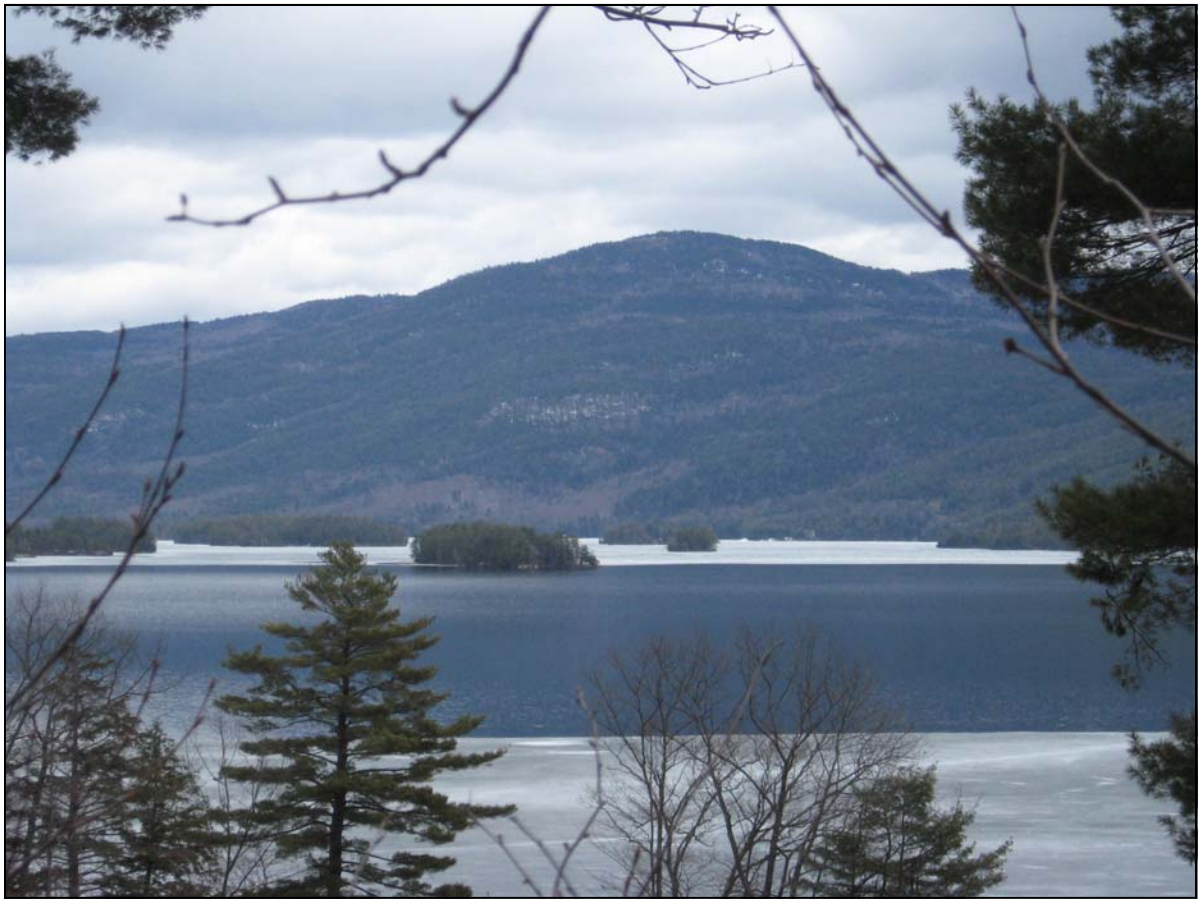
Town of Bolton Stormwater Retrofit Opportunities

Prepared by the

Warren County Soil and Water Conservation District

For the Town of Bolton under the Lake George Park Commission Community Stormwater Grant Program

April 2013



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Introduction and Background

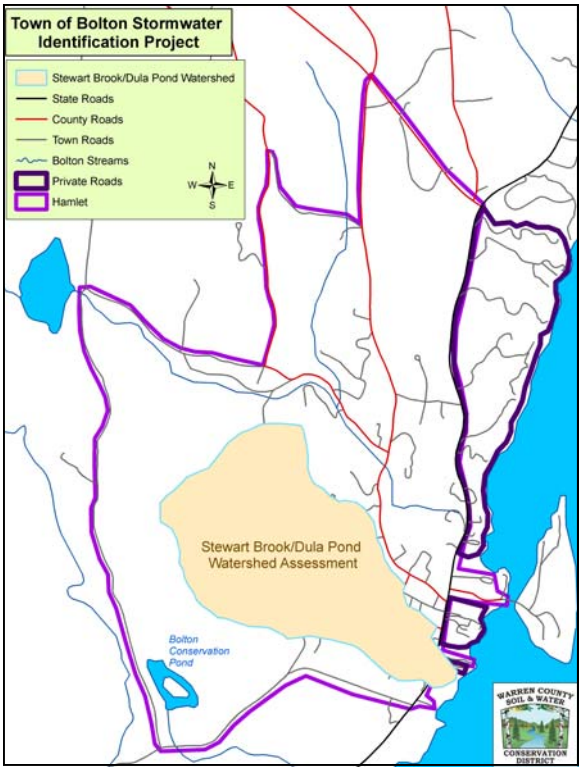
The hamlet of Bolton Landing stormwater retrofit opportunities analysis has been funded by the Lake George Park Commission Community Stormwater Grant Program for the Town of Bolton. Bolton has been very active in the field of stormwater management and is improving water quality within the community and Lake George through the stormwater grant program.

