that this is only a brief summary of the soil conditions, and much more detailed information and maps are available in the Warren County Soil Survey available through the Warren County Soil & Water Conservation District.

The watershed boundary line that was delineated in GIS was superimposed onto a GIS soils layer that was developed from the USDA Soil Survey conducted in 1981. Of the eleven soils that were identified, the majority of the soils (approximately 1200 acres or 40%) in the East Brook Watershed are in the Bice Series. According to the soil survey, Bice soils are well drained and depth to bedrock is fairly deep. These are typically fertile soils and desirable for agricultural usage in Warren County.

The Hinckley Series encompasses almost 400 acres (13%) and are composed of deep excessively drained gravely outwash plains. These soils are typical in floodplain areas.

If this soil used for sanitary waste disposal systems, the possibility of ground water contamination is a hazard because it is poor at filtering effluent.

The two other predominant soil types in the East Brook Watershed are in the Woodstock and Oakville Series. Woodstock is generally shallow and excessively drained upland soil scattered with glacial till and is poorly suited to recreational and urban uses. Oakville is deep well-drained and sandy usually outwash plains and deltas. This soil type is not well suited for septic tank absorption fields, because it is poor at filtering effluent, making the possibility of ground water contamination a hazard.

Whatever the soil conditions, whenever modifying an existing land use for development it is a good practice to control sediment and erosion with a good site plan and follow-up. Erosion and sediment control advice and technical assistance is available at no charge from the Warren County Soil & Water Conservation District. Soils information is also available at the District in both paper and digital formats.

Land Use

Land use information is very important when characterizing a watershed and determining potential impacts to water quality. The extent of development in an area is and where the development is located can play a key role in the contaminant loading to a waterbody.

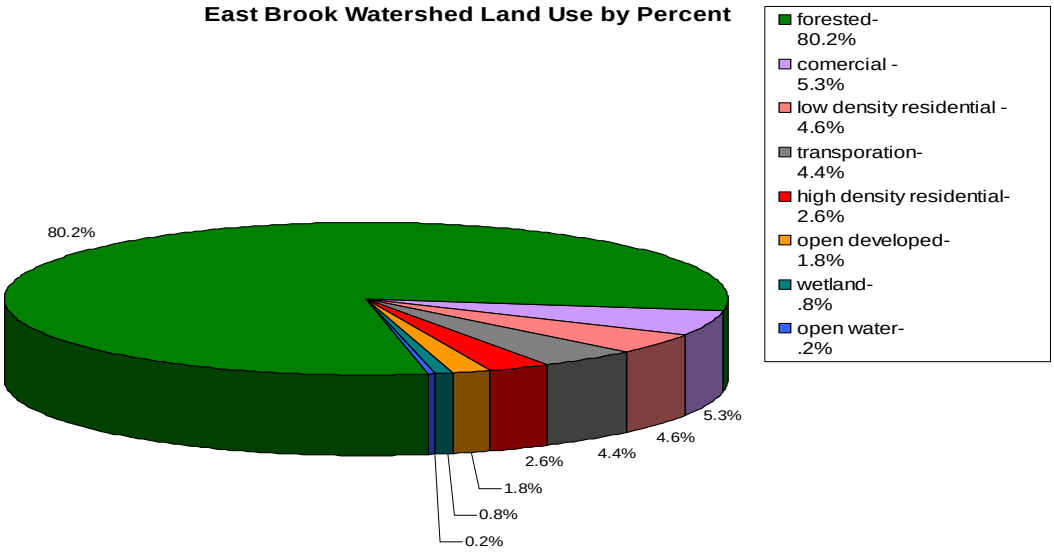

Figure 6: East Brook Watershed Land Use Graph delineated by percent.

To determine the land uses within the East Brook watershed, GIS was used to develop a layer that illustrated the various land uses. The parcel data was queried based on

property classification and graphed to delineate the percent land use of commercial, low and high density development, open land, water, forested, wetland and transportation.

The East Brook Watershed is predominantly forested. In fact, 81 percent of the watershed was undeveloped as of the 2007 assessment as can been seen on the *Land Cover* map and graph (Figures 6 and 7). Because of this the soil is relatively undisturbed, is anchored by the roots of the vegetation, and trees act as a buffer for overland runoff. Much of the water is intercepted by the vegetation before reaching the ground, and what reaches the ground is absorbed into the soil and utilized by the vegetation.

