THE GLEN LAKE WATERSHED MANAGEMENT PLAN

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TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

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The persons noted below have developed and written the Greater Glen Lake Watershed Management Plan.

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The students, professors, and volunteers from Adirondack Community College listed below provided a tremendous amount of time and expertise to this plan:

ACC Professors:	Peter Tarana, Holly Ahern, Don Minkle, Roger Eagan
ACC Students:	Norma Borlang, Kim Ghulam, Jamie O'Neill, Paul Derby, Sean Price, Vince Spadaro
Volunteers:	James Underwood, Herb Kane, Don Milne, Bill Miller, Roger Ryan, Gene Choppa

The Town of Queensbury Glen Lake Technical Advisory Committee (TAC) regrets that we are unable to individually acknowledge all the people who volunteered their time to make this plan a reality. Without the valuable contributions made in the areas of testing, inputting of data, analyzing data, modeling, surveying and providing research, the development of this plan could not have occurred.

Cover photo graciously supplied by Daniel Kane.

EXECUTIVE SUMMARY

In 1993, the Glen Lake Protective Association appointed an Environmental Committee to begin examining environmental issues and problems impacting Glen Lake and its' surroundings. Through its deliberations, the Environmental Committee established a framework within which a watershed management planning process could take place. The Glen Lake Watershed Management Plan is the culmination of the committees' initiative.

The Plan pulls together a wealth of information about the physical and chemical attributes relating to the health of Glen Lake, about attitudes toward Glen Lake, of people who use the lake and reside within its' watershed, about impacts of existing and future development on Glen Lake, and about goal related tasks that should be carried out to address and resolve existing and anticipated problems in the watershed.

Glen Lake is an oligotrophic lake bordering on mesotrophy. This means that, although there are minor or occasional algae blooms, by all indicators the lake is quite clear. The very minor aesthetic problems notwithstanding, Glen Lake is considered excellent for overall use.

Based on tributary sampling, nutrient and sediment loading from various developed and undeveloped sub-drainages within the Glen Lake watershed are relatively low; not an unexpected result given the overall favorable water quality of Glen Lake. However, stormwater nutrient and solids concentrations are higher than base flow at many of the sampled sites which remains a real concern for Glen Lake.

A comprehensive water quality sampling program was conducted by the Adirondack Community College in relation to septic system impacts on Glen Lake. From the result of this two year study, there is significant evidence to indicate that at a limited number of residences, domestic wastes may be reaching the lake. However, to more accurately assess the status of septic systems at lake front properties, dye testing at a specific site should be performed simultaneously with tests for coliform and strep bacteria.

Based on toxic substance monitoring in the Glen Lake fen, it was found that Interstate 87 is not contributing appreciably to toxic contamination of the fen. However, the PAH concentrations (polycyclic aromatic hydrocarbons, which include a range of chemicals found in urban runoff), and metals, including lead, and lubricating oil are first detected below Route 9. Pollutants are filtered out in the wetland before entering the Lake. Nevertheless, lake bottom contamination occurs at the mouth of the wetland as the stream widens out and contaminated fine organic material is deposited at the entrance to the lake.

In responding to a watershed –wide survey, a majority of respondents (61%) considered weed growth as a serious problem at Glen Lake. While the survey suggests that there is a safety problem relating to motor boating on Glen Lake, concern toward unsafe operation of jet skis, excessive noise and size of boats (i.e. boats too large for the lake) was an expressed concern among respondents. Furthermore, there is a strong perception that the level of development surrounding the lake combined with stormwater runoff and septic tank failures are adversely impacting water quality in the lake.

The Glen Lake Watershed Plan concludes with a number of goals and it identifies a number of tasks that, when implemented, will achieve the goals. The goals are as follows:

1. Protect and improve the water quality of Glen Lake and its tributaries.

2. Ensure that the Glen Lake fisheries and habitat areas are maintained and improved and that contact recreational uses of the lake are not diminished.

3. Control the growth and spread of noxious aquatic vegetation in the Glen Lake watershed.

4. Maintain the use of Glen Lake as a recreational resource.

5. Ensure that future development in the greater Glen Lake watershed is appropriate and sustainable.

PREFACE

A watershed management plan is a land use strategy that follows watershed boundaries rather than neighborhoods or single lots and considers the management of the water resource as the main planning objective.

The health of Glen Lake and its contributing waters has been open to debate because of the lack of comprehensive water quality information. In 1993, the Glen Lake Protective Association (GLPA) appointed of an Environmental Committee made up of three members of the Association. The committee members began contacting other individuals with specific expertise in community planning, resource management and water quality issues. By the end of 1993, an ad-hoc group of technical people was meeting with the committee to establish a framework within which a watershed management planning process could take place.

In February of 1994, the Open Space Institute announced the Rural New York Environmental Action Grant Program. Submission for a grant formalized the efforts of the individuals working on the water quality issues. The Town Board of the Town of Queensbury and the Glen Lake Protective Association both passed resolutions in support of development of a comprehensive watershed management and implementation plan and in support of the submission of the grant application to the Open Space Institute. The Town Board of the Town of Queensbury agreed to provide the 50% match for the grant and act as the grant recipient. They formally appointed the Greater Glen Lake Technical Advisory Committee (TAC), made up of the Environmental Committee and technical volunteers. The TAC reported directly to the Town Board and came under the legal umbrella of the Town. The Environmental Committee continued to provide regular reports of the TAC initiatives to the Glen Lake Protective Association (GLPA), which was a partner in the grant submission. On September 15, 1994, an Environmental Action Grant was awarded to the Town for the technical examination and analysis of Glen Lake's waters leading to a management plan.

The next steps taken were to gather and analyze water samples taken at designated locations in the watershed in order to gather baseline data and identify changes in the water quality. Volunteers of the Association gathered the samples and over a three-year period expanded the testing area to include the Glen Lake Fen and Rush Pond. These test results were correlated with the results of the CSLAP (Citizens Statewide Lake Assessment Program) tests, which have been done on Glen Lake for the last five years with the cooperation of DEC. The TAC conducted two opinion surveys which were distributed in the watershed through a Town mailing. The results were used to develop some of the issue statements and goals of the plan. A partnership was developed with the staff of the Adirondack Community College in which students from the geology and biology departments helped gather and analyze watershed data. The college also contributed extensively in development of a computer generated model of the watershed which identifies pollution loadings from various land uses. This provided a service to the Town and gave the students an opportunity to use their classroom skills in a practical, real life situation.

The Town of Queensbury Department of Community Development created digitized maps which would interface with the computer model and any other maps needed for the plan.

Early in the planning process an educational program on septic system maintenance was provided to the Glen Lake Association through a grant from the Warren County Soil and Water Conservation District. This was done to help address a concern that septic effluent was entering the lake. It was also a precursor to a formal septic survey (1997) which was conducted by trained volunteers to identify areas of possible contamination from shoreline development.

The potential for increases in point and nonpoint source pollution and the subsequent reduction in the water quality of Glen Lake sparked concern at both the neighborhood and the municipal level. The development of the Greater Glen Lake Watershed Management Plan has been an effort to quantitatively measure the impacts of various land uses on the water quality of the lake and to pinpoint areas generating contamination. The Plan details the problems and concerns generated by the watershed residents, State water quality documents and discussion among the Technical Advisory Committee. It describes the scientific testing, analysis and results which were undertaken in response to these issues. The plan then presents goals and objectives which should be achieved by the implementation of the Watershed Management Plan.

The Greater Glen Lake Watershed Management Plan has been a collaborative effort initiated at the local level and involving the participation of State and regional agencies, the Town of Queensbury, the Glen Lake Protective Association, Adirondack Community College and numerous dedicated volunteers. It has taken over three years to develop and is the result of many hours of work. It is anticipated that the watershed management plan will provide direction for future land use decisions, be a starting point for long term water quality maintenance of the lake and provide a model for further watershed planning in the Town.

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Purpose of the Watershed Plan

The purpose of the Watershed Management Plan for The Future of Glen Lake is to address a variety of environmental concerns expressed by people working and living within the watershed. Concerns which were further confirmed as being problems by the Greater Glen Lake Watershed Technical Advisory Committee (TAC). While the Plan addresses a variety of environmental concerns and issues, primary emphasis is on reducing nonpoint source pollution and to develop strategies for protecting and enhancing water quality within the watershed. Specific and very tangible tasks have been identified in this plan as a means to protect and improve Glen Lake for future use.

