Loon Lake Watershed Assessment

Prepared by the

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Marvin Cole, President, Loon Lake Association
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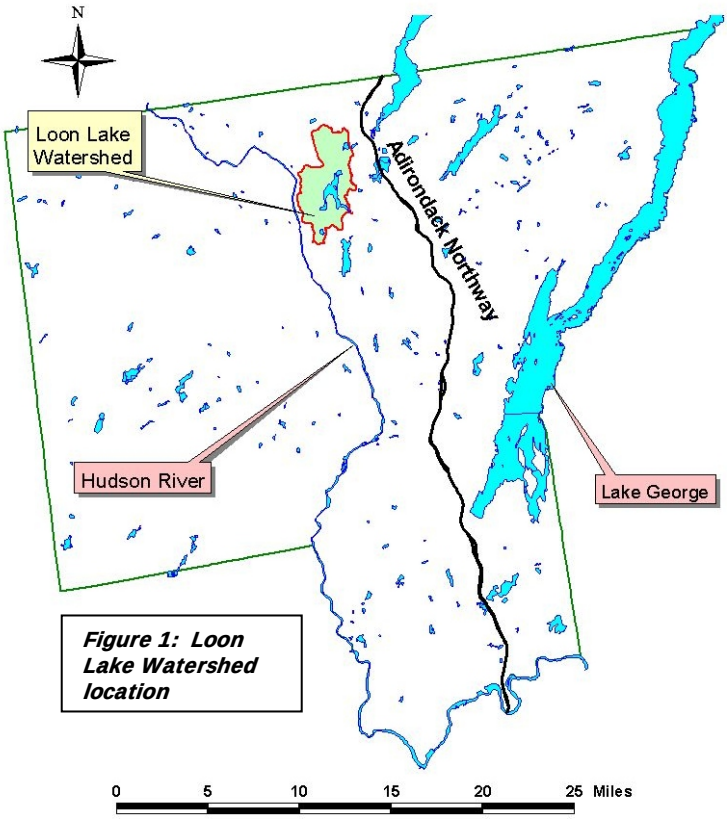

Figure 1: Loon Lake Watershed location

Introduction

Loon Lake is a 586 acre lake within Warren County, located in the Town of Chester. The Loon Lake Park District has been progressive in its approach to water related issues in the watershed. The Park District has recognized a need to understand the current condition of the lake and surrounding watershed, so that they might be better equipped to protect and improve it for the future. The Warren County Soil and Water Conservation District was invited to speak at the 2003 Loon Lake Annual Meeting to discuss the assessment program. The following document is a result of the work done by the Park District and WCSWCD.

Working with the Warren County Soil & Water Conservation District, an effort to evaluate the condition of the watershed and the lake itself was begun in 2003. A component of this effort was to complete an assessment of potential and existing nonpoint sources of pollution and nutrients into Loon Lake, in order to find practical means to minimize these inputs. Nonpoint source pollution is defined as any pollutant which enters a waterbody that does not come directly out of a point source, such as a pipe. Examples of nonpoint source pollution include runoff from fertilized lawns, failing septic systems, agricultural runoff, and runoff from roads and other asphalt surfaces which may have gas and oil on them. The District in conjunction with the Loon Lake Park District has conducted a watershed wide assessment of potential and existing sources of these pollutants entering Loon Lake, and is undertaking an effort to educate the lakeside residents about failing septic systems, lake management, and other water quality related issues.

This assessment is part of a larger project which is intended to raise the awareness of water quality and other issues on Loon Lake, and to determine the existing condition of the lake and its surrounding watershed. These efforts are intended to give local residents and the Town of Chester a better view into the condition of the lake, and to provide insight into issues that may be negatively impacting Loon Lake.

The following report is a brief review of the findings related to an assessment of the lake itself and the land use conditions within the watershed, and it includes specific recommendations for improvement projects and educational efforts which could be undertaken to protect and improve the lake.

Swimmers at beach off of Route 8/9

Lake and Tributary Characteristics

Overview

Loon Lake is located in Warren County, in the Upper Hudson River watershed drainage. The lake itself is encompassed solely within the Town of Chester, and it's surface area coverage is approximately 586 acres. The maximum depth of Loon Lake is 32 feet, with an average lake depth of approximately 15 feet. The volume of Loon Lake is approximately 8,895 acre-feet (acre foot equals the amount of water which would cover an acre to the depth of one foot). With this volume of water, the hydraulic retention time within the lake is approximately seven months. In other words, it takes about seven months for the lake to flush itself out. The NYS DEC water quality classification of Loon Lake is a "AA (Special)", which is classified as being suited to be a drinking water supply.

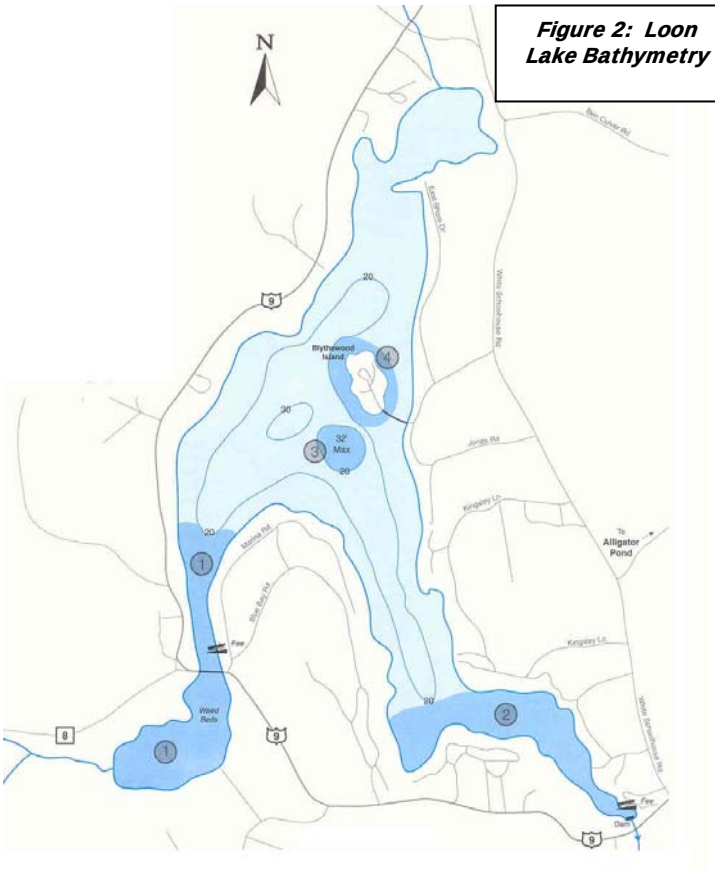

Figure 2: Loon Lake Bathymetry

This study is primarily intended to get a snapshot in time as to the condition of Loon Lake including the overall water quality of the lake, and to determine the existing and potential pollutant sources to the lake.