Over 5 percent of the watershed is developed commercially with approximately another 7 percent high and low density residential development. There is potential for impact from these developed areas because of increased stormwater runoff from impervious surfaces. Overland flow from manicured lawns through the use of pesticides and fertilizers is also a potential hazard due to leaching of these substances into the nearby water sources which can cause problems for fish and other aquatic life.

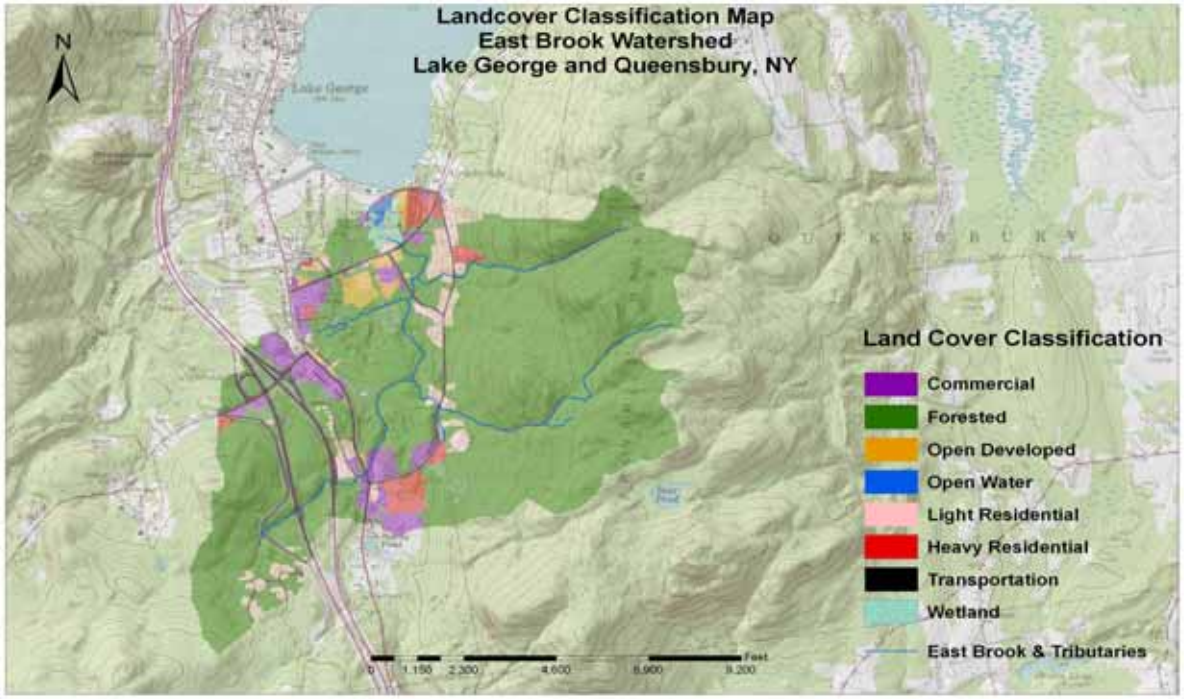

Figure 7: East Brook Watershed Land use classification

Transportation infrastructure in the form of roads and bridges also accounts for 4 percent of the land use. The runoff from these surfaces can contain petroleum products and other automotive debris as well as salt and sand from de-icing in the winter. The installation of stormwater treatment systems such as hydrodynamic

separators and infiltration chambers, to capture the first inch of runoff can greatly decrease the amount of pollutants coming from these surfaces.

Less than one percent of the watershed is open water in the form of lakes, streams, ponds and wetlands combined. These waters are classified drinking water sources that feed into Lake George itself. Uses include drinking, bathing, boating, fishing and other recreational activities.

Wetlands

East Brook is classified by the Adirondack Park Agency (APA) as linear wetland. According to APA Wetland Classification Maps 1980, the extent of the wetland delineation ranges approximately fifty to one hundred feet on either side of the mainstem and flatter portions of the tributaries. These shallow wet areas are abundant in native wetland vegetation, fish and wildlife habitat. These areas are subject to wetland regulations.

Photo 3: Wetland area near Green Pond along East Brook, upstream of the confluence with Lake George.

Located just upstream of Lake George's Million Dollar beach in the East Brook Watershed is the Green Pond wetland area. This area helps to trap much of the in-stream sediment allowing it to settle out of suspension before it reaches Lake George.

According to the studies conducted by Darrin Fresh Water institute East Brook carries approximately 21 metric tons (45,100 pounds) annually of suspended sediment to Green Pond, where the majority of this loading is captured prior to discharge to Lake George (Eichler, 2007). Although Green Pond acts like a sediment basin, it is not as easily maintained as a man-made basin would be and deposited sediment can fill this area in over time altering the hydrology and habitat in the area.