The Warren County Soil and Water Conservation District "District" has undertaken a review of the stormwater conveyance system within the hamlet of Bolton. The project determined areas of high priority in terms of stormwater runoff volume reaching Lake George. The hamlet falls completely within the Lake George Watershed resulting in all stormwater potentially draining to the lake.

Finkle Brook and Stewart Brook are both located within the hamlet of Bolton and both hold a AA-Special stream classification by the NYS Department of Environmental Conservation. The AA-Special stream classification holds the best usage for a source of drinking water status, which is the highest classification assigned, making both streams of very high importance when it comes to stormwater runoff entering these waters. With this report, the Town of Bolton will have a resource that identifies stormwater conveyance issues and retrofit recommendations to assist in resolving these issues.

Location

The District determined the boundaries of the Hamlet of Bolton Landing by the urbanized area of the Town of Bolton. The map on the right shows the boundaries within the town which also includes the private roads. The Stewart Brook/Dula Pond Watershed is located within the determined Hamlet boundaries and the study and information for the watershed can be located in the "Stewart Brook/Dula Pond Watershed Assessment" completed by the District in 2012. The report can be found on our District website at <http://www.warrenswcd.org/reports.html>. The Hamlet boundary southern border starts at Potter Hill Road and extends north to Bolton Landing Riverbank Road. The western border extends to Edgecomb Pond Road and the eastern border is created by the Lake George shoreline. The urbanized area and proximity to the lake makes stormwater runoff a priority in this location.



Stormwater Runoff

A significant concern in any developed area is the impact of stormwater runoff on the nearby waterbodies. Along roadways and parking lots, runoff is often channeled into drains and pipes, which most often outlet into a stream or a lake. Impervious surfaces such as roads, rooftops, and asphalt parking areas do not allow water from precipitation or snowmelt to infiltrate into the ground. As the water flows across these impervious surfaces, it can collect sediment, phosphorus, de-icing materials (sand and salt), petrochemicals and other pollutants.

Roadside ditches can also contribute to stormwater runoff issues when they are improperly installed or poorly maintained. A roadside ditch can contribute to increased stormwater runoff velocity leading to increased erosion and sedimentation. During warmer months, runoff can also be significantly warmer than the stream's water, causing thermal pollution affecting the stream's aquatic communities.

Stormwater discharges are a major contributor to sedimentation and delta formation issues in the lake and they can have significant negative impacts on aquatic communities. Calcium from road salt can create ideal conditions at the mouths of streams suitable for the colonization of zebra mussels. Phosphorus transportation by sediments may create multiple problems including the eutrophication of waterbodies, causing reductions in water quality and habitat for aquatic plants and animals.
Stormwater runoff can severely affect a waterbody's long-term stability. As land use patterns change and development occurs, typically more water runs off the land into nearby waters, often very quickly following a precipitation event. This increased volume of water entering a stream in a short period of time can cause an over widening of the stream channel in order to accommodate the increased volume of water. These channel widening processes occur through accelerated stream bank erosion, and ultimately more downstream deposition (deltas).

Stormwater runoff is considered to be the largest water quality impact in the Lake George Watershed. This report will provide the Town of Bolton the ability to identify opportunities to address stormwater issues and their impacts within the Lake George watershed.

Road De-icing Practices

Stormwater runoff in the Lake George Watershed is one of the highest priorities due to the pollutants stormwater carries to the waterbodies. Road de-icing practices (salt and sand) are a necessity for transportation safety, but also affect water quality when carried to a waterbody through stormwater conveyance. Within the Hamlet of Bolton Landing excluding the Stewart Brook Watershed, there are 17.6 lane miles of road that require de-icing practices during winter storm events. These de-icing practices vary between town, county, and state roads. The Town of Bolton uses salt only on the 10.6 miles of town roads. Warren County and NYS Department of Transportation (DOT) use salt only but in varying amounts and types. Warren County has 5.0 lane miles within the hamlet and the NYS DOT has 2.0 lane miles. Another factor of road de-icing is temperature during the storm event. A 15° to 23° storm event requires a higher applica-

tion rate of de-icing materials as opposed to a 23° to 32° event. For example a 32° snow storm may require only 125 Lbs of de-icing materials per lane mile, and a 15° snow storm may require 325 Lbs of de-icing materials per lane mile. The chart below represents an average of sand and salt application rates.

Average Salt and Sand Application Rates in the Hamlet of Bolton Landing

Roads	Lane Miles	Pounds salt/sand per lane mile	Total Lbs of Salt	Total Lbs of Sand
Town Roads	10.6	225/0	2,385	0
Warren Co. Roads	5.0	200/0	1,000	0
NYS Roads	2.0	195/0	390	0
Total Per Storm	17.6		3,775	0
	Total Average De-icing Materials Per Storm 3,775 Lbs			

Advancements and awareness in road de-icing practices and stormwater treatment are becoming a major part of municipal duties. Treated salts are now available that de-ice driving surfaces faster at colder temperatures, allowing for a lower application rate on roads. A lower salt application rate directly results in lower stormwater contamination from road runoff. Both Warren County and the NYS DOT have used treated salt, but their state contract controls whether or not they are able to purchase the treated salt. Another advancement is the DICKEY-john snowplow sander controller. The Town of Bolton trucks have be equipped with DICKEY-johns allowing the operator to program a set application rate of de-icing materials. Once programmed, the flow of de-icing material automatically adjusts depending on ground speed, allowing the applications rates to remain uniform at all speeds. There are now educational forums being held on best management practices for de-icing along with the newest technologies and techniques.