In order to undertake this study, it was first necessary to determine the extent of the watershed for the lake. While Loon Lake is of an odd wishbone shape, the watershed is one that is typical in the Adirondacks. A watershed is defined as "an area of land that drains to an associated water source such as a wetland, river or lake" (Terrene Institute, 1993). Essentially picture your sink, any water that flows into your sink is part of the watershed, any water that goes onto your counter tops or floors is in another watershed. A popular expression that is said to make people be aware of their surrounding is "We all live in a watershed".

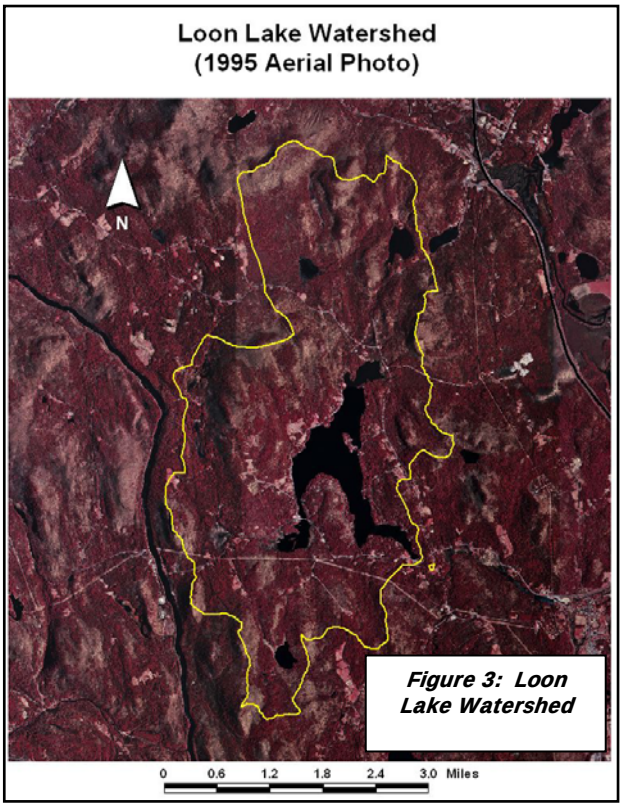

Figure 3: Loon Lake Watershed

Loon Lake's watershed is approximately 8,204 acres and has a lake to watershed ration of .07, which is a typical lake surface/watershed ration in the area. By comparison, Friends Lake is 0.12 and Schroon Lake is 0.01 (these numbers are just for comparison). There are two main streams that contribute to the Lake, one of which starts at Mountain Spring Lake in the North and the other begins at Palmer pond in the southwest.

Water samples had been collected under the Citizens Statewide Lake Assessment Program (CSLAP) from 1986-1990. The CSLAP program is a NYSDEC program in which a lake association conducts a sampling program for five years, then stops for five years, then resumes for five. This will give the association baseline data that would be useful in seeing any changes of water quality.

Lake Water Quality

To help determine the future of a lake in terms of its water quality and aquatic plant community, it is very helpful to evaluate past studies and try to determine a trend of what is happening. For Loon Lake, there is some historical data as well as some bacterial sampling information. This section will look briefly at the water quality of Loon Lake.

As mentioned previously, Loon Lake had been involved with the CSLAP program. The last sample from that program was taken in October of 1990. We are still able to look at this data however and make some general statements about the water quality within that time span.

A simple Secchi disk

Secchi Disk Depth: The Secchi disk is used to measure how deep a person can see into the water. It is lowered into the lake by unwinding the waterproof tape to which it is attached and until the observer loses sight of it. The disk is then raised until it reappears. The depth of the water where the disk vanishes and reappears is the Secchi disk reading. The depth level reading on the tape at the surface level of the lake is recorded to the nearest foot.

In the case of Loon Lake the average depth for the five years was 12.2 feet. That would suggest the lake is considered "mesotrophic", essentially not as clear as a coldwater lake trout pond, but not as cloudy as a pond filled with lots of plants and fish such as largemouth bass. One thing to note however is in 1986 the depth reading was 11.3 feet, and for the remaining years the reading was over 12.0'. This may indicate a change in the five years, and something to be looked at in the future.

Total Phosphorus: Phosphorus is the limiting nutrient in freshwater lakes. Generally the more phosphorus that a system has the more productive (i.e. weedy, murky) a system is. Not all types of phosphorus are available for plant use however, but analysis of the sample is done due to the potential of phosphorus changing into a useable form. Loon Lake's average was 0.01 milligrams per liter (mg/l), which is in the range of a low-moderate productivity lake.

Nitrate (NO_3): Nitrate is another nutrient necessary for plant growth and development. Too much nitrogen can cause changes in the quality of the aquatic plants. If drinking water has too much nitrogen, Methoglobinemia, "Blue Baby Syndrome "may occur. Levels of Nitrate in Loon Lake averaged 0.02 mg/l, which is well below the rate at which nitrates dramatically affect freshwater systems.

Color: Color is classified as the amount of dissolved materials in the water, usually consisting of organic matter. It does not indicate the quality of water, but may influence the waters transparency, directly relating to the amount of algae in the system. According to Larry Eichler at the Darrin Freshwater Institute, Loon Lake's color value, 18, classifies it as a "clearwater".

pH: Measure of hydrogen ions in the water. The average pH of Loon Lake from 1986-1990 was 7.43, which indicates that the lake is slightly basic (more like baking soda than vinegar). Neutral pH is 7, so Loon Lake's value is fine.

Conductivity: Essentially a measure of ions (charged particles) in the water. If baseline data for conductivity is established, then continued monitoring could produce prioritized data. For example, if conductivity usually measures 40 µmho/cm (micromhos) for a particular waterbody, then a storm hits and conductivity raises to 500 µmho/cm , stormwater may be an issue. You could then monitor the stormwater outfalls and see if that is where the spike in conductivity comes from. If that is the case, you now know an area which needs to be addressed for water quality. Loon Lake's conductivity is 80 µmho/cm, which is in the normal range for freshwater in the United States (Behar, et. al., 1996).

Chlorophyl A: The measure of chlorophyll **a**. This provides an estimate of the phytoplankton productivity. This may be in relation to the amount of phosphorus in the system. Loon Lake's chlorophyll a is 4.39 µg/l, which is typical in New York (Eichler, personal communication).

In addition to the sampling of the lake proper, Loon Lake has taken surface samples for bacterial counts. These samples have been analyzed at the Darrin Freshwater Institute and have not shown to have bacterial levels of significance, Bacteria is naturally found in nature, soils, humans, animals all contain bacteria, and there are many different forms. The form that most people are concerned with is *Escherichia coli (E. coli)*. *E. coli* indicates the presence of fecal matter from warm blooded creatures, including humans (beavers, dogs, failing septic system, untreated wastewater discharge, faulty sewer line). High rates of *E. coli* have been found in swimming areas where gastroenteritis is common (Behar, et. al., 1996). No shoreline samples have been conducted at this time, however if bacterial levels are not in concentration at the sample locations, that is still a good thing.