Wetlands have important filtering capabilities for intercepting surface water runoff from higher dry land before the runoff reaches open water. As the runoff water passes through, the wetlands retain excess nutrients and some pollutants, and reduce sediment that would fill in waterways and affect fish and amphibian egg development, according to the U.S. Environmental Protection Agency. More than one-third of the United States' threatened and endangered species live only in wetlands. Many of the U.S. breeding bird populations- including ducks, geese, woodpeckers, hawks, wading birds, and many song-birds feed, nest, and raise their young in wetlands(US EPA 2007).

When rivers overflow their banks, the wide open areas of wetlands, along with the associated native vegetation, act to slow down the water, lessening its destructive potential. The wetlands' ability to retain and slow down flood waters can help to save property and lives. Preserving natural wetlands can reduce or eliminate the need for expensive flood control structures. Wetlands act as natural sponges and have tremendous capacity to act as natural flood control.

Stream Ecology

In order to determine what organisms may be present in East Brook, the District applied for a NYS DEC Collectors permit to capture, identify and release macroinvertebrates and fish. This summer was a dry season, and as such may have different species present during a normal base flow year. The sampling was conducted at two locations on East Brook. The first, was 200 yards due west of the McGowan Circle cul-de-sac (Site #1) and the second was 300 yards upstream of the intersection of East Brook and Sun Valley Drive (Site #2). Sampling at both locations consisted of utilizing a seine downstream of the sampling location and two persons walking quickly towards the seine while kicking at the substrate to disturb any organism at the location, so they may flee or float into the seine. D-nets were employed for grab sampling on macro invertebrates as well. The purpose of this effort was to get a snapshot idea of what types of species were present at two locations in East Brook.

Site #1

The overstory above the stream had dense tree canopy, primarily of hemlock. This was a heavily forested section with a mixture of Eastern hemlock, Eastern white pine, American beech, Eastern hop hornbeam, white and red oaks. There was a small floodplain on both sides of the stream, which ran to a steep incline on either side. There was a small unnamed tributary that confluences with East Brook, upstream of the sampling site. This tributary originates on the East side of Bloody Pond Road. The average stream width at this location was 11 feet and the average water depth was 6-8".

Photo 4: Macroinvertebrate Sampling at Site #1

The average stream channel depth at this location was 1-2 feet, with bed substrate comprised primarily of cobble in the 2-5" range. At this site, participants took four

passes at 2 different locations in this stream section, without capturing any fish. The distance between the beginning of the sample run and the seine was approximately 100 feet. Few macroinvertebrates were captured. Several species of mayflies were captured with D-nets, as were web spinning caddis flies and dipteran larvae. No fish were captured at this location. The substrate, as mentioned previously, was mostly round rock and the stream bottom was very dark, presumably from organic matter. This section of stream appeared to be relatively undisturbed.

Site #2

This location was considerably different than Site #1. Surrounding landscape and vegetation shows that this is an old beaver meadow that periodically reverts to back to a flooded condition. Few trees are along the stream channel, but there are abundant grasses and other herbaceous plants. The stream channel in this area is much deeper and narrower than Site #1. The average water depth is 12" and the width is 6'. The stream channel depth is approximately 3'. The substrate is primarily sand/silt and organic material. There is overhanging streambank for habitat in this section.

This location provided a greater capture sample. Conducting the same type of sampling methodology as downstream resulted in the capture of several mayfly species, numerous scuds, dragonfly larvae (2 species), beetle larvae and dipteran larvae. This section also produced 2 brook trout that were 1.5" in length. This area of stream had some disturbance with recent logging and trail installation and there was a new wooden bridge that crossed this stream. It was obvious that beaver activity in the past had created a much different habitat at this location than at Site #1.

Some general observations of both sites:

- No other fish were observed at either location.
- Site #1 had 70-80% more shade over the stream than Site #2
- Site #1 had vegetation more typical of upland species. Site #2 had more species representative of lowland environments.
- The substrate was substantially different.
- At Sun Valley Road, the road culvert was plugged and was backing the water up in the stream channel, but the sampling location was well above the grade to have had any influence.
- Fish and macroinvertebrate numbers were less than expected. There was not a wide variety of species and numbers of organisms appeared low.
- No amphibians, reptiles or mollusks were observed.