Assessment Methodology

This report is a comprehensive stormwater examination of the roadway network in the hamlet area of the Town of Bolton. This consisted of a review of the stormwater runoff from the conveyance system along all town, county and state roads within the Lake George Watershed as well as detail cost effective recommendations that will reduce stormwater pollutants and sediment input to Lake George.

District staff used Geographic Information System ArcView 9.3 (GIS) to identify the road network within the hamlet. These maps were referenced throughout the project as a guide and layout for final stormwater identification mapping. Each of the roads were driven by district staff, documenting the stormwater network, outfalls and storm drain inlets along with any non-point source pollution. Data was collected using a Global Positioning System (GPS) Trimble Juno SB. And was logged and photographed to document the physical conditions of stormwater runoff from the conveyance system. The information collected was processed in the office and the GPS data were differentially corrected and exported as shapefiles for utilization in GIS maps.

Each area of concern identified as a contributor to erosion or stormwater pollution was reviewed for potential solutions. The recommendations identified in this report involve areas of direct discharge to a waterbody, inlets that receive significant amounts of stormwater runoff from the roadway network and roadside ditch erosion to the conveyance system.

Paved Ditch to Finkle Brook On Valley Woods Road

Stormwater Mapping and Retrofit Recommendations

Valley Woods Road South of Heroes Loop

A paved ditch located 50 feet south of Heroes Loop on Valley Woods Road drains directly to Finkle Brook. The location where the paved ditch outlets to the brook is a low point in the topography resulting in a stormwater runoff collection point. Valley Woods Road is crowned in the center draining a road width of 10 feet and a road length of 1,500 feet. Roadside runoff is conveyed from both the north and the south with the majority of the stormwater draining from the north. During a one inch storm, this location receives approximately 9,350 gallons of stormwater runoff.

Recommendation:

The recommended retrofit to slow velocity, capture and infiltrate stormwater runoff would consist of two parts. The initial work would be to replace the impervious paved swales with vegetation and check dams to slow stormwater velocity allowing for sediments to drop out, and by removing the impervious surface, stormwater will also be able to infiltrate, reducing runoff volume. The second part consists of two drywells that will capture and infiltrate stormwater preventing the first flush of stormwater which contains the highest amount of stormwater pollutants from entering Finkle Brook. Constructions constraints, such as depth to bedrock and groundwater, will determine if this location is feasible for stormwater infiltration.

Paved Ditch to Drop Inlet on Lake Shore Drive

Lake Shore Drive (9N)

Three drop inlets located on Lake Shore Drive drain a significant amount of roadside stormwater runoff directly to Finkle Brook. The drop inlet located at the intersection of North Brook Drive and Lake Shore Drive captures 200 feet of roadside drainage in paved ditches and is connected to a drop inlet located west across the road from Darin Fresh Water Institute. This second drop inlet located on the west side of Lake Shore Drive across from Drain Fresh Water Institue outlets directly to Finkle Brook and captures an additional

Intersection of Lake Shore Drive and North Brook Drive

250 feet of road in paved ditches adding to the 200 feet captured at the North Brook intersection. On the east side of Lake Shore Drive in front of the Darin Fresh Water Institute, another drop inlet captures 325 feet of drainage in paved ditches and connects to the drop inlet on the west side which outlets to Finkle Brook. Between the three drop inlets, the entire 775 feet of Lake Shore Drive stormwater runoff is capture and conveyed to Finkle Brook. During the summer months, stormwater heats up on the pavement causing superheated stormwater to runoff into the brook producing thermal pollution and disrupting the stream's ecology. Also, the paved ditches along both sides of Lake Shore Drive increase stormwater velocity allowing the runoff to pickup de-icing materials and other pollutants before draining into the brook. The two southern drop inlets across from Darin Fresh Water Institute are currently full of sediment, which is a good sign, because the drop inlets do allow for some sediment to drop out and collect before entering the brook. The amount of sediment in the drop inlets is also a reminder of the maintenance that needs to be performed on stormwater conveyance systems and the need for additional storage capacity for sediment and other suspended solids before entering the brook.

Recommendation:

This 775 foot stretch of Lake Shore Drive is in a challenging location with multiple construction constraints due to Finkle Brook's proximity to the road and the steep slopes with very limited treatment space on the west side of the road. The heavily forested area, necessary road de-icing materials for safe travel, and paved driveways connecting to the road make it difficult to establish vegetated swales in this particular location. The housing and building development, steep slopes, and bedrock all reduce the ability for stormwater retrofit opportunities.