1.2 Glen Lake and Surrounding Watershed Characteristics

Glen Lake is located in the Town of Queensbury, Warren County, New York (see Map 1). It is a 320 +/- acre glacial lake with a 5.1 mile shoreline that is intensely developed with seasonal and year-round residences. The watershed which contributes to the lake is approximately 7000 acres and incorporates a NYS DEC Class I wetland (the Glen Lake Fen), several threatened species, other smaller wetlands, areas designated by the Town of Queensbury as Critical Environmental Areas, a major theme park (The Great Escape), a number of shopping malls, retail outlet centers, restaurants, heavily used recreation areas, a road system which includes the Adirondack Northway (I-87) and a large amount of new residential development.

According to the New York State Water Quality Classification and Standards, Glen Lake and its tributaries have a "B" classification. This means that the lake and its tributaries are suitable for primary and secondary contact recreation, fishing, and fish propagation and survival. Any activity that impacts the lake or tributaries thereof, so as to preclude these uses would lower the water quality. The 1996 Priority Waterbodies List for the Lake Champlain Basin reports that swimming is a stressed activity and that both boating and the aesthetics associated with viewing Glen Lake are threatened as a result of algal growth and heavy infestations of aquatic vegetation in shallow areas of the lake. "Swimmers itch" is a condition attributed to schistosomiasis, a parasite associated with waterfowl which can enter the skin of humans and become an irritant. It usually occurs in lakes, such as Glen Lake, where larger than normal waterfowl populations are sustained through feeding by shoreline residents. There are indications that the occurrence of swimmers itch in Glen Lake is on the decline, presumably as a result of reduced water fowl feeding by shoreline residence.

Several wetlands in the watershed, including the Glen Lake fen, Saint Mary's Bay fen, and Rush Pond are critically important to the protection of water quality in Glen Lake. They serve to trap sediment, and filter nutrients and toxic substances. Furthermore, these wetlands provide important habitat to several species of fish that inhabit Glen Lake.

There are two major soils associations in the Glen Lake Watershed: Bice-Woodstock and Oakville. The Bice-Woodstock soils generally lie west of the Northway and are characterized as sloping to steep, deep and shallow, well drained to excessively drained, moderately coarse sandy soils. These soils are typically found on uplands at an elevation of about 1,000 to 1,500. The soils association generally lying east of the Northway are the Oakville soils which include nearly level and gently sloping, well drained, coarse sandy soils that are found in an out wash plain. Fertility for both associations soils tends to be low. Within both soils associations there are over sixty soils groups. Except for developed areas within the watershed, the dominant land cover is an eastern hardwood/pine mixture consisting of red oaks, white birch and white pine.

The shoreline of Glen Lake has been almost entirely encircled by high density development. The density of development is a function of two elements; small lot sizes and the large structures that are allowed to be built on them.

Much of the growth along the shoreline started from 50 to 75 years ago as seasonal camps on 50 x 75 foot lots. Over the years, particularly within the past 20 years, the camps have been expanded in size into year-round homes for permanent residency. Such conversions continue today. The problem that accompanies this conversion is that the antiquated septic tank/leach field systems cannot be brought up to current standards in terms of required separation distances from the lake and wells on the 50' by 75' shoreline lots.

The amended zoning code of 1988 required one acre of land for waterfront development as well as specific setback distances from lot lines. The pre-existing, nonconforming lots of record which surrounded the shoreline did, however, convey certain legal rights in terms of lot size and setback in relation to the amended zoning changes. The Queensbury Zoning Board of Appeals grants lot-by-lot variances to the zoning along the shoreline when necessary. Also, in some cases the lot sizes allowed the Board of Health to grant variances to the Town Sanitary Code. The Town regulations further allowed an existing septic system which exhibited no visible failure to remain rather than be upgraded to fit the expansion. What occurred was a progressive overbuilding on lots without adequate on-lot sanitary wastewater systems. This has served not only to diminish the aesthetics of the shoreline, but it has made Glen Lake vulnerable to pollution from substandard septic/leaching systems. The Town is addressing these issues with a stricter waterfront-residential zoning and an upgraded septic code.

In 1997, the Town of Queensbury Department of Planning and Community Development, using the best available growth projections, projected that a total of 465 housing units could be developed in the Greater Glen Lake Watershed during the 28-year period from 1997 through 2025. This constitutes 9% of the overall number of housing units expected to be developed town wide during the same period (5,124 units). Additionally, the Department projects 52 acres of commercial area could be developed within the watershed during the same period of time.

Related to the problem of shoreline development is the extensive removal of trees from shoreline areas on the lake. This, along with the fact that, until recently, building setback distances in the Town building code historically enabled development to occur close to the lake so that when viewed from the lake or opposite shore much of the development surrounding Glen Lake takes on a congested appearance. Another factor that has exacerbated the problem of over crowded shoreline development relates to the conversion of seasonal cottages to year-round homes and the relative ease with which variances are issued by the Town Zoning Board of Appeals to build larger than allowable structures for existing lot sizes (many fifty foot wide lots at the shoreline).

Pressures for further development in the watershed are likely to result in a second tier of development immediately adjacent to and upland of the shoreline development. To a certain extent, this already is occurring. In addition to the obvious loss of open space, a second tier of development may result in additional recreational demand for use of the lake. This will be particularly true in the case where shoreline owners plan to subdivide upland acreage and provide upland residences with lake access for boating and other recreational uses of the lake.

CHAPTER 2: WATER QUALITY STATUS

Every lake goes through a process of aging which is called eutrophication As a lake ages it receives more nutrients and sediments until it becomes dense with algal blooms, weed growth and silt. Once this happens, the lake is said to be in a eutrophic state. As inputs of phosphorus and other nutrients and pollutants enter a lake, its current state becomes more and more impacted which leads to higher algae concentrations. The trophic status of lakes, such as Glen Lake, can change from oligotrophic to mesotrophic through contamination by phosphorus from various land uses in the watershed and from contamination by failing septic tanks. The quality of the recreational experience generally diminishes as the trophic conditions change from oligotrophic to eutrophic.

Glen Lake is considered currently to be an oligotrophic lake, which means that it is a clean and clear lake overall with only minor or occasional algae blooms.   Through water quality sampling and watershed modeling efforts in this program, it was determined what the current inputs to Glen Lake are and if they could negatively impact the lake, accelerating the aging process. These studies and their results are summarized in the following few pages.

In any watershed and lake, there are pollutants which come from the surrounding watershed which can impact the lake. The following is a brief summary of the pollutants and how they can impact lakes:

Nutrients

Phosphorus is the nutrient of primary concern in the Glen Lake Watershed. The enrichment of surface waters by phosphorus can cause excessive algae and aquatic plant growth, which may choke open waters and lead to a depletion of oxygen in the water due to plant die-off. Fish and aquatic organisms, swimming, fishing and boating, and the use of the water body as a water supply are thereby impacted.

Pathogens

Bacteria and viruses include infectious agents and disease-producing organisms normally associated with human and animal wastes. The principal concerns are the survival and transmission of such organisms and their impacts on drinking water supplies, contact recreation, and fish and wildlife or domestic animals.

Sediments

Sediment in the Glen Lake watershed originates as unstable, eroding soil that is transported by stormwater runoff and deposited in the lake. As such, sediment transports nutrients which stimulate algal growth, as well as toxic substances (including pesticides, herbicides, and metals through chemical absorption to the soil surface). By reducing water clarity and aesthetic values, and by degrading and occasionally eliminating fisheries habitat, sediment deposition in Glen Lake decreases recreational opportunities and diminishes property values, particularly for shoreline residents.

Toxic Substances

Toxic chemicals, including heavy metals, pesticides, oil and other petroleum products, may enter surface waters either dissolved in runoff or attached to sediment or organic materials, and may enter groundwater through soil infiltration. The principal concerns in surface water are their entry into the food chain, bio-accumulation, toxic effects on fish, wildlife and microorganisms, habitat degradation, and potential degradation of water supplies. The groundwater impacts are primarily related to degradation of water supply resources.

Understanding to what degree the above pollutants may be entering and impacting Glen Lake was a major part of this study. As such, tributary and in-lake water quality sampling was conducted to determine the degree of pollutants entering Glen lake and their locations. The following is a summary of those activities and their results.