Although the macroinvertebrate and fish sampling was somewhat inconclusive related to water quality and ecological issues, the water chemistry and riparian health are indicative of a healthy stream. The reason for the low fish count is undetermined, and merits closer inspection. With the relatively large number of culverts along the stream's

length, it is likely that at least some of these culverts impede fish passage and migration into the upper reaches of the channel.

Water Quality Issues and Recommendations

The outcomes of this assessment are twofold: to get a snapshot in time of the watershed resources and conditions, and to identify issues affecting water quality and the overall health of the stream system. This section takes a look at potential and identified water quality issues within the watershed, in many cases providing specific restoration solutions to help improve East Brook and ultimately help protect Lake George.

Stream Buffers and Erosion

A vegetative buffer along a stream corridor and floodplain area plays an important role in the health of the waterbody. There are a whole range of benefits, some of which include helping reduce the amount of pollutants reaching the water, which consists of things such as fertilizer and pesticide from lawns to salts, sands and oil from roads. Water temperature which affects fish and aquatic life is affected by the amount of shade and shelter that trees and shrubs provide. Solar radiation of the streams can alter species from specialists such as brook trout to generalists like creek chubs. Colder water contains more dissolved oxygen than warmer water, so not only will the temperature of the water change due to light, but the amount of oxygen in the stream will be altered as well.

In addition to shading, vegetation along the streams helps to reduce nutrients to the streams, by acting as a buffer. Plants will uptake nutrients for their growth and as sediment laden water filters through the buffer, the sediment will be dropped out of suspension and left on the forest floor. Eventually this sediment will be incorporated into the ecosystem and plants will utilize this new material. It is important though to identify the source of the sediment and determine what can be done to reduce the sediment loading. If no remedial activity is taken to address the source of the sediment, a habitat can be altered by smothering vegetation and building up to the point that it is flushed out into the stream system as runoff events occur.

Photo 5: Stream with vegetative buffer removed

During the stream assessment District staff noted that the majority of the stream banks appeared stable and vegetated. However, there were portions in the more developed areas of the watershed that would benefit from larger vegetation such as trees and shrubs. There were also several locations where sandy deposits were noticeable along portions of the stream, indicative of erosion. In areas of development and road corridors, care should be taken to preserve greater vegetative buffers along the stream to filter the water before it enters the stream. Streamside landowners should be encouraged to minimize the amount of open lawn which abuts the stream, replacing these lawns with native vegetation which would provide both a water quality filter and perhaps some shading of this stream. Environmental groups such as the Lake George Association have considerable information regarding homeowners and buffers using native vegetation.

Currently, there is a regulatory process underway by the Lake George Park Commission to develop stream buffer requirements for new development and logging activities. The outcome of this process will be Lake George Park-wide application of these new regulations, which will help significantly in the protection of stream buffers in the East Brook watershed and all others within the basin. As these regulations are currently in the development phase, there is no standard set of buffer widths adopted as of yet. However, the current thinking is that a factor affecting buffer width will be the slope of land the surrounding the stream. The steeper the slope, the wider the buffer (and vice versa). These regulations are expected to be adopted in 2009.

Forest Management and Logging

Trees are one of our greatest renewable resources. When managed correctly and done in a responsible manner using silvicultural practices, tree harvesting can help increase timber production and the health of the stand of trees.

Photo 6: Forester reviewing property

The strong majority of the East Brook watershed is contained within the Town of Lake George, with a small portion of the easterly watershed and headwater tributaries originating in the Town of Queensbury. As far as can be determined, all recent logging activities have occurred in the Town Lake George portion of the watershed, so this report gives an overview of their review process.

On July 14, 2003, the Town of Lake George adopted new zoning ordinances for the town. Included in these ordinances are regulations regarding commercial logging activities. Commercial logging in the Town of Lake George is defined as "the cutting of 50% or greater of all trees greater than a 4 inch diameter at breast height (dbh) on a 5 acre property or greater." In addition, logging is only allowed on LC (Land Conservation) and RR (Residential Rural) zoned land. Proposed logging activities on lands with other zoning classifications require a zoning variance from the Town of Lake George Zoning Board of Appeals.

Commercial logging activities within the approved zones are required to submit a logging plan to the Town Codes office, and to go through the Site Plan Review process by the Planning Board. As knowledge of logging practices and activities is limited on this board, it is often a requirement of Town Planning Board approval that the logger get approval from the Warren County Soil and Water Conservation District. The District will review the plans, walk the property, and respond in writing with any concerns.

