ST-1, Ashley Cove

Description: Ashley Cove is an approximately 3.0 acre cove located along the northeastern shoreline of Lake Hopatcong, in Jefferson Township, Morris County.

Problems: There are a number of invasive species located in Ashley Cove, including Eurasian watermilfoil (*Myriophyllum spicatum*), an aquatic macrophyte, and semi-aquatic / terrestrial species such as purple loosestrife (*Lythrum salicaria*), tree of heaven (*Ailanthus altissima*), and Japanese knotweed (*Polygonum cuspidatum*).

A restoration planting project was conducted at Ashley Cove at in May 2006. Native species such as red maple (*Acer rubrum*), grey dogwood (*Cornus racemosa*) and witch hazel (*Hamamelis viriniana*) were planted along 400 feet of shoreline. With this shoreline stabilization project complete, there remains approximately 150 linear feet of the cove shoreline that is unvegetated and exhibits signs of erosion.

In addition to experiencing shoreline erosion, the cove experiences high rates of sedimentation from the watershed, which results in an in-filling of near shore areas. In turn, such in-filling negatively impacts littoral habitat which is used by many fish for spawning, as well as the ability to easily access the lake for recreational use. In-filling also promotes the further establishment of nuisance stands of submerged macrophytes, particularly invasive species such as Eurasian watermilfoil.

Recommendations:

Invasive species management. Mechanical weed harvesting is currently used by the Lake Hopatcong Commission (LHC) for the control of excessive densities of aquatic macrophytes, with an emphasis placed on invasive species such as Eurasian watermilfoil. The physical and/or chemical removal of the purple loosestrife should be implemented, in conjunction with planting some select areas of the infested and unvegetated sections of shoreline with native vegetation. In addition, an educational program should be developed that provides information on the identification of the known invasive species, as well how to physically remove and properly dispose of such species.

Shoreline stabilization. A continuation of shoreline planting at Ashley Cove is recommended. Assuming the targeted 150 linear feet of eroded shoreline is targeted for stabilization, such a project is estimated to cost approximately $6,000.00 to $7,000.00 if no machinery is necessary to re-grade the shoreline and the project only entails the planting of wetland and semi-aquatic vegetation. However, if machinery is required to re-grade the shoreline, additional labor and material costs would result in the project costing approximately $8,000.00 to $9,000.00. These prices include labor, purchase of materials and plants, and permitting. It should be noted that these prices assume all work would be conducted by hired contractors. The actual price of implementing this proposed project would be lower if volunteer and/or local staff (i.e. municipal employees and/or operations staff of the Commission) would participate in the project.

Stormwater retrofits. Ashley Cove is located in one of the prioritized areas targeted for the installation of stormwater retrofits and Best Management Practices (BMPs), as per the TMDL-based Restoration Plan (Princeton Hydro, 2006). Thus, this site should be designed as a high priority project relative to the other locations. The Township of Jefferson and the Lake Hopatcong Commission have identified the stormwater infrastructure and the local tributaries that discharge into Ashley Cove as high priority locals for future stormwater retrofits and/or the installation of BMPs.

ST-2, JP's Pizzeria

Description: An unnamed stream runs adjacent to the parking lot of JP's Pizzeria on Brady Road in Jefferson Township, Morris County. This stream has a well developed riparian corridor dominated by herbaceous plants.

Problems: This site lies on private property presenting a potential obstacle for restoration efforts. A make shift dam is present and is constructed of railroad ties across the channel at an outfall pipe. As a result, the channel has become inundated with sediments.

Recommendations:

Education/ Outreach. Due to the constraints of private ownership of the site, options are limited. Therefore, educating the property owner about appropriate stream stewardship appears to represent the best option for restoration.

Removal of sediments. Once the source of the sediment loading has been identified and addressed, the project of removing the sediment bar can be undertaken. It should be emphasized that any earth-moving activity near a waterway, whether a streambank stabilization project or the removal of a sediment bar, requires a permit through the New Jersey Department of Environmental Protection. Typically, the municipality and/or private landowner is responsible for obtaining the required permits. However, the Lake Hopatcong Commission may be able to assist in design, permitting or implementation of the project. The estimated cost to remove the sediment bar is dependent primarily upon the amount of sediment targeted for removal.