2.1 Water Quality Sampling Program -- Glen Lake

The Citizens Statewide Lake Assessment Program (CSLAP) is a program provided through DEC which trains volunteers to gather data on the lakes in New York State. Glen Lake has been participating in this program for approximately 10 years, and volunteers have been gathering information on water clarity, phosphorous and chlorophyll in the lake.

The parameters analyzed in CSLAP provide valuable information for characterizing lakes. By adhering to a consistent sampling protocol in the **CSLAP Sampling Protocol**, volunteers collect and use data consistent to assess both seasonal and yearly fluctuations in these parameters, and to evaluate the water quality in their lake. By comparing a specific year’s data to historical water quality information, lake managers can pinpoint trends and determine if water quality is improving, degrading, or remaining stable. Table 1 provides a summary of CSLAP data for Glen Lake from 1986 to 1996.

Table 1. CSLAP Data Summary for Glen Lake from 1986 to 1996.

Parameter	**Min**	**Ave**	**Max**	**N***
Secchi Disk (in meters)	3.00	5.26	7.88	57
Total Phosphorus (mg/l)	0.002	0.008	0.014	58
Nitrate Nitrogen (mg/l)	0.01	0.02	0.03	43
Chlorophyll *a* (ug/l)	0.07	2.87	14.60	54
A**	1.0	1.9	3.0	14

B***	2.0	2.2	3.0	14
C****	1.0	2.0	3.0	14

* N = number of samples during sampling period.
** Survey Question "A" re: physical condition of lake: (1) crystal clear; (2) not quite crystal clear; (3) definite algal greenness; (4) high algal levels; and (5) severely high algal levels.
*** Survey Question "B" re: aquatic plant populations of lake: (1) non visible; (2) visible underwater; (3) visible at lake surface; (4) dense growth at lake surface; and (5) dense growth completely covering the nearshore lake surface.
**** Survey Question "C" re: recreational suitability of lake: (1) couldn't be nicer; (2) very minor aesthetic problems but excellent for overall use; (3) slightly impaired; (4) substantially impaired although lake can be used; (5) recreation impossible.

The relationship between phosphorus, chlorophyll *a* and secchi disk transparency has been explored by many researchers, in hopes of assessing the trophic status (the degree of eutrophication) of lakes. Table 2 shows ranges for phosphorus, chlorophyll *a*, and Secchi disk transparency (summer averages) representative for the major trophic classifications.

Glen Lake appears to be in excellent shape by all CSLAP measured indicators of chemistry. Indices of trophic status, including total phosphorus, secchi disk depth and Chlorophyll suggest that Glen Lake is an oligotrophic lake bordering on mesotrophy. This means that Glen Lake is very clear and the algae content is relatively low. This is represented by Table 2 below:

Table 2: Trophic Status Indicators

Parameter	Eutrophic	Mesotrophic	Oligotrophic	**Glen Lake**
Phosphorus (mg/l)	> 0.02	0.01 – 0.02	< 0.01	**0.008**
Chlorophyll *a* (ug/l)	> 8	2 – 8	< 2	**2.9**
Secchi disc clarity (m)	2	2 – 5	> 5	**5.3**

2.2 Water Quality Sampling Program -- Tributaries

Beginning in 1994, the Technical Advisory Committee and the Glen Lake Association volunteers conducted baseline and limited stormwater monitoring in the major tributaries entering the lake. Water samples and basic physical information, including flow data, were collected by lake association volunteers at a number of sites within the Butler Pond/Rush Pond/Glen Lake Wetland sub-basin and the St. Mary's Bay sub-basin, using procedures outlined in a training session conducted by the NYSDEC. These sub-basins probably represent about 80% of the surface hydrologic loading to the lake. Water samples were analyzed for total phosphorus, suspended solids, and (less frequently) coliform bacteria by the Glens Falls Wastewater Treatment Plant Laboratory and the Darrin Fresh Water Institute. The results are in Appendix C.

The data collected through this tributary monitoring program are provided in Appendix C. The following sites were monitored:

Butler Pond/Rush Pond/Glen Lake Wetland sub-basin
Site 1- Rush Pond outlet, West side of Northway
Site 2- Rush Pond outlet, East side of Northway
Site 3- Rush Pond outlet, West of Rt. 9
Site 4- Rush Pond outlet, East of Rt. 9
Site 5- Great Escape Stream Exit @ Jungleland
Site 6- Wetlands Near the Sandpit
Site 7- Wetlands Where the Streams Converge
Site 8- Wetlands at Canterbury Lane Bridge

Glen Lake sub-basin (inflow directly to lake)
Site 9- Bike Path Stream at Glen Lake Road
Site 10- Bike Path Stream Below RV Park
Site 11- Bike Path Stream Above RV Park

St. Mary's Bay sub-basin
Site 12- St. Mary's Bay Culvert

Although not all sites were sampled during each sampling session, the following sampling dates were considered to be sampled during base-flow conditions: July 5, 1994; April 25, June 6, August 1, and September 12, 1995. Storm-flow conditions occurred during July 26, 28, and 29, 1994; May 15 and October 4, 1995; and April 16, May 6, and May 12, 1996.

It appears that overall nutrient and solids loading to Glen Lake, via the Butler Pond/Rush Pond/Glen Lake Wetland and St. Mary's Bay sub-basins are relatively low, an expected result given the overall favorable water quality of Glen Lake. Stormwater nutrient and solids concentrations are higher than base flow (normal summer low flow) throughout many of the sampled sites, as expected, but at both St. Mary's Bay and the Canterbury Bridge site, the stormwater influences on instantaneous loading appear to have been minimized. However, nutrients and solids deposited during previous storm water events may still be transported within the base flow, and this may affect the readings. As such, it is likely that stormwater remains a real concern at these tributaries and ultimately the lake.

Although there is insufficient stormwater data to accurately evaluate annual loading of nutrients and solids to Glen Lake, the limited data appear to be collected reasonably well, given the concurrence of flow data and the consistency of the overall annual nutrient loading at Canterbury Bridge to the expected loading rate. Additional stormwater data may help to better assess the true role of stormwater inputs to the lake, although it should be recognized that the process of collecting accurate stormwater data (hourly samples over the entire length of several storms) is probably beyond the scope of and reasonable expectation for volunteer-based programs.

2.3 Watershed Modeling

The Technical Advisory Committee, created a linkage with Adirondack Community College to facilitate the development of a computer generated model of the watershed. The Glen Lake watershed was modeled by using a watershed-scale model referred to as EUTROMOD. EUTROMOD enables watershed planners to integrate land use and soils information from within the watershed. When combined with specific weather and runoff characteristics of the land, EUTROMOD can be used to estimate how much phosphorus is derived from each of the major land uses in the watershed. Table 3 provides phosphorus loading estimates to Glen Lake from the greater Glen Lake watershed under existing land use conditions. Note that phosphorus loading estimates from septic tanks are provided in Table 3. This estimate is based on the assumption that soils retain 95% of the phosphorus from shoreline dwellings before septic tank leachate reaches Glen Lake.

Table 3

EUTROMOD derived phosphorus loading estimates in the Glen Lake Watershed for various land uses.

Land Use	Area in		Phosphorus Loading Estimate (kg/yr)
	Hectares	Acres	
Cropland	5.98	14.58	7.51
Forest	2277.29	5549.75	12.84
Commercial	137.25	137.25	3.71
Residential	316.7179	771.84	7.09
Parks and Rec.	33.06	80.57	10.11
Marsh/swamp	140.86	341.39	.91
Institution	14.86	36.21	8.13
Point Sources	---	---	-0-
Septic Tanks*	---	---	42.38

Total	92.68

*Phosphorus loading estimate is for septic tanks associated with shoreline households. Estimate assumes that soil is 95% effective in removing phosphorus from septic tank leachate before it reaches the lake.