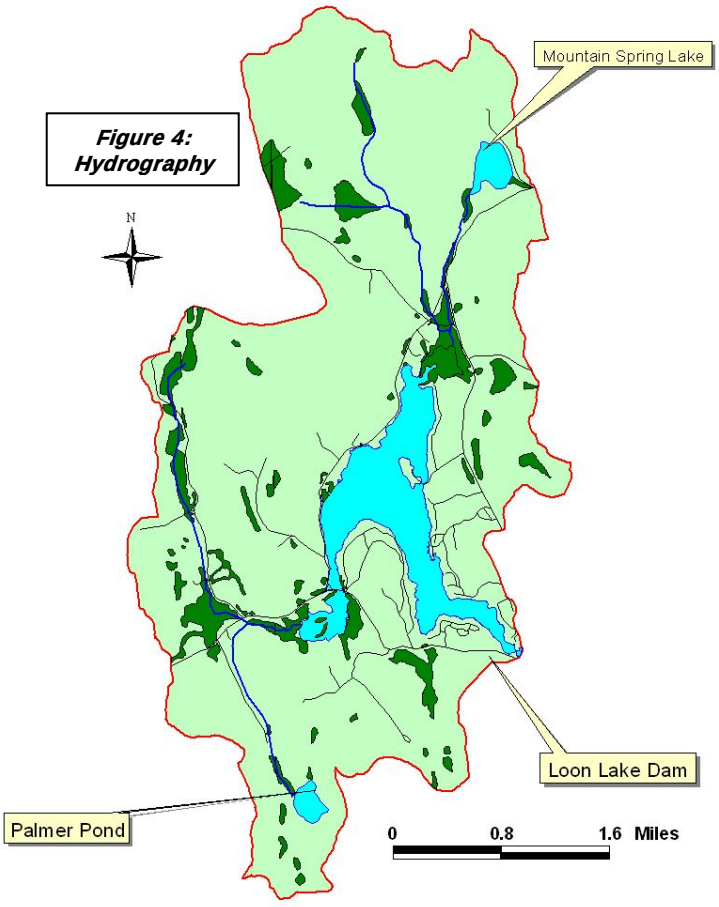

Figure 4: Hydrography

Although the 1986-1990 CSLAP data indicates good water quality, it is important that people do their part to keep it that way. Small increases in phosphorus from lawn fertilizers or failing septic systems can cause increases in lake algae content and a corresponding decrease in water clarity and quality. Once a lake has reached a lower level of water quality, it is very difficult to regain its original state. Information on lake management and water quality is available through the Warren County Soil & Water Conservation District (518-623-3119), the Darrin Freshwater Institute (644-3541) and the NYS Department of Environmental Conservation (518-623-1200).

Loon Lake Hydrography

Loon Lake has two main tributaries in its watershed, which comprises most of the concentrated flow to the lake. No volumetric sampling has occurred to this point, but regardless these are two areas that should be kept as clean as possible and future development and land use changes taken into consideration with careful planning.

It is fortunate that these tributaries first enter a major wetland, before the lake proper. Wetlands are nature's filters, and help to remove sediment and nutrients from the system. In urbanized areas, artificial wetlands are constructed to address stormwater issues. With Loon Lake the wetlands are natural and seem to be very functional in treating any stormwater that may occur. In fact there is approximately 600 acres of wetlands within the watershed. A second positive fact for the tributaries is that they are found largely in low impacted/forested areas of the watershed.

Streambank erosion can contribute sediment and phosphorus to lakes and occurs more readily around areas of human disturbance. Fortunately for Loon Lake its two major tributaries seem to be in pretty good shape, largely due to the forested area and wetlands that line the streambanks.

Aquatic Plants in Loon Lake

According to the Park District there has not been an aquatic plant survey done on the lake to determine the existing condition of the plants system. CSLAP had some data from its sampling on a few of the species that were encountered, but there is no complete information for this sample. Mesotrophic lakes typically reflect a diverse plant population. Many animals utilize the various species for cover, food and in the case of fish, as nursery for fry

(newly hatched fish). There are a number of invasive plants that can have a detrimental affect on lake systems, and Eurasian watermilfoil is one widely known example.

In 2000-2001 Eurasian Watermilfoil (*Myriophyllum spicatum*) was detected at the area of the boat launch at the outlet end of the lake. However, a diver was contacted to hand harvest this infestation, and was successful in containing this outbreak. In June of 2004, Eurasian milfoil once again was found in the same locale and a few plants in other scattered locations. Hand harvesting was conducted again and at the time of this report 15 gallons of milfoil had been harvested. There is no real way to eradicate Eurasian milfoil, however it can be successfully managed.

There are a number of native milfoil plants that are similar in appearance to Eurasian milfoil, proper identification is a must, to reduce disturbance to the lake bottom. Eurasian milfoil is commonly found in shallow water areas of lakes, and can colonize up to depths of 12-15 feet. Milfoil appears when there is a disturbed site, generally where native plants are not aggressively growing or have been killed, that is why it is important to identify and understand the life history of Eurasian milfoil. Milfoil can also colonize with just a small piece of plant matter. If a plant is harvested incorrectly, or gets chopped up in a propeller, these pieces may float through the water column and establish a new plant in other areas within the lake. It is imperative to understand Eurasian milfoil, for it has the ability to affect a great amount of Loon Lake. Completion of an aquatic plant survey can help a lake association monitor and manage their aquatic plant issues.

Eurasian Watermilfoil

Soils in the Watershed

What benefit is it to know what the soils are within a watershed or along a shoreline? This question is often asked by lakeshore residents and communities when evaluating potential water quality impacts. The soils lay the framework that all land uses are based upon, and they have a direct correlation to what type of land uses may be suited to a particular location. Very sandy soils may pose serious problems with siting a septic system for a house, whereas soils with a high clay content may cause difficulties with house foundations and construction. This section briefly evaluates the soils within the nearshore area of Loon Lake to summarize what some of the potential concerns might be with land uses and water quality within the lake. 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.

Within the Loon Lake watershed, the soils around Loon Lake are of concern, due to the amount of shoreline development. In order to better grasp the soils situation on the lakeshore, the Warren SWCD digitized soils and generated computerized maps for the area within 500' of the lake (Figure 5). Most of the soils within this 500' buffer of the lakeshore are primarily sandy soils. The rest of the soils in this area are primarily organic soils that are under water or frequently flooded. The sandy soils of concern for septic systems on Loon Lake would be the Hinckley and Hinckley –Plainfield Series'. According to the 1986 Warren County Soil Survey, these two series may not be suitable for septic system leachfields, and these soils constitute 11% of the soils found within 500 feet of the lakeshore. Groundwater contamination is listed as a hazard, primarily due to rapid infiltration rates within these soils, which results in poor effluent treatment.

The other soils may have conservation issues as well. Bice and Bice,-Woodstock soils (71% of soils within buffer area) are apt to erode if not protected. Erosion increases on these soils as slope increases. These are sandy soils and have little organic matter content which helps to "hold" them together. Once erosion begins, it makes controlling the movement of these soils very difficult. A second issue with the Bice and Bice-Woodstock soils is that they tend to be very acidic. It is likely that many landowners have planted a variety of plants in and around the lakeshore, only to discover that those plants do not survive, which may be a result of the low pH and low nutrient levels generally associated with it. Groundwater contamination is also a possibility with these soils, however if septic systems are properly installed and maintained, it is not as likely to occur as the Hinckley Series.