ST-3, Benedict's Lagoon

Description: Benedict's Lagoon is an approximately 5 acre waterbody located adjacent to the northeastern shore of Lake Hopatcong in Jefferson Township, Morris County. This site is currently scheduled for the installation of a three chambered baffle box in order to limit sedimentation in the lagoon.

Problems: The stream that drains to Benedict's Lagoon is currently in the initial stages of being infested with several invasive species, including common reed (*Phragmites australis)* and Japanese stiltgrass (*Microstegium vimineum).*

As the stream runs through a playground, stretches of the bank lack a proper riparian buffer. The lack of buffer is also contributing to the visible sedimentation problems in the stream. Such sedimentation of the streambed degrades the complex in-stream habitat utilized by macroinvertebrates and small fish. Extremely heavy rates of sedimentation can completely eliminate such valuable in-stream habitat.

Recommendations:

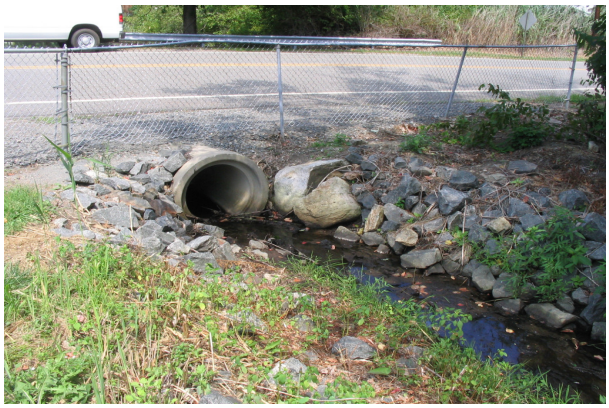
Streambank stabilization. A streambank stabilization project using native species is recommended along the stretch of the stream that runs through the park. This should stabilize the banks to reduce sediment loss and increase the buffer area to increase riparian function. Using an estimate of approximately 300 linear feet targeted for stabilization, the cost to implement this project is $11,000.00 to $12,500.00 if machinery is required and $8,000.00 to $9,000.00 if no machinery is required. These price estimates include labor, materials / plants and permitting.

Invasive species management. Invasive species should be removed by physical or chemical means and replaced with native vegetation. As with any chemical treatment in an aquatic or semi-aquatic habitat, a licensed applicator would need to obtain a State permit to implement an invasive species control program using an approved herbicide.

Education/ Outreach. This site would be an ideal location for teaching the local community about how a healthy and stable watershed that addresses its generated stormwater would translate to improved in-lake water quality conditions. The installation of a baffle box BMP, the planting of native species within the stream corridor and the removal of invasive species all in proximity to each other provides an excellent opportunity for an educational kiosk or as a site for environmental/watershed education events.

Benedict's Lagoons is located within one of the prioritized areas targeted for the installation of stormwater retrofits and Best Management Practices (BMPs), as per the TMDL-based Restoration Plan (Princeton Hydro, 2006). Thus, this site should be designed as a high priority project relative to the other locations.

ST-3, Benedict's Lagoon (continued)



ST-4, Memorial Park

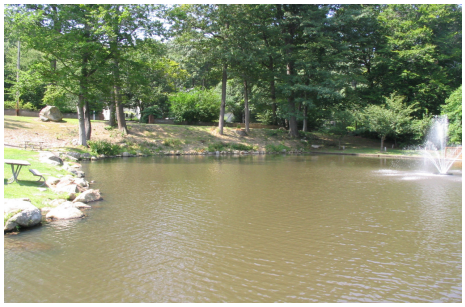
Description: Memorial Park is a 5 acre municipal park located off of Howard Boulevard in the Borough of Mount Arlington, Morris County.

Problems: A small pond is located at Memorial Pond. This pond has had sedimentation problems since the 1990's and was dredged in the late 1990's with funds provided by US EPA. The shoreline of the pond is bare and stabilized with large rocks at the base of the banks. The presence of tall trees on the edge of the pond is also of concern. Since the banks of the pond are losing sediment in the absence of stabilizing vegetation, there is potential for the trees to fall into the pond. Memorial Park is used by young children and densely surrounded by residential homes, causing concern for public safety.