The basic assumption of this model is the failure rate of septic systems along the lakeshore. Therefore, to demonstrate what the effects would be with higher and lower septic system failure rates, the model was run using failure rates of one percent and twenty percent also. The results are as follows:

- Scenario A: Existing watershed development (Assume a 99% soil retention of phosphorus for septic tanks of shoreline residences). Table 4
- Scenario B: Existing watershed development (Assume a 80% soil retention rate for phosphorus for septic tanks of shoreline residences). Table 5
- Scenario C: Future watershed development to year 2025, (assuming a 99% soil retention rate of phosphorus for septic tanks of shoreline residences). Table 6

Table 4

Scenario A: Existing Development (99% phosphorus retention rate)	
Land Use	Phosphorus Loading (Kg/yr)
Agriculture	7.51
Forest	12.84
Urban	10.80
Septic Tanks	8.47
Other	19.15
Estimated Total	58.77
Predicted Lake Trophic Status	
Variable (units)	Predicted Loading
Total Phosphorus in Lake Water	
Column (mg/l)	0.007
Chlorophyll *a* (ug/l)	1.86

Secchi Depth (m)	3.81

Table 5

Scenario B: Existing Development (80% phosphorus retention rate)	
Land Use	Phosphorus Loading (Kg/yr)
Agriculture	7.51
Forest	12.84
Urban	10.80
Septic Tanks	170.00
Other	19.15
Estimated Total	219.80
Predicted Lake Trophic Status	
Variable (units)	Predicted Loading
Total Phosphorus in Lake Water	
Column (mg/l)	0.016
Chlorophyll *a* (ug/l)	8.45
Secchi Depth (m)	3.14

Table 6

Scenario C: Future Development - Year 2025 (99% phosphorus retention rate)	
Land Use	Phosphorus Loading (Kg/yr)
Agriculture	6.36
Forest	11.96
Urban	14.06

Septic Tanks	8.47
Other	19.14
Estimated Total	91.42
Predicted Lake Trophic Status	
Variable (units)	Predicted Loading
Total Phosphorus in Lake Water	
Column (mg/l)	0.009
Chlorophyll *a* (ug/l)	3.60
Secchi Depth (m)	3.65

Table 3 shows that phosphorus loading in the watershed as derived by EUTROMOD is approximately 93 kg/yr. What should be noted from Table 3 is that at a 95% soil phosphorus retention rate, septic tanks surrounding Glen Lake contribute, more than all other sources combined, are the greatest amount of phosphorus reaching Glen Lake. Nevertheless, the relatively low estimated phosphorus loading to the lake is consistent with the CSLAP findings and in the overall favorable water quality in Glen Lake. If, on the other hand, soil retention of phosphorus from septic tanks surrounding the lake drops to 80%, i.e., a soil retention failure of 20% (Table 5), phosphorus loading from septic tanks would increase to nearly 170 kg/yr. Thus, because of the sensitivity of EUTROMOD to phosphorus loading in Glen Lake and its potential for lake degradation, it should be clear that for management purposes, greater precision and understanding of the actual contribution of septic tank leachate, including phosphorus, is essential.

The various development scenarios modeled with EUTROMOD provide several useful insights for better understanding watershed and developmental influences on Glen Lake. These insights in turn provide for a greater understanding of lake management needs for the protection of Glen Lake.

Of significance is the impact that failing septic tanks have on Glen Lake. As the effectiveness of soil to remove phosphorus from septic tank leachate decreases from 99% to 80% bringing about a corresponding increase in septic tank failure rate, phosphorus loading to Glen Lake will increase, according to EUTROMOD, from 8.47 to 179.00 kg/yr. With such a failure rate, lake productivity as reflected by chlorophyll *a* will increase from 2.23 ug/l to 8.45 ug/l resulting in greater algal production. The secchi disk readings in EUTROMOD show that as lake productivity increases, there will be a corresponding decrease in water transparency.

Development scenario C shows that as development in the watershed increases, there is a corresponding increase in lake productivity as revealed by increased chlorophyl a production and decreased water clarity. In comparison with existing development (scenario A), total phosphorus in the water column increases for projected development in the watershed in the year 2025. There are corresponding shifts in chlorophyll *a* production and secchi depth that reflect increased lake productivity.

The management implication of increased lake productivity in relation to increased growth and development suggests the need for effective stormwater management controls and properly functioning septic systems to ensure that phosphorus is removed. Through various BMPs (best management practices), runoff associated with new development can be minimized before it is discharged to Glen Lake.

2.4 Septic System Study

During the summers of 1997 and 1998, a near-shore sampling program designed to assess the status of septic systems around the lake was undertaken. From June to August 1997, lake resident Jim Underwood obtained water samples from in front of nearly 170 shoreline residences. These samples were analyzed for septic tank-associated contaminants (specifically, phosphates, anionic surfactant, and coliform bacteria) by Adirondack Community College students Norma Borlang and Kim Ghulam. The ACC students were supervised by Professor of Chemistry Peter Tarana and Assistant Professor of Microbiology Holly Ahern.

During the summer of 1998, the ACC students, working with Professor Ahern, were responsible for the implementation of the near-shore sampling program. Because the levels of surfactant and phosphate detected in 1997 were significantly less than the New York State standards, tests for these compounds were not performed. The water samples were analyzed only for coliform bacteria. Additionally, a rhodamine dye-testing program was implemented during July and August of this year.

All of the laboratory tests were performed in accordance with EPA guidelines, based on methods from the reference text Standard Methods of Water and Wastewater Analysis.

The contaminants for which the water samples were tested were chosen because detection of these compounds in lake water has been associated with septic system failure. Phosphates are found in many commercial cleaning products (such as laundry detergents) that make their way into septic tanks and leach fields. Phosphorus, a component of phosphate, binds strongly to most soils. Therefore, the detection of phosphorus or phosphate in the water column near shore indicates that the chemical is flowing along with the septic system leachate into the lake, through soils that are already saturated with phosphorus. Similarly, the detection of surfactant, which is not found in nature, would be an indicator of septic system pollution.

The biological indicators of human pollution used were total coliform and fecal coliform (in 1997) and fecal coliform and fecal streptococci (in 1998). The test for total coliform indicates the presence of gram negative rod-shaped bacteria that ferment lactose. Coliform bacteria, such as those belonging in the bacterial genera of Escherichia, Enterobacter, Citrobacter and Klebsiella, are non-pathogenic microbes that typically dwell in the intestines of mammals. These bacteria may also exist as free-living saprophytes. Their presence in the lake may be associated with animal body wastes, but since most mammals harbor coliform bacteria it is not possible to distinguish between human contamination and contamination from animals. However, a coliform count of 500 colonies per 100 milliliters of water in a near shore sample may be an indicator of septic tank pollution.

Fecal coliforms are thermo-tolerant coliforms which are not free-living and are more closely associated with human and animal contamination. These coliforms survive at higher temperatures (up to 45°C), and the test for fecal coliform involves an initial high-temperature incubation step to select against other types of coliform bacteria. Two important non-pathogenic fecal coliforms are Escherichia coli and Klebsiella pneumoniae. However, the presence of fecal coliforms in a water sample indicates that other, more pathogenic species of intestinal-dwelling microbes, such as those that cause the enteric diseases cholera, typhoid, or hepatitis, may also be present in the water. Low levels of fecal coliforms (10-100 fecal coliforms per 100 ml of water) are not cause for concern, but at higher levels (2,000-3,000/100 ml), even use of water for recreational purposes could be dangerous and public beaches would be closed.

Fecal strep is an additional test performed to detect the presence of enteric (intestinal-dwelling) bacteria. Fecal streptococci (also known as enterococci) are gram positive, oval or round bacteria that also live in the intestines of warm-blooded animals. The enterococci (such as Enterococcus faecalis and Streptococcus avium) are commonly found in the intestines of animals and birds. A high number of fecal strep would indicate recent pollution of animal nature. If the number of fecal coliform exceeds the number of fecal strep, it is more likely that the source of the bacteria was human. A high fecal coliform to fecal strep ratio (greater than 4) is considered by some to be a good indicator of a septic system problem.

The rhodamine dye testing program requires that the test compound rhodamine be introduced into a septic system, usually via the toilet. Rhodamine is a fluorescent chemical that can be detected with a sensitive instrument (a fluorometer) at very low concentrations. After the rhodamine has been flushed in the toilet of a lake front residence, water samples are obtained over several days in front of the residence. The samples are analyzed in a fluorometer set to detect the wavelengths of light characteristic of rhodamine. The detection of the dye in the water in front of the residence is a very strong indicator that septic system leachate is reaching the lake.

<u>Summary of Sampling Results</u>

In 1997, the concentration of phosphate and surfactant in the lake were found to be negligible. More specifically, the concentration of phosphorus (measured as total phosphorus) was a thousand times below the NYS standard of 20 ìg/L.