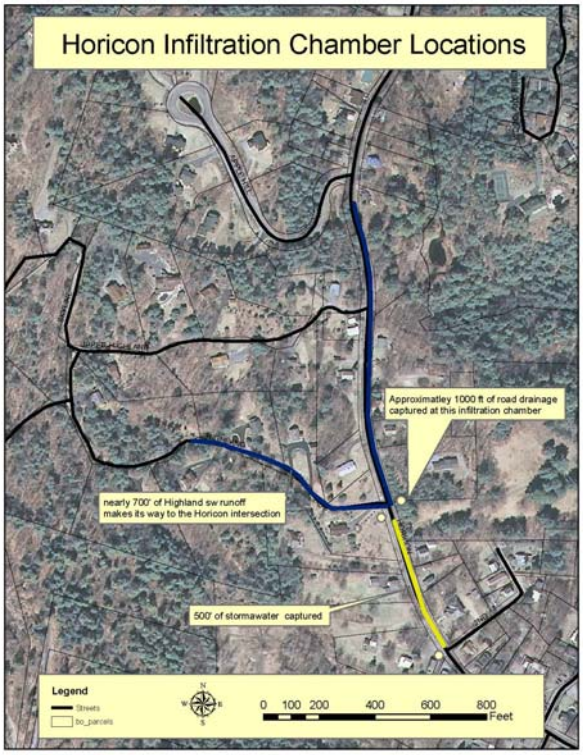
Due to all the site constraints, there are very limited possibilities for infiltration systems on this section of Lake Shore Drive. A system that works well in sites with multiple limitations is a hydrodynamic flow separator. The small footprint of this structure will make it ideal for the constrained location on Lake Shore Drive. In addition, the lightweight design makes for ease of install without the need for heavy lifting equipment. Hydrodynamic flow separators swirl stormwater allowing for the suspended solids (sediment) to be stored at the bottom, floatables such as plastic bottles and greases/oils to be at the top of the device until it is time for maintenance.

Maintenance includes twice yearly inspections (spring and fall) and uses a vacuum

truck to remove the suspended solids captured by the system. A maintenance agreement will be part of the planning stages if a hydrodynamic separator is implemented in the future.

Horicon Avenue

There is nearly a 2,000 foot stretch of Horicon Avenue starting just south of Apple Hill Road and continues to a bend just below Second Avenue. This portion of road includes upper and lower Highland Drive (which contributes another 1,000 feet) and continues down past the driveways across from Second Avenue that have been taking the majority of stormwater for some time. Residents have resorted to a speed bump deep lip in the swale at the end of their driveways to divert the stormwater further down the road. This section of Horicon Ave. has a nearly 20% slope. Much of this stretch of road drains towards Stewart Brook and carries the materials to Lake George. This stretch of road is neither ditched nor allows for the stormwater to splay to vegetated swales. Breaking up stormwater with retrofits above this location would go a long way to lessening the impact it currently has on residences, the road, and the stream below.



Recommendation:

The recommended retrofit to slow velocity, capture, and infiltrate stormwater runoff would consist of three installations. The first of three would place a double stack infiltration chamber on the south side of Upper Highland Drive that would capture stormwater from the nearly 800' of that road as well as,1,300' from Horicon Avenue itself through a turned out swale and catch basin on the north side of the road. A second installation would be placed on the east side of Horicon Avenue across from Highland Drive and would include a bowled out swale to a drop inlet on a single stack drywell. Lastly, a third infiltration chamber would be placed in the bend of Horicon Avenue above Second Avenue and would incorporate a rock lined swale to the drop inlet of the structure and a berm to divert excessive stormwater back to the ditch. These drywells will capture and infiltrate stormwater preventing the first flush of stormwater which contains the highest amount of stormwater pollutants from entering Stewart Brook. Construction constraints, such as depth to bedrock and utility locations will determine if this location is feasible for a stormwater infiltration system.

Horicon Avenue and First Street

A drop inlet located at the intersection of Horicon Avenue and First Street receives a

significant amount of stormwater that drains to Stewart Brook. A 1" storm in this location will receive up to 6,583 gallons of stormwater. The paved ditches draining southeast down Horicon Avenue do not allow for any infiltration and also increase stormwater velocity by concentrating the sheet flow coming off the road.

Recommendations:

The three drywells planned north of this location on Horicon Avenue will significantly reduce the amount of stormwater flowing to this location, as described in the previous section "Horicon Avenue". Additional recommended retrofits for Horicon Avenue would be vegetated swales with check dams to slow stormwater velocity and increase infiltration. Vegetated swales also collect suspended solids and pollutants. The NYS DEC recognizes that successfully developing a vegetative cover will reduce sediment inputs by up to 90%. A general seed mix that works successfully in the Lake George Watershed is comprised of creeping red fescue, Kentucky bluegrass, chewing fescue, and perennial ryegrass. It is also advisable to add annual ryegrass which will germinate quickly for short term vegetated cover, and at first frost it will die and decompose supplying a higher organic load (leaf debris) to the area.

Goodman Avenue

Goodman Avenue is a suggested site in the "Stewart Brook/Dula Pond Watershed Assessment" report, and while checking the feasibility of an infiltration system in this location, the District performed a secondary study. Stewart Brook flows south under Goodman Avenue where it receives roadside runoff at two location on the north and south side of the road. The north side of Goodman Avenue drains 150' of road while the south side drains 500' of road during a storm. At this location Stewart Brook receives 6,078 gallons of stormwater during a 1" storm event. The ditches are partially paved and partially vegetated with paved swales designed to catch stormwater around the outlets and convey it to Stewart Brook.