Recommendations:

Shoreline stabilization. To improve site aesthetics, decrease sedimentation to the pond, and calm public safety concerns, the banks of the pond at Memorial Park should be revegetated using native plants. If no mechanical equipment is necessary for shoreline planting along Memorial Pond and the total length of stabilization is approximately 300 linear feet, a shoreline planting project of the pond is estimated to cost between $8,000.00 to $9,000.00

Memorial Park, including Memorial Pond has already been identified as a prioritized site, targeted for the installation of stormwater retrofits and Best Management Practices (BMPs), as per the TMDL-based Restoration Plan (Princeton Hydro, 2006). Thus, this site should be designed as a high priority project relative to the other locations. Additionally, Memorial Pond is upstream of a site identified for some major stormwater infrastructure retrofits to reduce Mount Arlington's relative contribution to the lake's phosphorus, as described in the TMDL-based Restoration Plan.



ST-5, Howard Boulevard

Description: This site is located along Howard Boulevard in the Borough of Mount Arlington, Morris County.

Problem: The stream along Howard Boulevard is severely eroded. Impervious surfaces from a nearby shopping area lie within 50 feet of the stream bank. Large amounts of sheet flow from the immediate areas inundate the stream channel during storm events and are responsible for most or all of the extensive erosion. In addition, this stream corridor is infested with the invasive species Japanese knotweed (*Polygonum cuspidatum).*

Recommendations:

Invasive Species management. It is recommended that removal of Japanese knotweed by physical or chemical means should be coupled with replacement with native species.

Streambank Stabilization. In addition to the removal of the invasive species and planting of native species, some additional structural work (i.e. re-grading, installation of rip-rap) is recommended.

Stormwater retrofits. It may be possible to work with the property owners of the shopping area to install retrofits into the existing stormwater infrastructure to reduce the magnitude of the pollutant loads. It may also be possible to install small-scale infiltration BMPs into the existing parking lot in an effort to reduce the magnitude and force of the water that leaves the site and contributes toward the observed streambank erosion.

ST-6, Oneida and Mountain View

Description: The site at Oneida and Mountain View is located in the Borough of Mount Arlington, Morris County and was overgrown with the invasive species Japanese stiltgrass (*Microstegium vimineum*) and tree of heaven (*Ailanthus altissima*). Due to the high level of growth, access to the stream site was very limited. Thus, this did not allow for a thorough site evaluation at the time. At a minimum, some physical or chemical removal of the invasive species should be conducted, followed by the stabilization of the site with native species.

ST-7, Ingram Cove

Description: Ingram Cove is an approximately 5 acre cove located on the southwestern shoreline of Lake Hopatcong, in Hopatcong Borough, Sussex County.

Problems: Conditions in the cove include high concentrations of filamentous algal mats as a result of prevailing winds and high densities of the invasive aquatic macrophyte Eurasian watermilfoil (*Myriophyllum spicatum*). A stream flows into the cove draining Ingram Road. Extensive erosion, sedimentation and large amounts of woody debris were observed in the streambed at the time of the site evaluation. While the stream's upper banks are generally well vegetated the "lower" end of the stream, closer to the lake, displays a deep channel and severely eroded streambanks.

Recommendations:

Stormwater retrofits: Due to the recognized problems experienced at Ingram Cove, Ingram Road was selected for a large-scale BMP installation project to reduce the pollutant loads (i.e. total phosphorus and total suspended solids) entering the cove as part of a Non-Point Source grant awarded to the Lake Hopatcong Commission by the New Jersey Department of Environmental Protection. Unfortunately, due to site-specific complications associated with existing underground utilities, this project had to be moved to another site within the Borough of Hopatcong. However, retrofitting the existing catch basins along Ingram Road is still a potential option, which may be implemented as part of an upcoming US EPA Targeted Watershed grant.

Streambank stabilization: Some streambank stabilization efforts along 50 to 100 linear feet of stream edge is estimated to cost between $5,000.00 and $7,000.00, including labor, materials, plants and permitting. It should be noted that this cost does not include the use of any machinery to re-grade the streambank. Additionally, permitting of any restoration project at this site may be a little more complicated relative to other sites in the watershed.

ST-8, DuPont Avenue

Description: The DuPont Avenue wetland site is located in Hopatcong Borough, Sussex County. This wetland was designed and installed to function as a wetland treatment Best Management Practice (BMP). However, in addition to its functionality from a water quantity and quality perspective, it also is a valuable wildlife and natural resource amenity for the Borough.