Photo 7: Typical Adirondack timber harvesting operation

Both the towns and District emphasize the use of Best Management Practices (BMP's) such as the proper use of water bars and to develop an Erosion and Sediment Control plan. Utilizing good silvicultural BMP's can minimize the impacts on the land and water and actually increase productivity of the forest land.

Consulting a professional forester is the best way to properly manage your forest resources and achieve your ultimate management goal. There are many types of strategies for various practices including managing for timber, wildlife, firewood and maple production. They can provide information specific to the types of trees present and how to increase production without affecting the environment or the aesthetics.

There are a few guidelines to controlling erosion during a logging operation:

- The best time of year to log is winter when the ground is frozen and there is a blanket of snow to reduce the erosion caused by felling and dragging trees.

- A buffer should be maintained in its naturally vegetated state along both sides of any stream or wetland encountered. (a permit may be required from NYS DEC

in any area where the log road crosses a designated stream channel such as East Brook).

- The installation of the skid roads should attempt to maintain less than or equal to 15% grade. In steep areas, waterbars should be placed at varying intervals along the road depending on the steepness to divert water into vegetated areas that can slow and absorb the flow.

- Roadside ditches should be seeded and mulched upon excavation and check dams should be placed in the ditches in steeper sections to reduce velocity of stormwater runoff (NYS DEC 2005).

Upon request, Warren County SWCD personnel are available to assist with an erosion and sediment control plan, mark-out of buffer areas and waterbar locations on site.

On-site Wastewater Treatment Systems

There is a responsibility that goes with living along a stream or on a lake shore. One of those is maintaining private on-site wastewater treatment systems (septic systems). When properly designed, installed and maintained, septic systems have no adverse impacts on water quality or public health. When one of these criteria falls short, issues often arise.

Photo 8: Locating a septic tank

According to 2007 tax parcel information researched using ArcGIS, approximately half of the homes in the East Brook watershed are on private septic systems and half are on commercial or public wastewater treatment. A GIS and tax parcel review showed that homes in the East Brook watershed were built as far back as 1920. Typically less concern was given back then to the potential development impacts upon the water quality of the stream and lake than today. There are many three-bedroom and four-bedroom homes, some with two full bathroom capacity. In all likelihood, some of these structures may have previously been seasonal camps and the septic systems would have been designed as such, generally consisting of small septic tanks and seepage pits. Residents do not always know exactly what type of septic system is located on the property. This is a concern because if they do not know what

type of system is on the property, there is little likelihood that this system has been properly maintained.

Photo 9: Septic system pumpout and inspection

Improperly maintained septic systems can increase water quality impacts of nearby waterbodies. In addition, there may be health concerns related to improperly treated septic effluent, as bacteria may reach the groundwater and end up in a private or public well. Effluent from a standard septic system flows from the home to a septic tank and then to an absorption trench or a seepage pit and into the ground. Soil bacteria provide the final treatment and uptake of nutrients and pollutants. If the system is very old or has not been properly maintained, there is a good chance of the system is failing and not providing the treatment that it should. This is a major concern especially on lakes where lot sizes are small and many of the structures on these lots are older.

Given the average age of these septic systems, it is likely that a portion of these are not functioning properly and may be affecting the water quality of East Brook. A septic education program would be a valuable tool to educate landowners about the effects of untreated septic effluent can have on the environment and human health. A voluntary cost-shared pumpout program for residents within a 200 foot buffer from the brook, in addition to septic education is a very effective way to help reduce potential pollutants from septic systems.

The District has successfully completed three of these septic programs in other watersheds. In these programs, landowners are sent a letter inviting them to participate in a voluntary septic pumpout reimbursement program. The interested landowners send the information back and are signed up for a bulk rate septic pumpout cost, and then receive a 50% rebate of their pumpout cost. In addition to this pumpout effort, septic education materials are provided to the landowner and a water conservation kit is given to them. This is a voluntary program that educates the participating landowners in what type of system they have, how it works, what condition their system is in and what to do if there is a problem.

Cost estimate of septic program: $15,000 - $25,000 depending on level of participation

Stormwater Runoff

Stormwater runoff is the number one water quality impact to Lake George, and this holds true to the East Brook watershed as well. Stormwater runoff amounts fluctuate throughout the year and also vary with different land uses. When left uncontrolled it can be detrimental to the stream's ecology and quality, as well as that of the Lake George. This issue should be divided into two distinct sections: proper controls on new developments and retrofitting of existing developed properties.