The North Side of Goodman Avenue Draining to Stewart Brook

Recommendation:

Preventing direct stormwater discharge to Stewart Brook is a top priority in this location. The removal of the paved swales to the Brook and replacing them with vegetated swales at the north and south outlet to the brook. On steeper slopes it is recommended that the bottom or the entire ditch be stone lined to decrease stormwater velocities. To prevent any flooding during a large storm event, the swale would have an overflow outlet to the brook or forested area near the brook. This location would have to involve property owners. Also, connecting the roadside runoff and bioretention basin with vegetated ditches. To aid with stormwater velocity in this particular location, the addition of check dams will slow the runoff and allow for additional infiltration and suspended solid removal.

The low point in the topography at the Stewart Brook culvert crossing indicates high groundwater. A test pit will need to be dug to determine if larger stormwater infrastructure will be feasible at the Goodman Avenue location or if the site constraints, such as depth to groundwater and bedrock, will prevent a shallow drywell from being installed. The installation of a drywell will capture additional stormwater runoff and infiltrate it while recharging the groundwater and capturing sediments and pollutants before entering the brook.

Frank Cameron Road

Three culverts located on Frank Cameron Road drain stormwater from the golf course to an unnamed tributary of Finkle Brook. Further research would need to be done on the inlets and drainage to these culverts. Stormwater draining from a golf course is just like draining from a lawn but on a larger scale. The stormwater draining from lawns, depending on how the lawns are maintain, may by conveying herbicides to the stream but on the plus side the stormwater runoff is flowing through vegetation before entering the culvert inlets. A more in-depth study of this outfalls and stormwater conveyance may want to be done at some point in the future.

Frank Cameron Road Culverts

Recommendation:

Some overall recommendations for Frank Cameron Road would be talking to the golf course to see what kind and how much herbicide and nitrogen is applied to the grass. Once the information is gathered, further research (soil test) to see if any changes could be made to be more economical for golf course and outlet cleaner stormwater runoff.

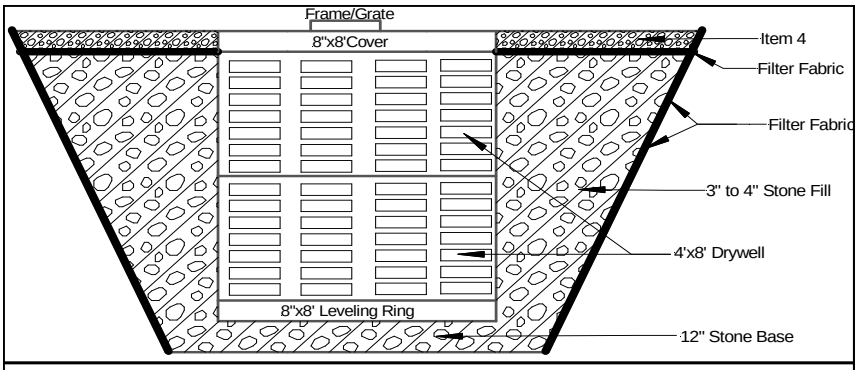
Mohican Road

Mohican Road drains a significant amount of stormwater east towards Lake Shore Drive (Route 9N) and Lake George. Using infiltration systems to break up stormwater drainage throughout the Lake George watershed is the best way of dealing with runoff and preventing pollutants from entering the lake. Multiple infiltration site locations will prevent any one location from being overwhelmed with stormwater runoff and failing during the continuously more common large storm events the northeast has been experiencing. Breaking up and infiltrating

Mohican Road Drainage

stormwater also prevents large volumes from accumulating at high velocities on steep roads creating other stormwater issues such as roadside erosion. Mohican Road is a straight road with paved swales that allow stormwater velocity to build and increase which in turn increases distance of stormwater travel and decreases infiltration rates. The increased stormwater velocity also carries higher amounts of de-icing materials and other pollutants.

A Mohican Road stormwater infiltration system is already well into the planning stages and consists of three potential locations located a third of a mile west of the intersection of Lake Shore Drive. Each of the planned drywells installations are located above drainage outfalls which will divert the stormwater from the ditching to a drywell. Depending on site constraints, the plan is to install one or two drywells that would be in series at each identified location. A test pit will be dug this spring and the groundwater elevation will determine size and depth of drywells. The series of drywells will all be located on the south side of Mohican Road due to utilities and other site constraints on the north side. The three drywell location will not be connected lessening the construction and disturbance footprint and allowing the ability to break up stormwater over a larger distance.



Double Stack 4'x8' Drywells

Bolton Highway Garage

The Town of Bolton Highway Garage has an unnamed tributary of Finkle Brook flowing just north of the building's parking lot. The parking area where sand and salt materials are held drains north towards the stream. A drywell installation in the back parking area of the highway garage would capture the sediments and de-icing materials from the back paved area of the garage before entering the stream while also infiltrating and recharging groundwater.

The other location on the highway garage property is located to the east of the old highway garage building. This section of the property receives stormwater flowing east from Finkle Road and turns north and flows through a ditch to the unnamed tributary of Finkle Brook. Each of these locations contribute stormwater drainage and de-icing material runoff to the stream. A single stack drywell retrofit or if feasible, a double stacked drywell will capture the majority of the runoff reducing stormwater impacts to the stream. This retrofit will


Stormwater Drainage from Lake Shore Drive to the Old Highway Garage

reduce the overall stormwater pollution Finkle Brook and eventually Lake George.