Coliform bacteria were detected at several locations in 1997. The majority of the sites at which total coliform or fecal coliform bacteria were identified were in the inlet (Fen) area and in the vicinity of the outlet. Both of these locations are shallower and in general, warmer, than the rest of the lake. The inlet and outlet also boast an abundance of organic material, mostly in the form of decaying vegetation. Therefore, the relatively high number of coliform bacteria detected in these areas are most likely attributable to natural populations of heterotrophic bacteria, and not to fecal contamination.

Total coliforms were also detected at sites along the shore and at one other site. At these locations, it is more likely that the coliforms were fecal in origin; however, because the number of fecal strep were not determined during the first year of the study, it can not be conclusively stated that fecal contamination from a septic system failure had occurred.

Overall, the number of coliform bacteria found at all sites was well below the water quality standards established by New York State, and also those established by the federal government. The overall water quality was therefore rated as “excellent” for recreational uses.

In 1998, a more comprehensive study of septic system integrity was undertaken. Near shore water samples were tested for fecal coliforms and fecal strep, and a fecal coliform to fecal strep ratio was determined. There were three locations where the FC/FS ratio exceeded a value of 4.

Rhodamine dye testing was coordinated by members of the Glen Lake Association in 1998. 49 residences participated in the endeavor. Given the sensitivity of the instrument and therefore the test, and the presence of sources of natural fluorescence in the lake, the ACC investigators chose to correlated septic system failure with a relatively high absorbance reading (>5.0) so as to minimize the margin of error.

Rhodamine was detected at absorbances above 5.0 in the water in front of five residences. Absorbance readings above the background, but below 5.0, were detected at an additional seven residences. The other residences were located near the lake’s outlet where the water is shallower and rich with organic material, which may have contributed to the higher absorbance readings.

At two of the residences, there was a positive correlation between rhodamine detection and fecal coliforms. At one of these the number of fecal coliforms was roughly equivalent to the number of fecal strep. Therefore, it is difficult to conclusively state that the coliforms were from a human source. However, at the other site, a high absorbance reading (7.0) corresponded with a high FC/FS ratio (6.82). This is a strong indication that there is a septic system problem at that site.

Although coliform bacteria were detected as several locations during the 1998 summer, the values did not exceed the NYS or federal water quality standards for either total or fecal coliform. The lake was once again rated as “excellent” for recreation use.

From the results of ACC’s 2-year study, there is significant evidence to indicated that at a limited number of residences, domestic wastes may be reaching the lake. However, at only one site could this be conclusively shown. At other sites where fecal coliform bacteria and/or rhodamine were detected, such as the outlet bay, additional tests should be performed. To more accurately assess the status of septic systems at lake front properties, rhodamine testing at a specific site should be performed simultaneously with tests for fecal coliform and fecal strep. In this way it would be possible to conclusively identify lake front properties that may be contributing to the decline of the lake through septic system failure

2.5 Aquatic Vegetation

Eurasian watermilfoil (Myriophllum spicatum), a plant species native to Europe and Asia, has been visually observed in Glen Lake for quite a few years principally in the vicinity of St. Mary’s Bay and at the eastern end of the lake near the outlet. Watermilfoil does not appear to be developing a canopy at the surface of the lake in either of these locations, nor does not seem to be impeding the use of the lake for recreational or other purposes at this point in time. What is unknown is whether the milfoil population in Glen Lake is expanding, decreasing, or has become stabilized.

2.6 Zebra Mussels

Zebra mussels (Dreissena polymorpha), a non-native species believed to have been carried in the ballast water of European vessels which emptied their water into the Great Lakes have found their way into Glen Lake. Zebra mussels can be recognized by the dark brown stripes on their light tannish shells. Adults average 1 – 1.5 inches in length and live up to 5 years. They reproduce quickly and form colonies that can reach 30,000 – 40,000 mussels per square yard. In Glen Lake the zebra mussel population has not reached this density. Zebra mussels eat phytoplankton and can therefore potentially reduce the food supply for native organisms. When attached to water intake pipes, they can greatly reduce and occasionally stop water flow.

Zebra mussels in Glen Lake are, nevertheless, colonizing solid surfaces such as docks, boats, water intake pipes, and stones and rocks. Also they have been observed clinging to aquatic vegetation The zebra mussel population in Glen Lake is expanding, as determined by a study by the Adirondack Commmunity College during 1998.

Efforts to control zebra mussels in North America have focused on chemical treatment, using protective coatings on surfaces to inhibit attachment, thermal treatments, acoustic treatments, and biological controls. Biological controls appear to be most feasible as a control method, but studies have not shown that the population densities are such that a large scale control program would be warranted. The status of the zebra mussel populations should continue to be monitored in the future, and cost effective solutions to their control should be sought as new technology becomes available.

2.7 Toxic Substance Study

On April 23, 1997, nine sediment grab samples were taken from the Glen Lake Fen wetlands in order to evaluate the impact of runoff from Routes I-87 and Route 9 upon the lake. The sample sites extend from just upstream of I-87 to just into Glen Lake itself . The sites bracket a large sandy area occupied by the Great Escape amusement park. Samples were taken with a hand-held ponar dredge. Analyzes for metals, petroleum products, and EPA's 16 priority pollutant poly aromatic hydrocarbons (PAH) compounds were done at the NYS Department of Health Wadsworth Laboratories. The data and results are presented in Appendix H .

Based on the sampling and analysis that followed, it was found that I-87 is not contributing appreciably to toxic contamination of the fen. However, the PAH concentrations, metals, including lead, lubricating oil increase are first detected below Route 9. Contaminant concentrations drop in the wetland before entering Glen Lake. It should be noted that test sample site #5, which is located adjacent to The Great Escape amusement park shows significant levels of certain toxic substances compared to the other test sites. It is important that continued testing as well as ongoing monitoring of this location be considered to determine the causes of the unusually high test results and the impact of such substances on the fen and Glen Lake. With this baseline date that has been collected, an ongoing sampling program can now be instituted through the Town of Queensbury.

Lake contamination occurs at the mouth of the wetland as the stream widens out and contaminated fine organic material is deposited at the entrance to the lake. The Glen Lake sample (site 8) contained elevated concentrations for PAH and a few of the metals, significantly zinc. None of the four lightest, and possibly toxic, PAH compounds were detected, but most of the others, including potentially toxic phenanthranes and anthracenes, are present at levels falling around the base of the medium range(Long and Morgan 1990) for sediment impact on biota. The zinc concentration is above the low effect level (Persaud et al), but still below effect level.

From this investigation, it can be concluded that Glen Lake and its upstream wetland are impacted by road runoff from Route 9 and other possible sources. The wetland is an important contaminant buffer, preventing potentially toxic PAH compounds, other petroleum products, and metals from reaching severe contamination levels in the lake. Nevertheless, zinc concentrations are above the low effect level (on living organisms), and toxic phenanthranes and anthracenes are present at levels falling around base of the medium effects range for sediment impact on biota. Thus there is sufficient reason to be concerned about the control of the future contamination inputs from highway runoff to Glen Lake and controls should be considered.

2.8 Water Quality Summary

The overall water quality of Glen Lake is excellent for swimming, boating and other recreational activities, according to the near shore water sampling done in 1997. The lake is clear, which is consistent with an oligotrophic water body, and sustains a trout fishery and wildlife habitat. Sampling of the tributaries flowing into Glen Lake indicate that the nonpoint source pollution being carried by stormwater is relatively low. Since the sampling was done to establish base line information it should be continued to determine if trends occur as development takes place in the watershed.

Analyses of near shore samples of lake water did indicate areas of concern. The data suggest there are areas of septic tank/leach field failure randomly distributed in clusters in various areas around the lake shore. Along with the continuation of the near shore sampling, septic system dye testing should be continued to provide conclusive results.

There are pockets of aquatic vegetation which need to be accurately mapped and tracked to determine the rate of the expansion of the existing beds and the creation of new beds. Once the data are collected, various control mechanisms should be examined to determine if an aquatic weed management program is feasible and needed.

The control of zebra mussels should follow a similar path. Research has to be done on eradication or control of these bi-valves, and a control plan should be developed for Glen Lake.

Swimmers' itch appears to be an infrequent occurrence. However, dissemination of educational information about the problem and how to prevent it needs to be an on going activity.