Problems: Extensive invasive species infestation is visible at the wetland and surrounding area at DuPont Avenue. Invasive species include: purple loosestrife (*Lythrum salicaria)*, multiflora rose (*Rosa multiflora)* and Japanese stiltgrass (*Microstegium vimineum*). Of particular concern is the quick colonization of the wetland itself by the purple loosestrife.

Recommendations:

Invasive species management. The physical and/or chemical removal of the purple loosestrife and Japanese stiltgrass should be implemented in conjunction with planting native obligate wetland species. The removal of multiflora rose will be more intensive and may require the use of mechanical devices.

The quick colonization of purple loosestrife is reducing the overall plant diversity of the wetland basin. In turn, this reduction in native vegetation will impact the wildlife value of the wetland BMP. Additionally, a particularly large accumulation of purple loosestrife in the basin may eventually impact the hydrology and functionality of its pollutant removal capacity. Thus, in order to ensure that the basin is operating at its optimal capacity to remove pollutants, the purple loosestrife needs to be eradiated and it should be re-planted with native wetland species.

The DuPont Avenue site is located within in one of the prioritized areas targeted for the installation of stormwater retrofits and BMPs, as per the TMDL-based Restoration Plan (Princeton Hydro, 2006). In fact, the sub-watersheds that drain directly into the southern end of Crescent Cove is one of the highest ranked areas targeted for restoration. This is primarily due to the magnitude of the phosphorus load originating from developed lands in this portion of the watershed. Thus, this site should be designed as a high priority project relative to the other locations.

ST-9, Maxim Road

Description: The Maxim Road site is located in Hopatcong Borough, Sussex County. This site includes a wetland area and an ephemeral stream. At the time of site evaluation in August 2006, the stream channel was dry.

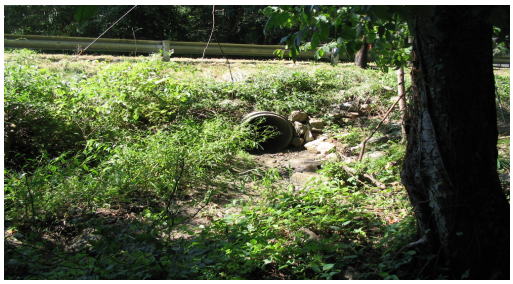
Problems: The wetland area at Maxim Road is infested with the invasive species, Japanese stiltgrass (*Microstegium vimineum*). There is also a large amount of litter, debris and sediment in the stream channel, most likely the result of drainage during storm events.

Recommendations:

Invasive species management. The physical and/or chemical removal of Japanese stiltgrass should be implemented in conjunction with planting native obligate wetland species.

Stormwater retrofits. In order to decrease the amount of sediment and debris entering this area, it is suggested that the stormwater infrastructure along Maxim Road be examined for possible stormwater retrofits or perhaps the installation of a larger BMP device to reduce the pollutant loads entering the wetland and ephemeral stream habitat.

Streambed restoration. The streambed at the Maxim Road site needs to be restored after the source of the debris and sediment is addressed. A more detailed assessment should be conducted to assess how best to stabilize and, possibly if needed, re-configure the streambed.



ST-10, Lakeside Boulevard and Sharp Avenue

Description: This site is located along the southwestern shore of Lake Hopatcong in Hopatcong Borough, Sussex County.

Problems: The stream located at Lakeside Boulevard and Sharp Avenue is within a residential section of the watershed. A deteriorating outfall pipe is present at the site. Significant bank erosion is also evident with railroad ties in the stream channel.

Recommendations:

Stormwater retrofit. It is recommended that the failing outfall pipe be replaced with an upgraded pipe. A scour hole lined with rip-rap should be designed and placed immediately below the upgraded pipe to reduce the velocity of the storm flow and settle out some of the solids. Railroad ties should be removed and, where needed, the banks should be stabilized with rip-rap and/or native vegetation (see below).

Streambank stabilization. Native species should be planted along the stream corridor to improve riparian function and stabilize banks.