Photo 10: New home under construction within the East Brook watershed

Prevention of runoff is a key constituent in maintaining the fragile ecological balance between development and environmental health. Reviewing new developments in the East Brook watershed is first and foremost the responsibility of the Town of Lake George Planning Board. It is incumbent upon them to have the full knowledge and resources available to them to make informed decisions regarding new developments and their potential impacts from erosion and stormwater runoff. Towards this end, it is recommended that these board members have full access to an independent engineer's technical review of those plans to help them determine if they are will not negatively affect nearby waterbodies or wetlands.

The modification of existing stormwater issues (retrofitting) is a practice that has been occurring in the southern end of the watershed, specifically in the West Brook Watershed. This is an effective option when funding is available. Increased attention to this subject may allow for further projects which would address issues within the developed areas of the watershed (homes, businesses, roads, etc.). With continual increase in development and the current land use patterns, stormwater runoff needs to be controlled onsite, and if left unchecked will lead to the concerns listed above.

Photo 11: Sediment collecting near drop inlet on NYS Route 9N.

In many cases throughout the watershed, infiltration into the ground is a viable option as the sandy soils of the watershed allow for this practice. Use of drywells, subsurface structures such as StormTech® infiltration chambers and slotted drains in combination with one another are extremely effective in controlling runoff.

Other Potential Solutions include:

- Proper hydroseeding of non-vegetated disturbed land such as new road side ditching can reduce the negative impact of runoff.
- Continued cooperation with the local highway departments in ensuring proper best management practices (BMP's)
- Presentations to local planning boards regarding erosion, sediment control and stormwater.