Toxic contaminants from Route 9 are impacting Glen Lake and the Fen. Substances, including lead, lubricating oil and zinc, are first detected downstream of Route 9, with an increase noted at a sampling site adjacent to the Great Escape. As the toxic substances go through the fen a cleansing occurs which partially prevents the toxins from entering the Lake, although zinc concentrations are found around the mouth of the Lake where the wetland empties into it. The factors which are unknown at this time are: to what extent is the fen polluted and how much more toxins can it bioaccumulate before it can no longer serve as a buffer which protects the Lake. It is important that continued testing and monitoring at the sites identified in the base line analysis be financially supported and carried out by the Town of Queensbury.

CHAPTER 3: WATERSHED RESIDENTS' SURVEY

Early in the planning process the Technical Advisory Committee recognized the need to determine the attitudes and views of citizens in the Glen Lake watershed. Accordingly, an opinion survey was developed. The survey was constructed in such a way as to gather data about the residents of the watershed as well as issues the residents feel are important. The survey (see Appendix B) was set up in five parts: 1) Background Information which asked about where the resident lived, whether they were permanent or seasonal, own or rent or operated a business; 2) Lake Usage asked about the type of activity the residents participated in within the watershed and how they accessed Glen Lake; 3) Problems Affecting Glen Lake such as water quality, recreational use conflicts and land use problems; 4) Goals & Objectives responding to listed goals and adding written comments; and 5) Financial Responsibility for Water Management & Water Quality. The results are as follows:

3.1 Background Information

The survey was mailed to over 1100 Glen Lake watershed residents during May and June of 1996. It was prepared so that it could be completed by the resident and returned, postage paid, to Adirondack Community College by folding the survey and dropping it in the mail.

There were 191 surveys returned (17%) from the 1100+ surveys originally mailed. The addresses were taken from a mailing list prepared by the Town of Queensbury Planning Department using property owners of record during the spring of 1996.

The information asked about the respondents location in the watershed and the type of resident they were. Of the 191 survey responses, over 42% were Glen Lake shoreline residents and over 30% were 3-5 miles from Glen Lake. Most were permanent residents 76.84%, and 95.79% owned a residence (renters were not contacted unless their name appeared on the Town of Queensbury mailing list) and only 9% of the respondents were business owners/operators.

The results indicate that residents from both the shoreline and 3-5 miles from Glen Lake responded. This allows for opinions from a cross-section of property owners.

3.2 Lake Usage

This section surveyed the residents use of Glen Lake for boating, fishing/hunting, swimming, winter sports and nature/hiking and how they got access to the lake.

Residents most frequently use the lake for swimming and boating with occasional usage of the lake for boating, fishing, swimming, etc. Over 50% of the respondents do not use Glen Lake for winter sports. Lake access for these residents is from being a shoreline resident (41%) or by access granted by a shoreline resident (12%) or by using the Docksider boat launch. Fourteen percent (14%) use the Town access point.

3.3 Problems Affecting Glen Lake

Residents were asked to respond to a list of categorized problems throughout the watershed. They were water quality, conflicting residential uses, and land use problems. Under each category, a number of problems were listed and residents were asked to indicate the severity of the problems.

Water Quality

Over 61% felt that aquatic weed growth was a serious problem followed by algae blooms 32.9% as a serious problem. The perception among many respondents to the survey is that weed growth is a problem in Glen Lake. Furthermore, many respondents consider the lake “murky”, ostensibly due to occasional algal blooms that occur at certain times of the year. For some respondents, both weed growth, specifically Eurasian Milfoil, and the algal blooms detract from the quality of the lake particularly for swimming. Seven large patches of milfoil have been mapped in Glen Lake.

Conflicting Recreational Uses

Overall, there was no overwhelming perception of problems associated with boating/fishing conflicts nor boaters/swimmers conflict. Under the Excessive Noise on Lake category, nearly 47% felt that there was a minor (28.66%) to serious (18.9%) problem. The watershed survey suggests that the majority of respondents feel there is a safety problem relating to motor boating on Glen Lake. Respondents have pointed to excessive boating speed, unsafe operation of jet skis, excessive noise and size of boats (i.e. boats too large for size of lake) as being a problem on the lake. Also, concern was expressed about day cruisers on the lake with inadequate sanitary facilities either in the boat or on shore. Moreover, concern was expressed about indiscriminate launching of contaminated boats by nonresident (i.e. contaminated with milfoil or zebra mussels).

The category for Unsafe Watercraft Operation showed that 34% felt it was a minor problem and 22% felt it was a serious problem. The Lack of Public Access was not deemed a problem by 45% of respondents, possibly because the residents that responded may already have lake access.

Land Use Problems

The problem of septic system failure was deemed serious by over 50% and 20% felt it was a minor problem. The over development of lake shore was a serious problem for over 44% and 25% felt it was a minor problem. 37% felt overdeveloped watershed was a serious problem.
The category of Too Few Commercial Enterprises on Lake was not perceived to be a problem for nearly 69% of the residents which is supported by the residents that feel the lake shore is overdeveloped.

There are a number of unresolved land use problems and issues in the Glen Lake watershed. There is a strong feeling that the shoreline area of the lake has become overdeveloped as a result of small lot sizes and that the watershed also is becoming overdeveloped. The perception is that the level of development in the watershed and, in particular, the level of development surrounding the lake and resulting storm water runoff and septic tank failures are adversely impacting water quality in the lake. Furthermore, the high density of development along most of the lake shore area has impaired and detracts from the visual character of the lake. Corresponding to the over development is a zoning variance issue. The lot sizes around Glen Lake are very small and can provide a hardship in terms of development. This has previously allowed the Queensbury Zoning Board of Appeals to grant lot-by-lot variances to the zoning along the shoreline. Also, in some cases the lot sizes allowed the Board of Health to grant variances to the Town Sanitary Code. What occurred was a progressive overbuilding on lots with on-lot sanitary wastewater systems which did not meet the code.

3.4 Residents' Priorities

A list of statements was included in the survey for residents to react to and to determine the level of concern for each item. Additionally, space was provided for written comments by respondents. The following statements were considered the most important (written comments included in attachments):

- To protect and enhance water quality - 98.3%
- To increase public educational awareness concerning the Glen Lake Watershed - 95%
- To protect and preserve critical environmental resource - 91.2%
- To manage growth and development within Glen Lake Watershed - 81.32%
- To preserve and protect undeveloped, open space - 80.77%

3.5 Financial Responsibility for Glen Lake

This category asked about who should be responsible for management and protection of water quality within the greater Glen Lake Watershed. It was felt that local government (78%) , lake association members (73%), lakeshore property owners (73%) and all lake users (73%) should be responsible.

A follow-up category inquired about contributing for the Glen Lake Watershed to 1) Maintain Water Quality 2) Increase and Maintain Public Access and 3) Protect and Preserve Open Space and Wildlife Habitats. The first category, Maintain Water Quality, had 71 (45%) respondents that would contribute \$5-25 and 51 (33%) that would contribute \$50-200. The second category over 53% indicated that they would not contribute for increased public access. The Protect and Preserve Open Space and Wildlife Habitats responses showed nearly 50% would spend \$5-25 and 20% would spend \$50-200.

CHAPTER 4: RECOMMENDATIONS FOR FUTURE EFFORTS

The following are goals and tasks that have been established for the greater Glen Lake Watershed. They generally reflect the visions and aspirations of respondents to the Glen Lake Watershed Survey conducted in 1996, and they are consistent with directions that need to be taken in order to begin addressing watershed-wide problems and issues which have been identified.

(GL) = Glen Lake specific application
(WW) = Watershed wide application

4.1 Water Quality

- **GOAL**

  Protect and improve the water quality of Glen Lake and its tributaries.

  <u>TASKS</u>

1. (GL) The Glen Lake Protective Association: sponsor an annual septic system/water quality workshop for shoreline/watershed residents on the importance of proper septic tank maintenance for the protection of Glen Lake.

2. (WW) Warren County DPW, NYS DOT and the Queensbury Highway Department: utilize best management practices to the greatest extent possible to control and minimize the impacts of stormwater runoff on water quality from roads, highways and bridges in the greater Glen Lake Watershed.

3. (GL) The Town of Queensbury: develop and seek funding for an annual water quality sampling/monitoring program to determine the source(s) of pollutants entering Glen Lake. Students may be utilized to keep the cost minimal while providing educational opportunities. The long term collection of water quality data will help identify pollutant sources and allow for their remediation.

4. (GL) Locate areas of streambank erosion, by conducting walking surveys of the major tributaries and keeping a log of information relating to major bank erosion. Report any major streambank erosion problems to the Warren County Soil and Water Conservation District.