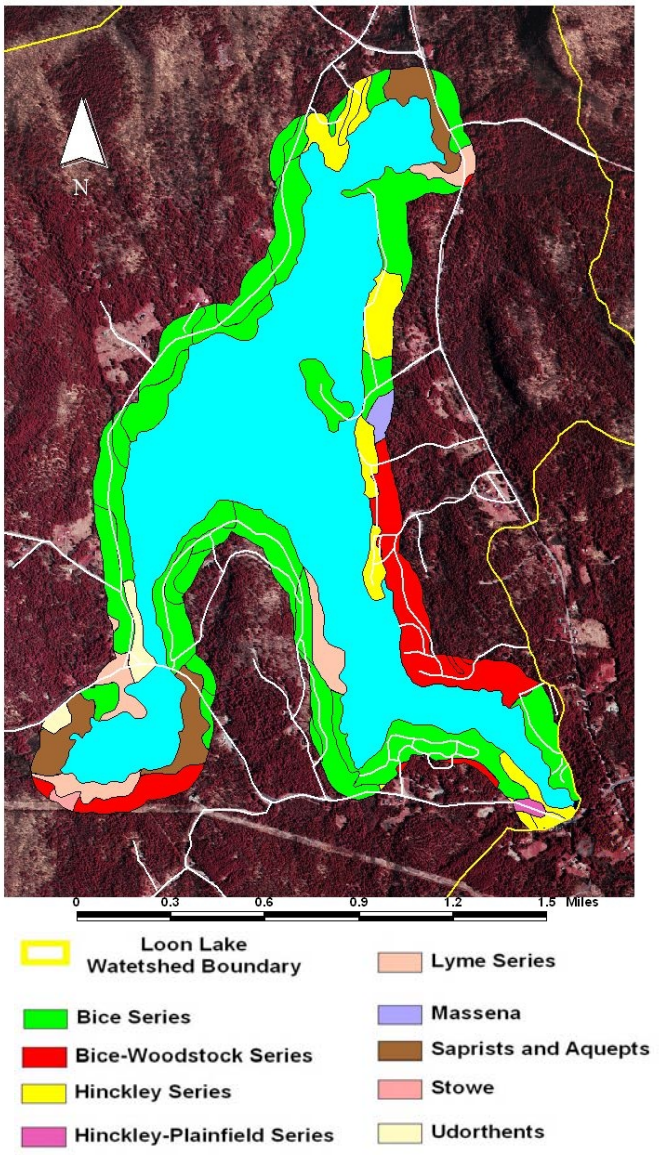

Figure 5: Soils within 500' of the Loon lake Shoreline

The remaining soils, which make up 18% of the buffer area, may have issues with a high ground water table. Many of these soils have higher levels of organic matter, and the land is considered a "wetland". These soils generally have slow infiltration due to the high water table and standing water.

Eroding soils are also cause for concern when they are carried to a nearby waterbody. Eroded soils can carry large amounts of phosphorous and nitrogen with them, which aids in the growth of algae and aquatic weeds. A complete roadside survey of existing bare banks, ditches and other potential erosion sites within the watershed revealed no considerable concern for soil erosion at the present time. However, new construction on or near the lakeshore, if improperly undertaken, can be a substantial source of eroding soil at any time in the future. This is particularly true given the steep slope conditions close to Loon Lake in developed areas of the watershed.

Road ditch maintenance activities undertaken by local highway departments, if improperly seeded and mulched, can be a direct source of erosion and sedimentation to a nearby waterbody. It is very important to keep soil in place during construction activities by proper planning and installation of erosion control devices such as silt fence and hay bales. Staff from the Warren County Soil and Water Conservation District are available to landowners at no charge to assist with recommendations for erosion control.

Soils do present limitations to land uses in the watershed and to further development; therefore, they need to be considered in land use planning and water quality protection efforts. Whatever the soil conditions, whenever modifying an existing land use for development it is a good practice to control for erosion with a good site plan and follow-up. Erosion of soil into Loon Lake can cause problems with increased algae and weed production, both of which negatively impact the quality of the lake and its surrounding community. Erosion control advice and technical assistance is available at no charge from the Warren County Soil & Water Conservation District (518-623-3119).

Land Use and Development in the Watershed

Land use information is very important when characterizing a watershed and determining potential impacts to water quality of a lake. The extent to which an area is developed and where the development has occurred, can play a key role in the contaminant loading to a waterbody. To determine the land uses within the Loon Lake watershed, a geographic information system (GIS) was employed to develop a coverage related to the various land uses. Initially the watershed was delineated on USGS 7.5 minute topographic maps. Using 1995 digital aerial photos, land uses were identified and referenced back to the topographic maps.

From the GIS information it was determined that there are approximately 614 dwellings within the watershed and 1023 total parcels within the watershed (60% of the parcels have some development). It is interesting to note that out of the 600 dwellings, approximately 499 (81%) have been developed since 1950. That is a significant increase from the previous 200 years. Figure 6 shows a breakdown of this development over time.

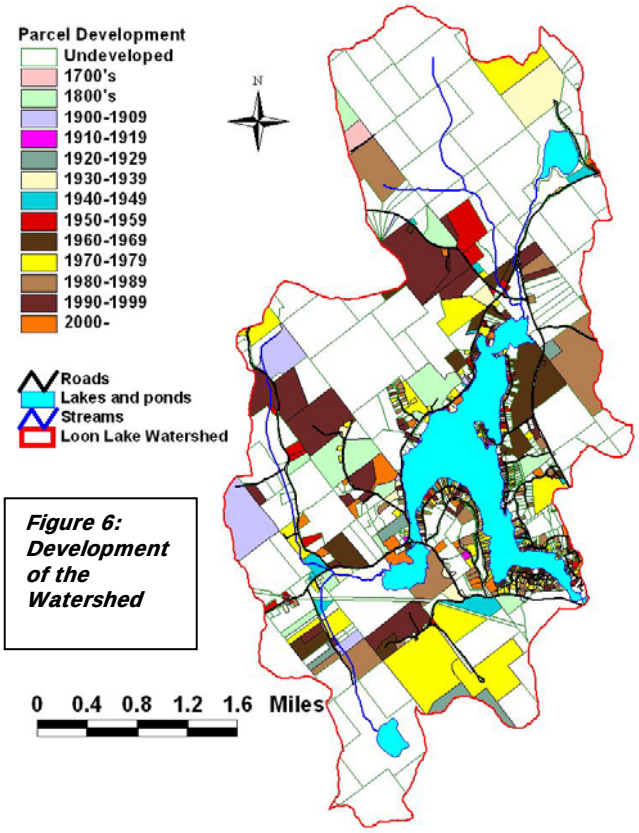

Figure 6: Development of the Watershed

The most heavily developed areas are along the shoreline around Loon Lake proper. There are still areas that could be developed along the shoreline; however that percentage is not very large. Any future development would need to be done properly, as to not negatively affect Loon Lake's water quality. When development occurs off the shoreline, care must be taken as well. Numerous building lots are currently being put up, on sloping ground. It is important to remember that erosion control practices should be in place to keep the soil stable. Sediment control devices should also be considered in case the soils move from the site. The NYSDEC and USEPA require all soil disturbance (grubbing, clearing, tree removal) over 1 acre in size to go through a DEC permit process. Essentially if you are going to develop a parcel and disturb 1 or more acres, you will need to fill out a permit form from the NYS Department of Environmental Conservation. This will be examined by the regional staff to see if your plan meets all required conditions listed on the permit. Failure to file a permit can result in stop work orders and/or daily fines. For more detailed information please contact the Warren County SWCD, 518 623-3119 or the NYS DEC Warrensburg office at 518 623-1200.