Town Municipal Parking Lot

The town municipal parking lot is located on the west side of Lake Shore Drive (9N) and has an issue with stormwater pooling on the lot. Approximately six feet in from Lake Shore Drive, the parking lot has a slight rise preventing the stormwater from draining to Lake Shore Drive. Not draining to Lake Shore Drive is actually good due to the multiple drop inlets on Lake Shore Drive that drain directly to Lake George but also requires a stormwater retrofit to prevent flooding in the lot. The lot is 13,125 square feet and in a half inch storm the lot collects 4,846 gallons of stormwater. Two 4'x8' drywells will have a storage volume of 3,007 gallons which does not include infiltration rates and the stone fill storage which will capture the majority of the stormwater prevent flooding on the lot.

Town Municipal Parking Lot

Juniper Hill Drop Inlet to Lake

Other Recommendations:

Private Roads within the hamlet

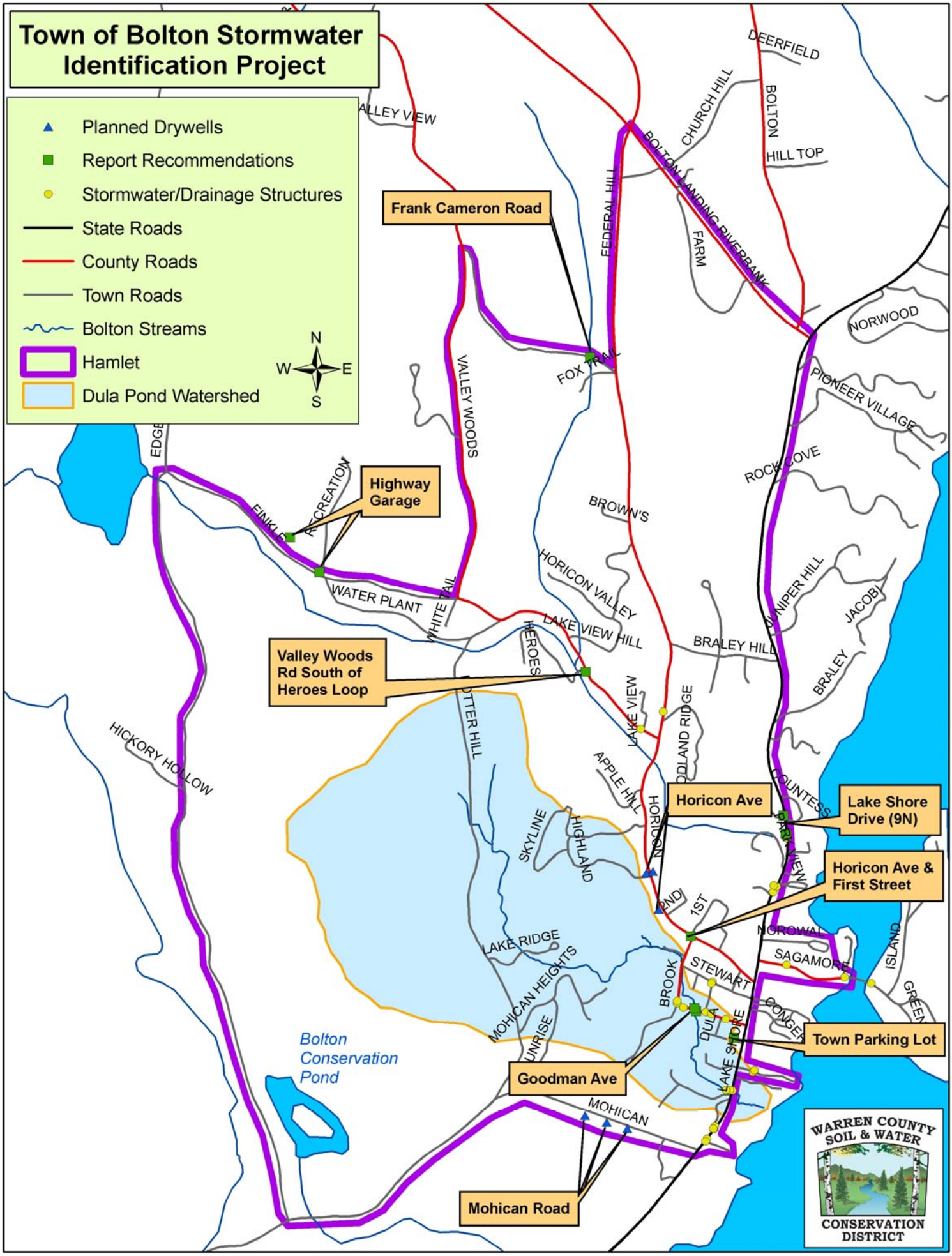
The private roads within the hamlet of Bolton Landing are not calculated into the de-icing totals due to the private residence responsibly of taking care of the roads and de-icing materials. The private roads in the hamlet are of high priority due to there proximity to the lake. Education and outreach to this local community along the shoreline about stormwater impacts to Lake George, stormwater management techniques, and best management practices for de-icing would assist in improving water quality in this sensitive area. The private roads map shown on page 12 displays the 4.2 lane miles of private roads along the shoreline.

These private roads appear to be well maintained and the overall stormwater conveyance is well taken care of. One of the main concerns is the bedrock they are constructed on. Bedrock does not allow for infiltration and a more in-depth study may show more of a stormwater concern due to limited infiltration. The majority of the roads end with a driveway or property along the lake shoreline restricting the mapping abilities in these areas and full evaluation of the stormwater. An agreement with the landowners in these locations would have to be established in order to walk over the properties and finish collecting stormwater data. From the data collected, these roads do not appear to have any areas of high priority, but there are certainly areas of concern due to direct outfalls into the lake.