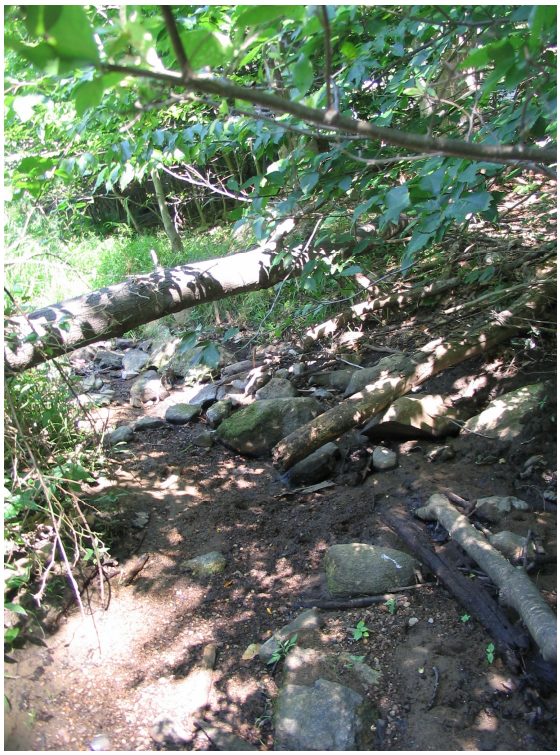
ST-11, Ford Avenue

Description: The Ford Avenue site is located in the Borough of Hopatcong, Sussex County in the southwestern area of the Lake Hopatcong watershed.

Problem: Due to the existing subdivision in the immediate vicinity of this site, drainage issues are having more of an impact on the Borough of Hopatcong. This site is borough-owned and has been identified as a potential site for stormwater retrofits by the Borough's Engineer.

Recommendations: Since this site is located in one of the TMDL-Restoration Plan's prioritized areas in need of stormwater upgrades / retrofits, is recommended that the Lake Hopatcong Commission continues to work in conjunction with the Borough Engineer to improve conditions at this site. Bank stabilization, vegetative enhancements and outlet structure modifications would all contribute toward increasing the pollutant removal efficiencies of the downgradient basins.

As sited above, the Ford Avenue site is located within one of the prioritized areas targeted for the installation of stormwater retrofits and Best Management Practices (BMPs), as per the TMDL-based Restoration Plan (Princeton Hydro, 2006). Similar to the DuPont Avenue site, the Ford Avenue site is located in a sub-watershed that drains directly into the southern end of Crescent Cove and is one of the highest ranked areas targeted for restoration. Again, this is primarily due to the magnitude of the phosphorus load originating from developed lands from this portion of the watershed. Thus, this site should be designed as a high priority project relative to the other locations.



ST-12, Edith Decker School

Description: The stream near the Edith Decker School is located on Howard Boulevard, across from Lee's County Park on Lake Hopatcong's eastern shore in the Borough of Mount Arlington, Morris County. This was an initial site for the installation of a Manufactured Treatment Device (MTD) through funding by an US EPA Targeted Watershed Grant. This structure would have reduced the pollutant loads entering the lake. Instead, the US EPA funding was used to install Suntree Units (a MTD) at alternative sites within the Borough of Mount Arlington, which are located in prioritized sites as per the TMDL Restoration Plan. However, the Edith Decker School site should still be considered for a future stormwater project.

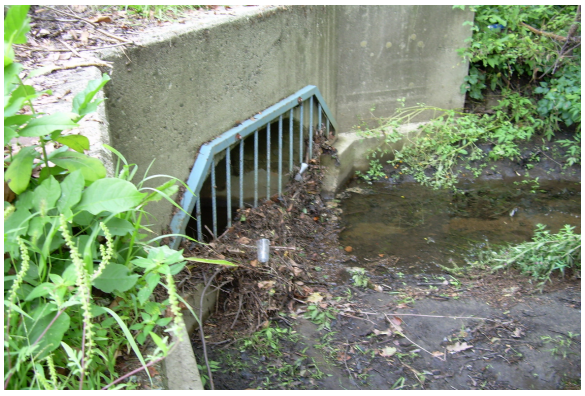
Problems: Excess sediment has accumulated against the grate of the culvert in the stream. The stream channel has narrowed due to the accumulation of sediment. Adjacent to the stream is a driveway to the school parking lot. The catch basins in this driveway are very shallow, causing the sediment to quickly build up.