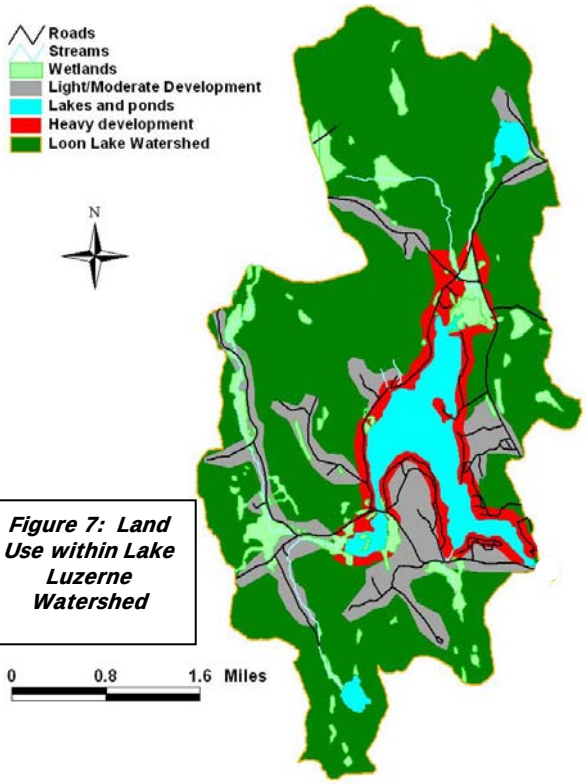

Figure 7: Land Use within Lake Luzerne Watershed

Land Use Considerations on Water Quality

One of the overriding factors affecting the quality and health of a lake is the composition of its surrounding watershed. In lakes with heavily developed watersheds, there tend to be more impacts to the lake from stormwater runoff, erosion, failing septic systems, and other development related issues. In largely forested watersheds, these impacts are generally minimal or

largely nonexistent. As seen from the land use map of the Loon Lake watershed (Figure7), the strong majority of the 8,204 acre watershed is forest land. In a water quality sense, this is very good for Loon Lake.

Forested	4,918	60%
Light -Moderate Residential	1,249	15%
Water	676	8%
Dense Residential/Commercial	694	9%
Wetland	600	7%
Roadway	67	1%
TOTAL	8,204 acres	100 %

Table 1 is a representation of land use. These are estimated numbers only.

Septic Systems

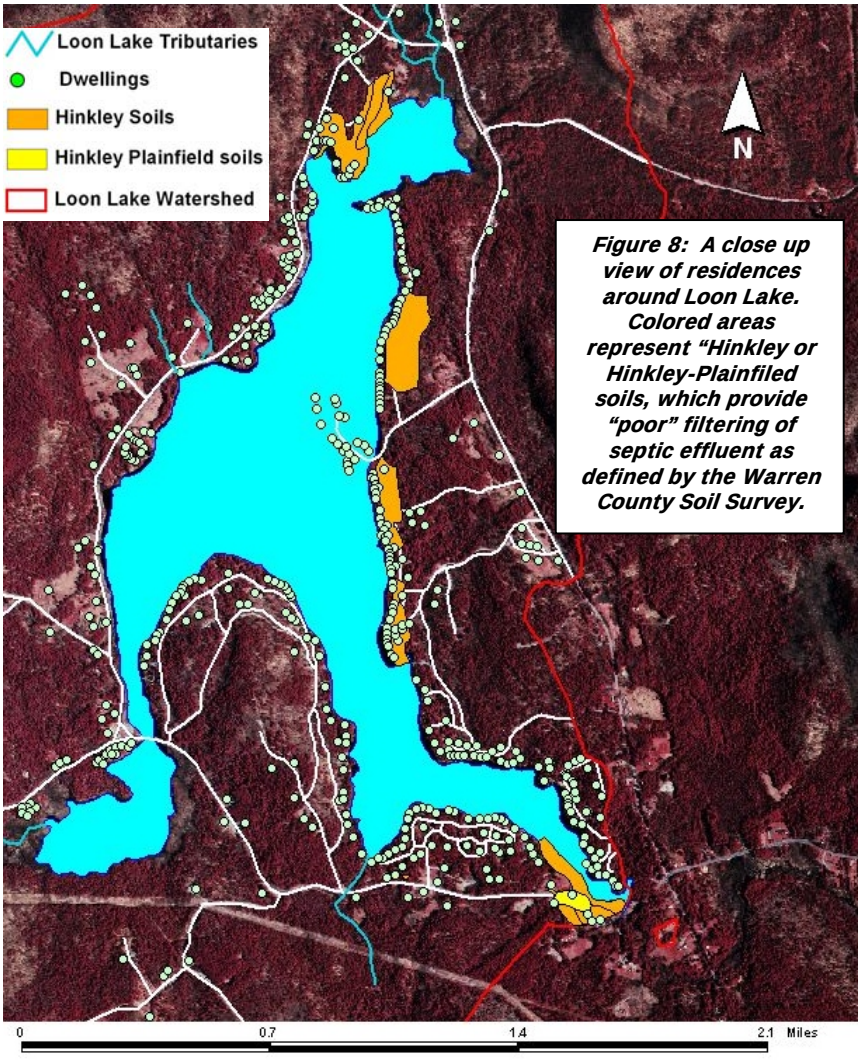

Figure 8: A close up view of residences around Loon Lake. Colored areas represent "Hinkley or Hinkley-Plainfiled soils, which provide "poor" filtering of septic effluent as defined by the Warren County Soil Survey.