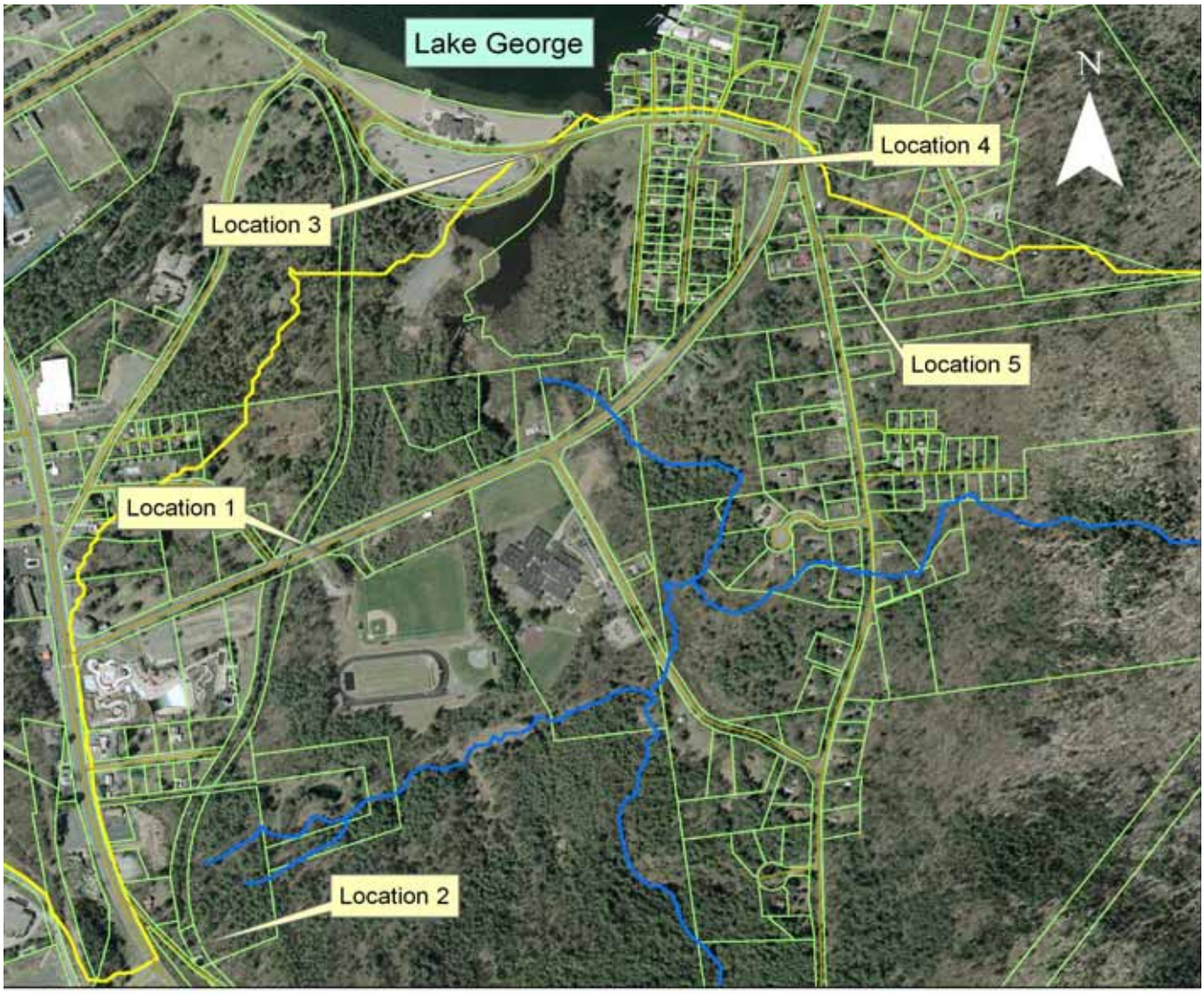

Figure 8: Sites proposed for restoration or retrofitting activities

Priority areas for stormwater management

Soil and Water Conservation District staff walked the entire East Brook watershed including the populated areas of each tributary, the mainstem and the road network. Photographs were taken to document areas of excessive erosion or aggradation along the stream bed or banks and stormwater drainage and sedimentation were documented within the road network. A few areas were noted as critical due to the proximity and drainage to the stream. These locations are shown in Figure 8, and are expanded upon below.

1. State Route 9L

Stormwater flows along NYS Route 9L beginning to the east where it intersects NYS Route 9. The stormwater flows down the roadside ditch for approximately ½ mile which ultimately outlets into East Brook near Green Pond (location #1 on Figure 8). At this site, a stormwater basin or small constructed wetland could be installed to reduce pollutant loading to East Brook. By having the runoff drain into either a surface or subsurface structure, water would infiltrate into the ground and be treated by the soil. Sediment would be left in the basin, which could be maintained by the Town of Lake George Highway Department on an annual basis. The out of pocket cost of this could be minimal, as it could be able to be done with Town equipment and Town labor. Measures such as this are simple and cost effective yet can have a tremendous impact on water quality in terms of sediment load to the stream.

Cost Estimate: $5,000-$20,000 depending upon solution chosen.

2. Northway Exit 21 (photo 12)

The Exit 21 outfall collects runoff from a large developed area including ¼ mile of the north and southbound lanes of Interstate 87. The drainage channel that this area feeds was noted as being scoured and deeply incised. The soils in this area are composed of a sandy silt mixture with clay; inclusions which are highly susceptible to erosion. As evidenced in the photograph, water velocities at this location are extreme and have carried much sediment downstream and caused the outlet culvert pipe to fail.

Photo 12: Erosion at the Exit 21 tributary (looking upstream)

The water flows into a woodland area, where much of the flow appears to infiltrate into the ground before it reaches a tributary to the brook.

The soils are excessively drained and sandy and act as a broad alluvial floodplain. The area is predominately vegetated with Eastern White pine that would indicate drier soils. It is important to note though, that there is a clay deposit in the stream channel approximately 1/5 mile downstream from the culvert. When water does reach this far, the channel becomes highly incised through clay soils; meaning that these clays have eroded over time from this stormwater flow. There is still a distance from this point to the mainstem of East Brook and wetland areas where clay may be deposited, however, this is an area to observe for future potential issues.

The culvert should be fixed by attaching an additional section of pipe and placing medium to medium heavy NYS DOT stone at the outlet area to break up the kinetic energy of the flow. There is also an opportunity to redirect flow away from the clay channel and allow for more infiltration. *Cost Estimate: $10,000-$20,000*

3. Beach Road

Several drop inlets along Beach Road collect stormwater runoff which outlets directly into Lake George with no treatment. With its close proximity to Lake George and its relatively high amount of de-icing materials in winter and spring runoff, this area is a high priority for stormwater remediation.

Photo 13: Beach Road showing sand buildup from winter sanding operations

In 2010, Beach Road is scheduled for reconstruction by Warren County. The county is addressing flooding concerns on the roadway, and is open to addressing water quality issues as well. There are many opportunities for stormwater structures including catch basins and infiltration units along portions of the road, and these will be looked into by the county and the Warren County SWCD during the planning and engineering process for the Beach Road reconstruction effort.

Cost Estimate: $25,000-$50,000

4. Beatty Road and Cedar Lane

Cedar Lane and Beatty Road both exhibit issues with erosion and scour which contribute to the sediment load near the outlet of East Brook. Due to the amount of

sediment they export, stabilizing these roads with crowning and proper drainage structures is needed. Along with proper reconstruction, a series of pretreatment and infiltration structures could be installed to reduce the volume of runoff from these roads.