5. (WW) For any Homeowner within the greater Glen Lake Watershed, who is building a new home or addition, include with the building permit, a copy of Cornell Cooperative Extension's publication FSI "Septic System Maintenance".

6. (WW) The Town of Queensbury should create a GIS map overlay of the greater Glen Lake Watershed with the locations of the stormwater system outlets. All identified outlets and the stormwater systems should be evaluated to determine if

catch basins or other structures could be utilized to minimize sediment and phosphorus inputs into the lake and its tributaries.

7. (GL) The Glen Lake Association: annually document the frequency and locations of any reported incidences of Swimmer's Itch. If there is a problem, contact the Department of Health and DEC to create a control plan. In the meantime, continue to discourage the feeding of waterfowl on the Lake.

8. (GL) Glen Lake Association: Create a water quality section in the newsletter, and solicit related articles from the Warren County SWCD, Cornell Cooperative Extension, and DEC and DOH relating to water quality issues.

9. (GL) The Glen Lake Association: give an annual presentation to the Queensbury Town Board relating to the Lake and the new projects, programs, issues, solutions, and success stories relating to water quality.

10. (GL) Shoreline residents should be encouraged to reduce or eliminate the use of fertilizers on their lawns.

11. (WW) Reduce pollutant loadings through educational programs specifically aimed at boaters and home owners regarding the proper disposal of household chemicals and the proper maintenance of boats /watercraft such as:
    - debris, waste oil, litter and gasoline
    - improper storage, use, and disposal of household hazardous chemicals, pesticides, paints, solvents
    - discharges from boats/watercraft and from the in-water cleaning of boats/watercraft.

12. (GL) A flourometer and associated equipment should be purchased to provide ongoing studies into the impacts of septic systems on Glen Lake.

13. (GL) Septic system sampling program should be continued, following the protocol set forth in the current sampling program, to continue to identify failing septic systems on the shore of Glen Lake.

14. A stormwater control system should be installed by NYS DOT along NYS Route 9 in the vicinity of the Great Escape to prevent sediment and other pollutants from entering Rush Pond outlet and the Glen Lake wetland.

15. A roadside survey of upland erosion sites should be conducted approximately every few years to determine potential locations and sources of sediment which could impact Glen Lake.

4.2 Recreation/Aesthetics/Land Use

➢ **GOAL**

Ensure that the Glen Lake fisheries and habitat areas are maintained and improved and that contact recreational uses of the lake are not diminished.

TASKS

1. A sediment dredging project should be conducted at the northern tip of Glen Lake to remove the thousands of yards of silt and muck which has accumulated there preventing any recreational opportunity for the lakeshore landowners. Working with the Warren County Soil and Water Conservation District, the shoreline owners should develop a plan of action to undertake this effort.

2. (WW) Encourage appropriate lawn and garden care activities, relating to fertilizers and pesticides.

3. (GL) Encourage the use of native vegetation to visually enhance and protect the shoreline of Glen Lake and its tributaries. This can be done through educational efforts and demonstration projects.

4. (WW) The Town of Queensbury: though various zoning techniques, preclude strip or open pit mining within the viewshed of Glen Lake.

4.3 Control Of Nuisance Aquatics

➢ **GOAL**

Control the growth and spread of noxious aquatic vegetation, zebra mussels, and other nuisance aquatics in Glen Lake.

TASKS

1. (GL) Continue to monitor Glen Lake for zebra mussels and look for cost effective solutions to control their spread.

2. (GL) Map the locations of Eurasian Milfoil in Glen Lake every five years to track the progress made in eliminating the plant species or keeping the population in check.

3. (GL) The Glen Lake Protective Association: investigate current methods of controlling Eurasian Milfoil and sponsor a coordinated effort by lake property owners to control the spread of milfoil (educational seminars, coordinated harvesting, etc.) This could be facilitated through information provided by the COLAM and other lake associations.

4. (GL) Encourage the use of weed rakes to remove algae mats until they can be brought under control.

4.4 Stewardship

➢ **GOAL**

Maintain the use of Glen lake as a recreational resource.

<u>TASKS</u>

1. (WW) The Town of Queensbury: provide educational information through a brochure and other appropriate means to boaters using the lake regarding their responsibility to obey the speed limits for safety and environmental reasons. To the extent practical, the GLPA should provide signage for placement on private property where owners allow access to others or have boat ramps.

2. (WW) Encourage the residents and Associations (GLPA membership) to become “environmental and safety caretakers” of the lake and to call the appropriate authority should they observe activities which threaten the quality or safety of the people using lake.

3. (WW) Provide for the protection of the islands in Glen Lake either through purchase, easements or use agreements. The islands are a part of a Critical Environmental Area and should be treated as such.

4. (WW) The Town of Queensbury and the GLPA: consider various options for preserving open space such as easements, land trusts, donations of land, and work with other public agencies and private groups to preserve critical open space in the greater Glen Lake Watershed.

4.5 New Development

➢ **GOAL**

Ensure that future development in the greater Glen Lake Watershed is appropriate and sustainable.

<u>TASKS</u>

1. (WW) The Town of Queensbury: utilize computer modeling programs in planning for proposed development in the watershed to determine the contribution to the pollutant loading from proposed developments within the watershed and what pollution reduction techniques are appropriate to reduce that loading.

2. (WW) Develop watershed wide policies and programs which minimize lawn sizes while maximizing the use of natural vegetation and tree cover to preserve remaining pervious areas.

3. (WW) The Town of Queensbury should develop a comprehensive stormwater management program for reducing pollutant loading to Glen Lake from urban runoff. The Town should provide:
    - provisions for minimizing the destruction of natural vegetation on sites being developed,
    - close review of construction plans to ensure the adequacy of stormwater runoff and erosion and sediment control and
    - provisions for long term inspection and maintenance of stormwater and erosion control facilities, either structural or nonstructural, and the provision for trained personnel to do the inspections.

4. (WW) The Town of Queensbury: require the use of effective construction management practices in all developments. These are published in the NYSDEC

Management Practices Catalogue which should be made available to any department which deals with land use. The Town should provide information on these topics to the public as well as training on the use of the practices for the appropriate staff.

5. (WW) The Town of Queensbury: incorporate New York State Department of Transportation design and guidance documents, standards, specifications, and procedural manuals (Highway Design Manual, Environmental Procedures Manual, Maintenance Guidelines, etc.) into an operating procedures manual for the Highway Department. Creating such a document will insure long term consistency of highway construction and maintenance.
6. Develop education programs which outline operation and maintenance of on-site septic systems.

7. Contact property owners where there are unreclaimed sand and gravel mines and recommend to the owners that they contact the Warren County Soil and Water Conservation District to help with a reclamation plan and utilize local service organizations to help carry out the plan.

8. (WW) The Town of Queensbury: when reviewing development plans on or near the lake, recommend the use of pervious surfaces for the driveways and parking areas to minimize stormwater runoff.

9. (WW) Work toward the creation of a land conservation program in the watershed to maintain open space.

Town Board Resolution

Controlling stormwater runoff and the nonpoint source pollution it carries is a very important aspect of water quality maintenance. Because this pollution can be of a number of types and come from multiple sources, it needs to be dealt with comprehensively. The most effective way is to stop the generation of nonpoint source pollution at its source. Within a watershed area any effort will require a partnership of both public and private groups which will take responsibility for certain aspects of a management program. A program will include an educational/training component, a legislative component and an implementation component. Correcting a pollution problem may require any or all components of the management effort to be utilized.

The Town Board of the Town of Queensbury passed a resolution on December 15, 1997, which outlines their vision of how this document will be implemented within the Town. The resolution follows.

GLOSSARY

Algae - Minute floating plants distributed throughout a lake/pond as deep as light penetrates. They usually carry out photosynthesis in surface water bodies.

Algae bloom - Population explosion of algae in surface waters due to an increase in plant nutrients (such as nitrates and phosphates), temperature, or both. The blooms turn water a greenish color and reduce clarity.

Anthracene - A polycyclic aromatic hydrocarbon (PAH) which is commonly found in urban runoff.

Aquifer - A water-bearing layer of earth, gravel, or porous stone, or bedrock.

Biomass - Organic matter produced by plants and other photo synthetic producers.

Contaminated sediments - Those sediments containing either toxic substances or excessive nutrients.

Contributing area - The land area which drains into the stormwater outfall or drainage site.