On-site wastewater treatment systems (septic systems), when properly designed, installed and maintained, have no adverse impacts on water quality or public health. When one of these three criteria fall short, there may be impacts to water quality of a nearby lake. In addition, there may be health concerns related to improperly treated septic effluent, as bacteria may reach the groundwater and may end up in a private or public well. Effluent from a standard septic system flows out of an absorption trench or a seepage pit and into the ground where the soil provides the final treatment and uptake of nutrients and pollutants. If the system is very old or is not properly maintained, it has a good chance of 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, such as Loon Lake

Loon Lake has numerous year-round residences and camps upon its shoreline. Many of these residences were built since the 1950's (figures 6 and 8), and less concern was given to the potential development impacts upon the water quality of the lake than is today. The building lot sizes around the shoreline of Loon Lake are relatively small, with camps and small homes built close to the shoreline. As many of these structures were seasonal camps, the septic systems were designed as such and generally consist of small septic tanks and seepage pits. There is little room on most of these lots for a standard leach field type system, and therefore very few are likely to exist. The issue that arises is the level of treatment that the septic effluent receives may not be as high as on a larger lot with a

leach field system because the effluent is localized in a seepage pit. In addition, many of the residents on the lake do not 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, then there is little likelihood that this system has been properly maintained.

Lawn Care and Fertilizer Use

Lawn care activities are a concern along the shoreline of lakes because they are potential non-point sources of pollution either through the excessive use of lawn care products (fertilizers and pesticides) or by disposal of lawn clippings and other debris close to the water. By definition, fertilizers are created to provide nutrients to improve the growth of lawns and other vegetation. If a landowner puts down more fertilizer than a plant can uptake, the remaining fertilizer may run off into the nearest waterbody. If this fertilizer reaches the waterbody, it acts in exactly the same way as it does on a lawn. The nutrients in fertilizer allow for much more aggressive growth of aquatic plants and algae, which may cause problems with the water quality and recreational opportunities for the lake. With such a large percentage of the Loon Lake shoreline area in residential development, the use of fertilizers on properties adjacent to the lake is a very real concern for water quality impacts. Lawns in and of themselves are not a concern, as the grasses in a lawn actually slow the flow of runoff and allow for infiltration of stormwater runoff. Where it does become a concern is when landowners *over-fertilize* in an attempt to create the perfect lawn.

The degree to which the shoreline landowners apply fertilizers and pesticides to their lawns is not known on Loon Lake. As there are no regulations or statutes regarding lawn care, there is no good way to control the application of these chemicals to shoreline areas. The best means of minimizing the impacts from over-fertilization from these landowners is through education. Suggestion for educational efforts are outlined in the "Recommendations" section that follows.

Road Runoff

One of the primary factors in lake quality and health of the aquatic ecosystem is the quality of the runoff which enters the lake. As land gets developed and roads are constructed, the flow patterns of rain runoff get altered in these areas. In most cases, runoff which once infiltrated into the ground before development, now runs off into drainage ditches and storm drains. The eventual outlet of these storm drains and ditches is the lowest point in the area, most times being the lake itself. The result is a larger amount of surface runoff going directly into the lake, and in many cases the water quality of this runoff is generally less than it would have been under pristine conditions. As this runoff flows across blacktop and other impervious surfaces, it picks up contaminants on the road such as salt and sand from winter de-icing operations, oil and other chemicals, metals, and possibly fecal coliform bacteria from animal wastes. These pollutants are conveyed into the lake via the constructed drainage system, i.e. the stormwater inlets and pipes and roadside ditches.

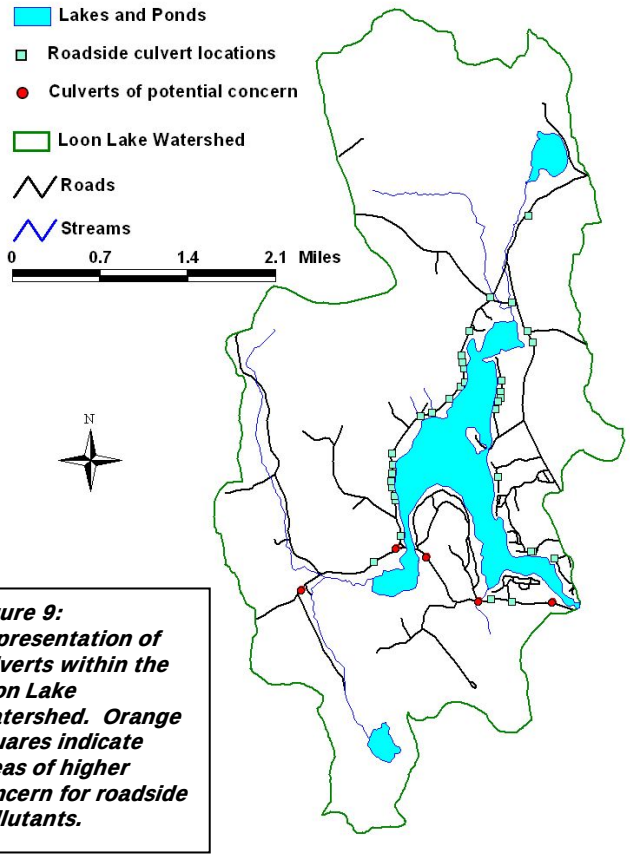

Figure 9: Representation of culverts within the Loon Lake Watershed. Orange squares indicate areas of higher concern for roadside pollutants.

Loon Lake, like most other developed lakes, has this roadside drainage network surrounding the lake. The road system within the Loon Lake watershed was evaluated, on site, for potential road runoff impacts to Loon Lake. Even with the extensive road network, fortunately there are only a few areas of concern. For much of the Loon Lake road system, the ditches are grassed or stoned, and as being such tend to cause few problems. If a

ditch is vegetated, then the material will filter out solids (sands, silts) and take up nutrients. If the ditch is rocked, then the solids are removed from suspension as well (Appendix A). Maintenance is the key to these designs, if there is a build up of material in a ditch, then it would need to be removed, otherwise the sediment could overtime, be washed into the lake. The following are potential areas of concern within the watershed (fig. 9).

1. Route 8 at the intersection of Route 9: Due to a direct outletting of the roadside ditch into the southern Loon Lake wetland this area is of concern. Wetlands, as mentioned previously, will filter pollutants and help to improve water quality. However, this is an extensively traveled area, and may contribute higher levels of pollutants and hydrocarbons (see recommendations sections for suggested improvements).
2. Route 8/9, within watershed: Sediment loading is a concern. Sediment is found along the highway in this section, in the ditches. This sediment appears to be moving during storm events.
3. Route 8/9 1/10 mi. east of Marina Rd.: There is a second large drainage into the southern Loon Lake wetland. As mentioned previously, it is fortunate in the sense that the outlet is into the wetland, however the stormwater may impact the wetland itself.
4. Route 8/9 (over inlet): While there is not a stormwater culvert entering the lake at this location, surface flow may be an issue. The way that the road is designed at this location allows for little or no treatment by vegetation. During winter sanding operations, sand and/or salt may enter directly into the lake at this location, completely bypassing the wetland.
5. Route 8/9 (Near Dam): Roadside ditch collects water from southern edge of watershed, conveys to Loon Lake under road. There is no apparent sediment in the vegetated area, however filter area is not too large. This may be a concern in spring time.
6. Bluebay Road: A steep road with sand shoulders. There are several "turn-outs" (earthen berms to direct flow into a treatment area) along this road, however the shoulder sand can contribute to a water quality issue. There is a stream that flows under Route 8/9 at this location, and is thought to be adding to the lake bottom at the point where the stream enters the lake.
7. Lakeview Point Rd.: Another steep road in the southern end of the watershed. While it appears that there may not be a water quality issue from this road, there seems to be an inordinate amount of material moving from the roadsides and ending up in the wooded edges of properties and ditches. Erosion control and roadside stabilization would probably benefit this road.
8. Palmer Pond Road: Roadside erosion is evident. Some of the material does go into vegetated treatment area, however a tributary of Loon Lake may receive sediment from the intersection of Palmer Pond Road and Route 8.