Photo 14: Downstream of Cedar Lane

Cost Estimate: $20,000 - $30,000 depending upon solution

The drainage channel between Beatty Road and Cedar Lane is in need of protection as well. This unnamed tributary to East Brook is scoured between Beatty Road and Cedar Lane, as can been seen in the photos. There is a lack of deep rooted vegetation such as trees and shrubs along this portion of the stream. There are sand deposits present in the channel and it does not appear to be stable or holding its shape along the banks and stream bottom.

The channel below should be lined with stone and the banks graded back if possible and revegetated with trees and shrubs such as willow, silky dogwood or red maple. This is a narrow work area which poses a challenge. However if this is completed this would likely reduce a large sediment source to East Brook.

Cost Estimate: $5,000-$10,000

5. Bloody Pond Road

Most of the stormwater runoff from the northernmost ¼ mile of Bloody Pond Road flows to NYS Route 9L, and then through a series of culverts until outleting into the Cedar Lane channel mentioned above. There are two relatively steep roads which drain on to Bloody Pond Road: Mockingbird Hill Road, Robin Lane. Robin and Dyer are privately owned and unpaved. Robin Lane has exhibited significant ongoing issues with erosion and sedimentation onto Bloody Pond Road over the years. These road networks merit a closer look for opportunities to address both erosion problems and associated stormwater runoff.

In addition to these roads, Bloody Pond Road itself should be reviewed for opportunities to infiltrate or divert stormwater runoff, keeping it from reaching Route 9L and ultimately the lake.

Cost Estimate: $30,000 - $50,000

Project Summary and Conclusions

The East Brook Watershed is one of the eight "major" tributary streams to Lake George. The watershed is approximately 80% forested, with much of the remainder in residential, commercial, and roadways. This makes it one of the most developed large watersheds in the Lake George basin. For this reason, this "watershed assessment" was undertaken to review the existing state of the watershed and to identify water quality issues.

Much of this stream is well buffered from development impacts. However, there are several specific areas of concern that have contributed to an increase in pollutants and sediment into the stream. This is evidenced by the delta at the outlet of the stream into the lake which has grown over the past few decades. The areas that have been identified as impacting the water quality are in the lower 25% of the watershed and are found in conjunction with road networks and residential areas.

Issues such as stormwater runoff, onsite wastewater treatment, logging, streambank erosion and others were reviewed as a part of this assessment. A significant amount of field investigation was conducted for this assessment, including the walking of miles of stream channels and roadways. Stream water quality data and analysis provided by the Darrin Freshwater Institute, and a macroinvertebrate study was conducted to give a feel for the aquatic ecosystem.

It is our conclusion that the East Brook Watershed is in relatively good condition related to natural resources and overall water quality, particularly given the percentage of developed land within the watershed. Stream buffering is considered to be good, the majority of onsite wastewater systems are generally located an acceptable distance from the stream, no illegal septic system overflow pipes to the stream were found, logging activities are regulated by the Town of Lake George, and development within the watershed must meet Lake George Park Commission regulations for stormwater management and erosion control.

However, there are certainly signs of negative impacts to the East Brook stream system. These issues become manifested as mildly degraded sections of stream, its riparian corridor, and ultimately the delta at its confluence into Lake George. Given the relatively large percentage of existing development, there is a fairly significant amount of untreated stormwater runoff which enters the brook, primarily from both public and private roadways. Stormwater runoff is the number one impact to the stream system in terms of water quality, and flashy runoff events from roadway runoff has impacted the stream channel dimensions and morphology at roadway crossings. As development pressure continues, the ability for this watershed to maintain its water quality will be diminished. It is important to address the nonpoint source pollutant issues now, rather than waiting until the situation becomes untenable.

This being the case, it is imperative that existing stormwater runoff be addressed through retrofitting activities, and that new development meets the new stormwater management standards. Since the latter is a regulated activity and is addressed on a regular basis, this report looked at opportunities to address existing issues. Site specific stormwater runoff issues were identified within the watershed, and recommendations for improvement were discussed.

It is recommended that funding be sought to address these concerns, working with local municipalities and lake-based organizations. Given the size of the East Brook watershed and the percentage of development, the East Brook stream and watershed should stand out as a priority for restoration activities. If we are to work effectively to protect Lake George, we must begin this work upland to restore its tributary streams, including this important 3,000 acre watershed in the southern basin of the lake.

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