Recommendations:

Stormwater retrofit: The original plans for the US EPA Targeted Watershed Grant for this site should be implemented, a Suntree Unit or similar stormwater MTD should be installed within the stormwater conveyance system prior to the outfall into the stream. This will serve to reduce the sediment and phosphorus loading to the stream channel.

Streambank restoration. The stream channel is stressed and eroded from the large stormwater volumes entering the waterway. These large stormwater volumes convey pollutants to the lake, as well as erode the streambanks. Thus, the planting of native riparian vegetation will aid in improving the functioning of this stream. However, a more detailed site assessment should be conducted to determine if more structural modification of the streambank / stream channel itself should be conducted prior to the establishment of riparian vegetation.

ST-12, Edith Decker School (continued)



ST-13, Quarry Brook

Description: The section of Quarry Brook of interest is located on Prospect Point Road in Jefferson Township, Morris County. This stretch of stream is in between two private lots; there is an open lot on one side and a private home on the other side of the stream. The Knee Deep Club, a local fishermen's group, has identified this stream as an important area for fish breeding. The stream has also been identified and assessed by the Lake Hopatcong Commission for the 2006 baseline tributary monitoring program.

Problems: The banks of the stream were overgrown at the time of the site visit in late August 2006. The dense vegetation made it difficult to make any objective assessments of the condition of the stream.

Across the street at the lake's shore, however, the outfall pipe is cracked. The shoreline surrounding the outfall is also eroded for a length of approximately 50 feet. Overgrowth of algae and aquatic weeds such as Eurasian watermilfoil (*Myriophyllum spicatum*) are visible in the lake. A fence surrounds the lake, including the deteriorating outfall pipe.

Recommendations:

Stormwater retrofit. The deteriorating outfall pipe should be repaired or replaced. It is also recommended that a retrofit should be applied such as an MTD to reduce sediment and floatables to Lake Hopatcong. The retrofit could be installed in the catch basins that convey stormwater directly to the pipe. In addition, some rip-rap should be placed immediately below the pipe to reduce erosion of the immediate area. Depending on the type of MTD used, such a retrofit and rip-rap project is estimated to cost between $10,000.00 and $30,000.00.

Shoreline stabilization. It is recommended that the fence be removed to plant an adequate buffer at this section of the lake consisting of native species. In addition, a more detailed assessment of the in-stream and near shore habitat should be conducted to determine its quality relative to fish spawning. Some additional wetland or semi-aquatic vegetation may be required to enhance the fishery habitat along this near shore section of the lake.

ST-14, First Bridge on Three Rivers Drive

Description: The first bridge on Three Rivers Drive is located in the Township of Jefferson, Morris County. This is known as "The Canals" section of Lake Hopatcong.

Problems: The banks of the canal that flow under the first bridge are eroded; visible aquatic weed and algae growth are apparent. Sparse vegetation, including purple loosestrife *(Lythrum salicara*), is present, growing in the rocks at the base of the bridge abutment on both sides of the road and bridge. At the corner of Three Rivers Drive and Venetian Drive, there is a sparsely vegetated area.

Recommendations:

Invasive species management. The existing purple loosestrife should be physically removed and then replaced with native species.

Shoreline stabilization. Installing native herbaceous plants along the tow of the banks of the canal may deter further bank erosion and help filter runoff from residential lawns. However, a more detailed assessment of the banks is required. Native species plantings near the bridge abutments will also have a positive impact on the water quality of the canal.

Stormwater retrofits. The corner lot of Three Rivers Drive and Venetian Drive may be a good area for wetland plantings, a rain garden and/or a bioretention system if this area is municipally-owned. At the time of this survey, there was sparse vegetation, mature trees, and a pile of grass clippings.

The Three Rivers Drive site is located in one of the prioritized areas targeted for the installation of stormwater retrofits and Best Management Practices (BMPs), as per the TMDL-based Restoration Plan (Princeton Hydro, 2006). Thus, this site should be designed as a high priority project relative to the other locations.

ST-14, First Bridge on Three Rivers Drive (continued)

ST-15, End of Three Rivers Drive

Description: This site is accessed from a pathway at the end of Three Bridges Drive and East/West Emerald Isle Drive which crosses over and along the canal. Looking across the canal and to the right or west from the road, there is a bare area on the banks of the canal. This area is actually adjacent to the housing development on Swan Lane near Lakeside Park in Jefferson Township, Morris County.