As previously stated, many of the culverts outlet into areas where treatment may occur. Forestland and wetlands are great for treating stormwater before it enters a waterbody. The southern end of the lake would be an area to keep an eye on in regards to water quality. In essence, the only contaminants coming from this section of highway should be winter road de-icing products (salt and sand), possibly some oil and grease and anti-freeze from leaking automobiles, fecal coliform bacteria from animals, and thermal impacts from hot road surfaces. To date, there has been no comprehensive study of the water quality of the stormwater coming out of these culverts, and therefore no quantitative measure can be given herein. However, the above mentioned pollutants are likely present on this roadway to some degree based on visual inspection, mandatory roadway maintenance (de-icing activities), and common sense. With having just one area, it will be easier to concentrate on a potential solution that would allow the stormwater to be treated before it goes into the lake.

Overall, the impacts to Loon Lake from road runoff are seen as moderate, and can be minimized through some roadside drainage improvements. These drainage suggestions are listed in the "Recommendations" section below.

Recommendations to Protect the Quality of Loon Lake

Currently, the Loon Lake watershed appears to be in good condition related to the level of pollutants which enter the lake through surface runoff. However, there are situations that exist within the watershed which may have negative impacts on the water quality

and overall health of Loon Lake. It is these situations which the following recommendations have been put forth to improve upon.

The following recommendations are intended to provide specific, cost effective means to protect the quality of the water of Loon Lake. They entail both educational efforts and on-the-ground tasks to be undertaken to help ensure the long term water quality of the lake. These recommendations do not go into issues regarding zoning regulations around the lake, nor do they look at statutory changes to the Town of Loon Lake codes. They are primarily geared towards local stewardship of the lake and projects that can be done locally to protect this lake. The Loon Lake Association will likely be the catalyst for much of the protection and improvement efforts to be undertaken for Loon Lake, with assistance from the Town of Chester, the Warren County Soil and Water Conservation District, and many others. By increasing the awareness of the issues on Loon Lake, the lake association can begin to achieve support from all landowners on the lake and undertake many of the improvements to protect it for the future.

General Recommendations

1. Maintain an active lake association to act as a hub to address issues of concern on Loon Lake, and to provide information relating to issues on Loon Lake to all shoreline and association residents. The ongoing activity and interest within this association is paramount to the continued long term health of Loon Lake.

2. Give an annual presentation to the Chester Town Board relating to work accomplished on Loon Lake and the status of water quality, nuisance aquatic weeds, and other related issues.

3. Contact Scott Kishbaugh (518.402.8282 or sakishba@gw.dec.state.ny.us) to discuss Loon Lake's entry into the Citizens Statewide Lake Assessment Program, which is a voluntary lake water quality assessment program administered by the NYS DEC. As this is a five year on / five year off / five year on program, determine a way to fund those middle five years so that a continuous record of water quality data will be created for the lake. The New York State Federation of Lake Associations is also a place to get current information at their website: http://www.nysfola.org/.

4. Conduct frequent roadside surveys of potential soil erosion sites, on road ditches and banks and new development sites. Contact the Warren County Soil and Water Conservation District if any sites of significance are found, so that technical assistance may be given to correct the situation.

5. Have copies of this document sent to all residences along the lake with a cover letter encouraging them to get involved with their lake association if they are not already, or post the document at the Loon Lake Park Districts Website.

Nuisance Aquatic Plant Recommendations

1. The Loon Lake Association should consider the formation of an aquatic plant management committee, if one does not exist. The committee should review the recommendations contained in this report and initiate aquatic plant management.

2. Consider conducting an aquatic plant survey. This survey will help to understand the aquatic vegetation in your lake. As noted in the Aquatic Plants section of this document, Eurasian Milfoil has been found and a management strategy has been used. However, little if any information about the health of the aquatic vegetation is available. There are several organizations that do this type of project, Paul Smith's College and Cedar Eden Environmental are two groups in the north that do this and Larry Eichler at the Darrin Freshwater Institute in Bolton does this as well. The cost should be +/- $1000.

3. Continue to identify locations of Eurasian Milfoil and if practical, hand pull. A milfoil management strategy should be developed which includes education and management of milfoil as well as other invasive/nuisance species.

4. The Loon Lake Association should post all boat access areas on Loon Lake, with posters identifying Eurasian watermilfoil and urging boaters to clean their boats prior to launching and upon retrieval. This would help prevent the spread of Eurasian watermilfoil from Loon Lake as well as further introductions into Loon Lake.

5. Be active in the Adirondack Park Invasive Plant Program (APIPP). Loon Lake is currently identified in the "Terrestrial Plant Program", however only one species is listed –Phragmites. APIPP is involved with aquatic invasives as well. Check out their website, as it is very detailed with invasive species within the Adirondack Park.
   Hillary Oles, Program Coordinator
   c/o Adirondack Nature Conservancy
   PO Box 65
   Keene Valley, New York 12943
   518-576-2082 x 131
   email : holes@tnc.org Website: http://www.adkinvasives.com/

6. Work with the Warren County Soil and Water Conservation District to develop a presentation on Loon Lake for a Town of Chester Board Meeting.

Water Quality Recommendations

Stormwater

1. Work with NYS DOT and Town of Chester DPW to ensure that cleanup after winter sanding operations is done. Sweeping the roads and removing the excess sand will help to reduce the amount of sediment that may reach a waterbody.
2. Develop a stormwater sampling program for roadside drainages. Evaluating stormwater quality will help to identify the areas of greatest concern for impacts on water quality. Phosphorus and Nitrogen would be key indicators that a retrofit project may be needed.

Sediment and Erosion Control

1. Work with NYS DOT and the Town of Chester DPW to hydroseed the newly cleaned ditches (Route 8/9) in the watershed. Bare ditches can increase sedimentation to a waterbody if left untreated. The Warren County SWCD can provide this assistance to the NYS DOT and the Town at no cost.
2. Educate the residents within the watershed on the issue of erosion control. As mentioned previously, there are a number of buildings that are being built within the watershed. Most of those buildings appear to not have the proper sediment and erosion control measures. Fortunately for Loon Lake, most of the erosion is being deposited in the forested areas. However, just because it is not a water quality issue that does not mean it is not important.
3. Construction Site Sediment Control: Maintaining the soil at the job site not only reduces the effects of it moving offsite, but can save money for the developer. If fill or topsoil from the site moves, then it will need to be replaced, why not capture it and retain it on-site instead of purchasing more to bring in? That would help reduce purchase and trucking costs. Keeping soil on site would reduce the likelihood of receiving soil form another location that may have a non-native weed seed in it. Japanese Knotweed is an example of an invasive plant that can be transported this way, and once it is in the locale, it is nearly impossible to eradicate.