The stormwater conveyance from the private roads is not significant and the majority of stormwater is properly taken care of with stabilized rock lined ditches and vegetated swales into forested areas. One area of concern is located on Juniper Hill and consisted of a maintained ditch that needs to be vegetated or rock lined, and a drop inlet at the end of the road draining to the lake. Other areas of concern were, two larger private driveways located off route 9N that drain directly to the lake with nothing to slow, divert, or infiltrate the stormwater runoff. Also, a drop inlet on The Anchorage Road drains a small area to the lake which is only a minor concern but may vary depending on de-icing materials used.

Conclusions

The Town of Bolton is working to keep the waters entering Lake George clean by advancing its stormwater management ability through this document. The District is already working with the Bolton Highway Department on multiple stormwater retrofit projects that are in the planning stages to be implemented this coming summer of 2013. Overall five locations have been agreed upon through meetings and site visits between the Bolton Highway Department and the District. The five locations referenced in the report are Mohican Street, Horicon Avenue, two sites at the Bolton Highway Garage and the town parking lot. Each project is waiting for the spring thaw and the ground to dry up enough for a test pit. A test pit is the final step in determining if the project will move in to the implementation phase or if adjustments to the location and design will be needed. Overall, with each stormwater retrofit within the Lake George Watershed, the tributaries of the lake are continuing to stay clean by preventing stormwater pollution, which in turn keeps Lake George one of the most pristine lakes in the country.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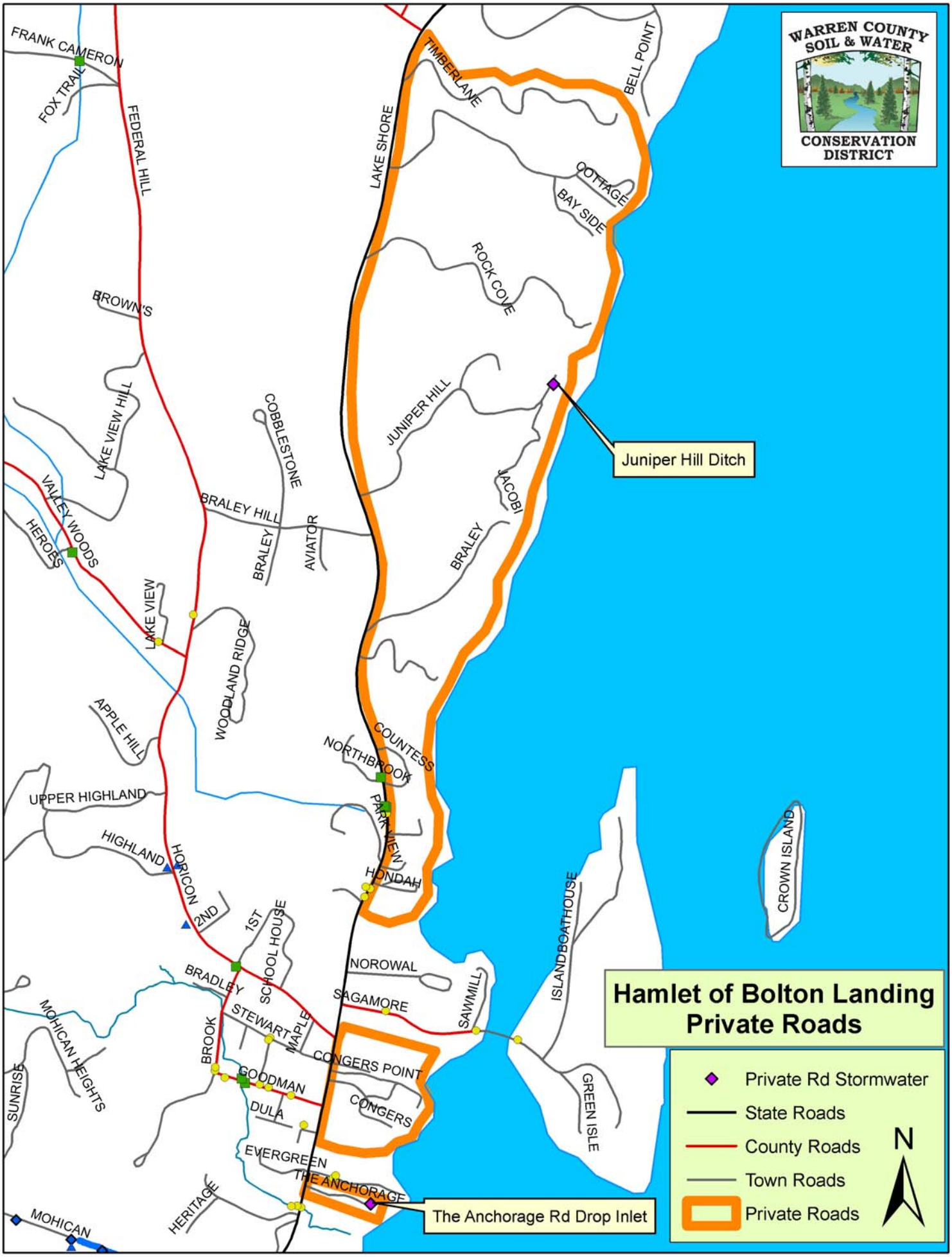
BROOK
STEWART
DULA
LAKE SHORE
MOHICAN
NOROWAL
SAGAMORE
ISLAND
CONGER
WARREN COUNTY SOIL & WATER CONSERVATION DISTRICT