Problems: A strong septic odor was apparent in this area at time of the site evaluation. Abundant waterfowl, algae, and aquatic weed growth were present in the canal. Along the shoreline, in an area 60 feet by 20 feet, efforts were underway to establish a lawn. All other areas between the canal and fenced-in yards are vegetated. This may be an encroachment issue but nevertheless, planting of wetland plants is beneficial to stabilizing banks and purifying runoff from fertilized yards.

Recommendations:

Regulatory: Possible enforcement of streambank encroachment. However, it may be more beneficial to provide information to the property owner on the value of using non-phosphorus fertilizers on the lawn once it is established and of installing some near shore, wetland plants along the lake shore to reduce the pollutant load entering the lake.

Streambank stabilization: The planting of turf grass should not be allowed and planting of native wetland vegetation should be encouraged. The successful implementation of a streambank stabilization project would make this bank of the canal fully vegetated as opposed to the opposite bank which is dominated by residential lawns.

Similar to the Three Rivers Drive site, the End of the Three Rivers Drive site is located in one of the prioritized areas targeted for the installation of stormwater retrofits and Best Management Practices (BMPs), as per the TMDL-based Restoration Plan (Princeton Hydro, 2006). Thus, this site should be designed as a high priority project relative to the other locations.

ST-16, End of Canal at Fireman's Field

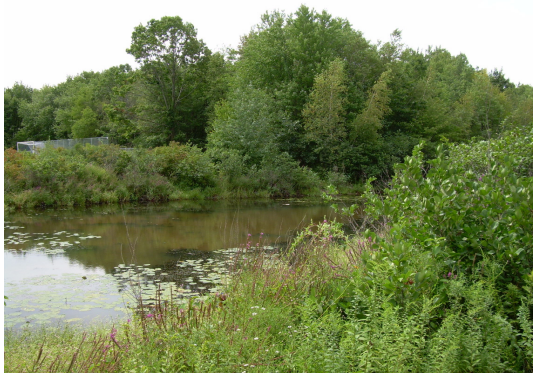
Description: This site is located at Firemen's Field across the street from Lakeside Park in Jefferson Township, Morris County. The parks are located at the corner of Swan Lane and Route 15.

Problems: The banks of the canal are well vegetated but the invasive species purple loosestrife (*Lythrum salicara*) is the dominant plant. The heaviest infestation is located along the bank of the canal at the east end of the field.

Recommendations:

Invasive species management. The physical and/or chemical removal of invasive species should be implemented in conjunction with planting of additional native species. In addition, if this part of the canals is used as a site of access for water withdrawal during fires in the local area, a section of the shoreline should be cleared of the purple loosestrife and planted with low-lying herbaceous plants.

Similar to all of the sites identified within the canals (ST-14 through ST-17), the End of Canal at Fireman's Field (ST-16) is located within one of Jefferson's prioritized areas targeted for the installation of stormwater retrofits and Best Management Practices (BMPs), as per the TMDL-based Restoration Plan (Princeton Hydro, 2006). Thus, this site should be designed as a high priority project relative to the other locations.



ST-17, Entrance to Canals at Diamond Drive

Description: This site is located at the entrance to the canals and can be accessed by parking at the end of Diamond Drive in Jefferson Township, Morris County.

Problems: Spotty wetland vegetation is present throughout the grassy area leading from Diamond Drive to the shore of the lake and canals. Debris and dog waste are scattered along this grassy area as well. The shoreline is sparsely vegetated, and exposed roots and gravel are visible. The canal and cove at the end of Diamond Drive is filling in with sediment and the aquatic weed Eurasian watermilfoil (*Myriophyllum spicatum*).

Recommendations:

Shoreline stabilization. There are several areas of shoreline and bank that are not vegetated and should be considered for native planting.

Education/Outreach. Better property management and dog care by residents can be encouraged through mailings and press releases. Signs can be posted warning of fines for not picking up after pets and dumping of other waste.

Regulatory. Better property management and dog care by residents can be encouraged by posting of signs and enforced by fines. However, better "house keeping" behavior from a non-point source pollutant loading perspective is generally well received through an aggressive educational campaign instead of strict enforcement.

Again, as previously cited, this site is located one of the highest ranked areas targeted for restoration as per the TMDL Restoration Plan.