Septic Systems

1. Contact Adirondack Community College professor Holly Ahern to determine the feasibility of the college undertaking a water quality sampling study to determine the degree to which septic systems are failing along the lakeshore (particularly the heavily developed southwest shoreline). Professor Ahern and her students

conducted a comprehensive study on Glen Lake in 1997-1998 on this topic, and may have interest and availability of doing it for Loon Lake.

2. Contact John Miller, past president of the NYS Federation of Lake Associations (FOLA) to get the Loon Lake Association involved with their volunteer septic monitoring program. This program works on the Lake Association level through cooperation with local landowners to dye test individual septics to check for failures. The number for FOLA is (800) 796-3652.

3. Conduct a voluntary survey of lakeshore landowners to obtain information regarding individual septic systems regarding their age, size, and maintenance schedule. This will give the lake association a clear idea of the necessity of upgrading or maintaining systems around the lake. Since this is always a sensitive issue among homeowners, the association should network with their friends around the lake to get as much cooperation as possible.

4. Create a water quality section in the Loon Lake Association's newsletter which would feature articles on such topics as the impacts to water quality from failing septic systems, septic system maintenance tips, who to call if you have a septic problem, and any others related to this topic.

5. Contact a reputable septic system pumper to work out a bulk deal whereby many landowners get their septic tanks pumped out at a reduced cost. Network with the landowners on the lake to generate interest in this. If it works out, attempt to make this a three year program whereby these landowners know that this deal will come around only once every three years and to get involved.

6. Sponsor an annual water quality workshop and invite interesting speakers to discuss the issues surrounding Loon Lake. A general rule: feed them and they will come...

Lawn Care/Fertilizers

1. Through the Association's newsletter, educate watershed residents about the issues related to over-fertilization of lawns and gardens and the impacts to water quality on their lake from these activities.

2. Contact a local landscape nursery to determine the most environmentally friendly (low phosphorus) fertilizer which would be recommended for lawns on a shoreline. Discourage fertilizer use on any lawn which is adjacent to the lake shore and is sloped towards the lake.

3. Contact Cornell Cooperative Extension to obtain soil sample bags for use by landowners to determine the nutrient needs of their lawns. To increase participation, create a "lawn care program" where the cost of analysis ($17) is cost shared or paid for by the Association. This is a simple, yet extremely valuable tool to reduce nonpoint source pollutants (i.e. phosphorus, nitrogen) from affecting the lake's water quality.

Summary and Conclusions

Lakes are one of our most precious natural resources. As population increases and development pressure expands its force on these resources, it is imperative that we strive to maintain these natural systems in a state where it can continue to support the aquatic ecosystem that it has developed. One key component in this effort is watershed management. By understanding the lands surrounding a lake, we can begin to understand how lakes respond to man's influence.

Over the past year, a watershed planning effort has taken place on Loon Lake to determine the current health of the lake and its surrounding watershed. Local citizens, the Loon Lake Association, the local Soil and Water Conservation District joined together in this undertaking, utilizing their diverse backgrounds and expertise in this endeavor. A close look was taken at the current and historical water quality of Loon Lake, the status of nuisance aquatic plants in the lake, and the condition of the land surrounding the lake. By reviewing all of this information,

we get a feel for the health of the lake in its current state. Perhaps more importantly however is that this information gives us a perspective on where the lake is headed in the near future in relation to these issues.

A primary concern in lake management today is nuisance aquatic plants. One specific plant is of considerable concern for residents and visitors to Loon Lake; Eurasian Watermilfoil (milfoil). Milfoil is an aggressive plant which grows quickly and abundantly, with the potential to create large dense beds in water depths of up to twenty feet, in good conditions. Milfoil does exist in Loon Lake, but it is not known to what degree. Recommendations for management include completing an Aquatic Plant Survey for the Loon Lake, hand harvesting the scattered areas, and looking into other possibilities such as benthic barriers for managing the dense beds.

The third component of this study was an evaluation of the watershed lands surrounding Loon Lake. The quality of a lake's water and ecosystem are largely a result of the lands surrounding the lake. As development increases, many times there becomes a corresponding decrease in water quality due to road runoff, construction practices, and other related items. In the case of Loon Lake, most of the development in the watershed is adjacent to the shoreline, which creates a higher potential for impacts to the lake.

Road runoff in intensely developed areas can be a major contributor to lake water quality decline, if this runoff picks up contaminants which lie on road surfaces. To determine any potential impacts to Loon Lake, a watershed wide study of the roads and highways was conducted. Route 8/9 on the south side of Loon Lake is of the greatest concern. Working with the NYS Department of Transportation, the southern side locations can be improved to a state where stormwater impacts to Loon Lake are minimized.

Another potential water quality concern for lakes is failing on-site septic systems. It is difficult to determine whether one of these private wastewater treatment systems is working properly, but through nearshore water sampling, some of these sites can be detected. A good volunteer program exists through the NYS Federation of Lake Associations regarding volunteer testing of private systems, with a main component being homeowner education. To minimize the impacts of failing septic systems on Loon Lake, a strong educational effort for shoreline residents is strongly recommended regarding the necessary maintenance of their systems and other potential water quality impacts such as excessive lawn fertilizing.

Loon Lake as a waterbody will be around for many hundreds or thousands of years. Development around Loon Lake and within its watershed is not likely to end in the near future. Poor management of these lands can strongly impact the water quality and aquatic ecosystem of Loon Lake. It is incumbent upon the residents and visitors of this precious resource to be vigilant in protecting this lake for the future. This report is intended to summarize and prioritize natural resource issues within the watershed and to improve our awareness of them. It is the responsibility of the landowners within the watershed to become stewards of this lake so generations beyond themselves may enjoy its beauty.

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Appendix A – Roadside Trenches

Rock lined trench: This structure is working well, note the sediment dropped from suspension. Routine maintenance of the trench is necessary, as is an investigation of the source.

Unprotected Trench: This situation can contribute to sedimentation of a waterbody. Unprotected soils may be carried from a trench and deposited down channel. If the material enters a waterbody untreated, nutrients and sediment can accumulate and negatively affect the waterbody

Vegetated Trench: A great example of a vegetated trench. Stormwater will filter through the vegetation and sediment will be deposited. Nutrients are taken up by the plants. Maintenance by removal of sediment and proper mowing will help to reduce the likelihood of nonpoint source pollutants from leaching out.

Useful Websites

- Warren County Soil and Water Conservation District: www.warrenswcd.org
- New York State Department of Environmental Conservation: http://www.dec.state.ny.us/
- Loon Lake Park District: http://www.loonlakeassociation.com/
- New York State Federation of Lake Associations: http://www.nysfola.org/
- Adirondack Park Invasive Plant Program: http://www.adkinvasives.com/
- Warren County: http://www.co.warren.ny.us/
- Adirondack Park Agency: http://www.apa.state.ny.us/