Critical Environmental Area - A specific geographical area designated by a state or local agency having exceptional or unique characteristics that make the area environmentally important.

CSLAP - Citizens Statewide Lake Assessment Program. A NY State program which is a cooperative effort between the Department of Environmental Conservation (DEC) and the New York Federation of Lakes. DEC administers the program and provides the equipment and training and relies on local volunteers to gather the water samples which are then tested for various substances by the Department of Health.

Development - To make a site available for physical alteration, including but not limited to providing access, clearing the site of vegetation, grading, earth moving, providing utilities, altering land forms or construction of a structure.

Dimictic lakes - Lakes which circulate freely from top to bottom twice a year (see fall and spring overturn). This is a natural occurrence. These lakes represent the most common type of thermal stratification of the cool temperate regions of the world.

Ecosystem - An interactive community of animals, plants and microorganisms and the physical-chemical environment in which they live.

Effluent - Liquid wastes from sewage treatment, septic systems, or industrial sources that are released to a surface water body.

Eurasian Milfoil - An extremely invasive aquatic plant which is not native to North America. It grows rapidly and can form dense mats which can reduce the health of a lake.

Eutrophication - The process by which a water body becomes progressively enriched in dissolved nutrients resulting in increases in biomass of algae and other plants. These biological changes take place after a lake or slow moving stream receives the inputs of plant nutrients - mostly nitrates and phosphates - from erosion and runoff from the surrounding land basin.

Fall overturn - The autumn mixing, top to bottom, of lake water caused by cooling and wind-derived energy.

Fecal Coliform test - Most common test for the presence of fecal material from warm-blooded animals. Fecal coliform are measured because of convenience. They are not necessarily harmful, but indicate the potential presence of other disease-causing organisms.

Flushing rate - The rate at which water enters or leaves a lake relative to lake volume, usually expressed as time needed to replace the lake volume with in-flowing water.

Groundcover - Plants grown to keep soil from eroding.

Groundwater - Water that sinks into the soil and is stored in slowly flowing and slowly renewed underground reservoirs called aquifers.

Hydromodification - Alteration of the hydrologic characteristics of coastal and noncoastal water bodies, which in turn could cause degradation of water bodies.

Immigrant species - Species that migrate into an ecosystem or that are deliberately or accidentally introduced into an ecosystem by humans. Some of these species are beneficial, while others can take over and eliminate many native species.

Impaired (use or water body) - Term used to refer to a water body whose water quality and/or associated habitat degradation eliminates or does not support a classified use; natural ecosystems functions may be significantly disrupted. This category is used for the most severe impacts.

Impervious area - Impermeable surfaces, such as pavement or rooftops, which prevent the percolation of water into the soil.

Infiltration - The downward movement of water through soil.

Land use planning - Process for deciding the best present and future use of each parcel of land in an area.

Leaching - Process by which various chemicals in upper layers of soil are dissolved and carried to lower levels, and in some cases to groundwater.

Mesotrohic lake - A lake with a moderate supply of plant nutrients.

Native species - Species that normally live in a particular ecosystem.

Noise pollution - Any unwanted, disturbing, or harmful sound that impairs or interferes with hearing, causes stress or hampers concentration and work efficiency or causes accidents.

Nondegradable pollutant - Material that is not broken down by natural processes.

Nonpoint source - Large or dispersed land areas such as streets, lawns, fields, etc. that discharge pollutants into the environment over a large area.

Nutrient - Any element an organism needs to live, grow, and reproduce.

Nutrient pollution - Contamination of water resources by excessive inputs of nutrients; in surface waters, excessive algae production is a major concern.

Oligotrophic lake - Lake with a low supply of plant nutrients.

Outfall - The terminus of a storm drain where the contents are released.

PAH - Polycyclic aromatic hydrocarbon compounds normally found in urban runoff (most commonly anthracene, chrysene, fluoranthene and phenanthrene)

Parasite - Consumer organism that lives on or in and feeds on a living plant or animal, known as a host, over an extended period of time. The parasite draws nourishment from and gradually weakens its host. This may or may not kill the host.

Pathogen - Organism that produces disease.

Parts per billion (ppb) - Number of parts of chemical found in one billion parts of particular gas, liquid or solid mixture.

Parts per million (ppm) - Number of parts of chemical found in one million parts of particular gas, liquid or solid mixture.

Phenanthrene - A polycyclic aromatic hydrocarbon (PAH) commonly found in urban runoff.

Point source - A single identifiable source that discharges pollutants into the environment.

Pollution - An undesirable change in the physical, chemical, or biological characteristics of air, water, soil, or food that can adversely affect the health, survival, or activities of humans or other living organisms.

Pollution prevention - Device or process that prevents a potential pollutant from entering the environment or that sharply reduces the amounts entering the environment.

Primary pollution source - The source of pollution, identified in the Priority Water Problem List, as being the major origin of the water quality concern in a specific water body segment.

Runoff - Freshwater from precipitation and melting ice that flows on the earth's surface into nearby streams, lakes, wetlands, and reservoirs.

Secchi disk depth - A measure of the transparency of water by lowering a black and white or all white disk into the water until it is no longer visible. Measured in units of meters or feet.

Soil Erosion - Movement of soil components, especially topsoil, from one place to another, usually by exposure to wind, flowing water, or both. This natural process can be greatly accelerated by human activities that remove vegetation from soil.

Soil retention capacity - The ability of a give soil type to absorb substances such as phosphorus, thus retarding their movement to the water.

Spring overturn - The spring mixing, top to bottom, of lake water caused by cooling and wind-derived energy.

Stormwater runoff - That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows as overland flow, underflow, or channels or is piped into a defined surface water channel or a construction infiltration facility. This term is used in this plan refers to many different types of runoff including urban runoff, and road, highway and bridge runoff.

Stream corridor - The landscape features on both sides of a stream, including soils, slope and vegetation, whose alteration can directly impact the stream's physical characteristics and biological properties. Taken from New York State Department of Environmental Conservation. Reducing the Impacts of Stormwater Runoff from New Development.

Stressed (use or water body) - Term used to refer to a water body where reduced water quality is occasionally evident and designated uses are intermittently or marginally restricted; natural ecosystem may exhibit adverse changes. These waters have moderate impacts.

Swimmer's itch - A rash caused by skin penetration of the immature stage (cercaria) of a flatworm.

Toxic substance - A chemical such as arsenic, heavy metals or certain synthetic pesticides capable of causing adverse physiological effects or either acute or chronic health problems.

Threatened (use or water body) - Term used to refer to a water body whose water quality, presently, is supporting designated uses and ecosystems are experiencing no obvious signs of stress; however, existing or changing land use patterns may result in restricted usage or ecosystem disruption. These waters have the least impact.

Trophic state - The degree of eutrophication of a lake.

Urban areas - Those locations that have been altered from their natural state by human actions to create impervious surfaces or to otherwise change the natural conditions.

Urban runoff - Surface runoff that enters water bodies either diffusely or through stormwater systems from areas such as streets, parking lots and roofs.

Variance, zoning - A legal waiver of the zoning requirements applying to a particular parcel of land.

Vegetative buffers - Natural vegetated areas set aside or restored to filter pollutants form runoff and maintain ecological integrity of the water body and land adjacent to it.

Water body - A stream, pond, lake, river or embayment.

Watershed - Land area that delivers the water, sediment, and devolved substances via small streams to a major stream, river, lake or other water body. Also referred to as a drainage basin.

Water table - The upper limit of the zone of saturation in which all available pores of the soil and rock in the earth's crust are filled with water.

Wetland - Land that is covered all or part of the year with water, excluding streams, lakes and the open ocean.

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APPENDICES

A. Resolutions: Queensbury Town Board to establish the Glen Lake Technical Advisory Committee, and Glen Lake Association Support for the Plan
B. Compiled Watershed Survey Results
C. Tributary Sampling and Stormwater Flow Results
D. The 1996 Priority Waterbody Listing for the Glen Lake and NYS DEC Water Quality classifications
E. Map: Location of Glen Lake Watershed
F. Map: Land Use in the Glen Lake Watershed
G. Map: Topography within the Glen Lake Watershed
H. Map: DEC Designated Wetlands within the Glen Lake Watershed
I. Map: Town of Queensbury Critical Environmental Areas within the Glen Lake Watershed.
J. Map: Road Runoff Sampling Locations and Sampling Results