WARREN COUNTY SOIL & WATER CONSERVATION DISTRICT
Hamlet of Bolton Landing Private Roads
Private Rd Stormwater
State Roads
County Roads
Town Roads
Private Roads
N
Juniper Hill Ditch
The Anchorage Rd Drop Inlet
FRANK CAMERON
FOX TRAIL
FEDERAL HILL
TIMBERLANE
BELL POINT
LAKE SHORE
COTTAGE
BAY SIDE
ROCK COVE
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PARK VIEW
HONDAH
UPPER HIGHLAND
HIGHLAND
HORICON
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SCHOOL HOUSE
BRADLEY
NOROWAL
SAGAMORE
SAWMILL
ISLANDBOATHOUSE
CROWN ISLAND
MOHICAN HEIGHTS
STEWART
MAPLE
BROOK
CONGERS POINT
GOODMAN
CONGERS
DULA
SUNRISE
EVERGREEN
THE ANCHORAGE
GREEN ISLE
HERITAGE
MOHICAN

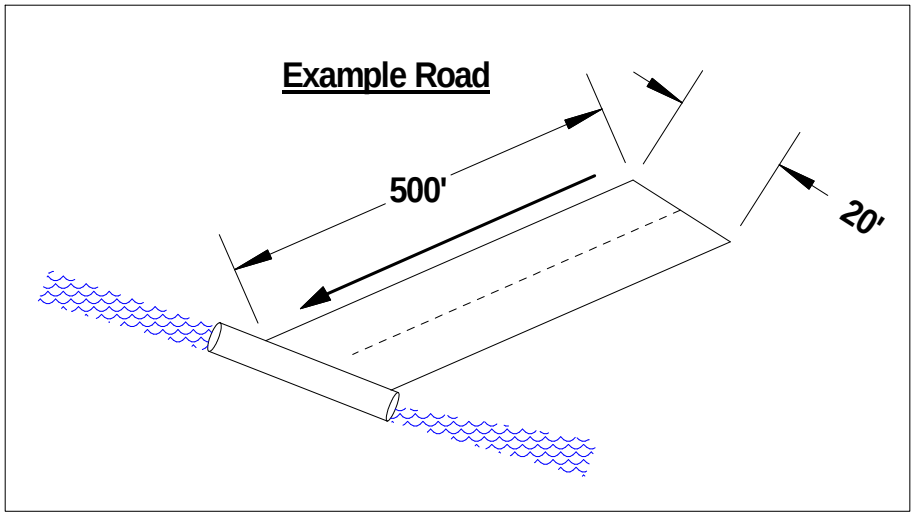
Appendix

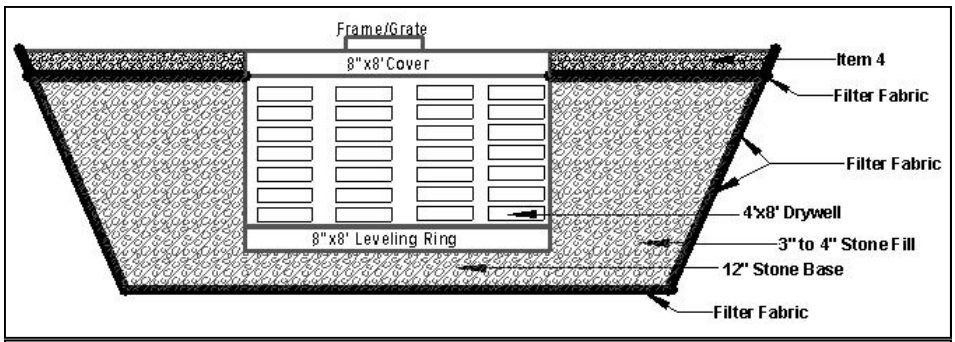
Stormwater Resource Websites

- DEC Division of Water Stormwater Webpage:
  http://www.dec.ny.gov/chemical/8468.html
  - New York State Standards and Specification for Erosion and Sediment Control ("Blue Book") Current Version: August 2005
  - New York Stormwater Management Design Manual
    Current Version: August 2005
- Lake George Park Commission:
  http://www.lgpc.state.ny.us/
- Warren County Soil & Water Conservation District:
  http://www.warrenswcd.org/
- The Lake George Association:
  http://www.lakegeorgeassociation.org/
- The Fund For Lake George:
  http://www.fundforlakegeorge.org/
- Soil & Water Conservation Society - Empire State Chapter:
  http://www.swcsnewyork.org/
- SUNY-ESF Continuing Education - Stormwater Management Program:
  http://www.esf.edu/outreach/stormwater/
- Center For Watershed Protection:
  http://www.cwp.org/
- EPA Stormwater Homepage:
  http://cfpub.epa.gov/npdes/home.cfm?program_id=6

Typical Roadside Treatment Calculation

Example Road drains 500’ of length and 20’ of width to the low point in the topography. The low point in Example Road is a culvert with a stream flowing under the road. This section of Example Road drains 500’ x 20’ = 10,000 square feet of road drainage. To calculate volume of stormwater in a 1” storm divide 10,000 sq ft by 12” and you get 833 cubic feet which converts to 6,231 gallons of stormwater draining to the stream.





Cross section of a typical 4’ x 8’ Drywell