

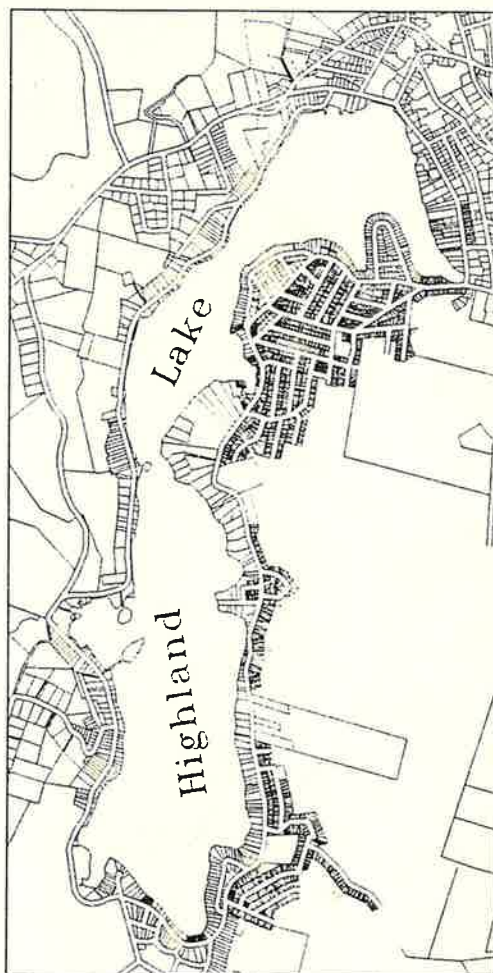
HIGHLAND LAKE MANAGEMENT PLAN

Prepared For

HIGHLAND LAKE COMMISSION

INLAND WETLANDS COMMISSION

TOWN OF WINCHESTER, CONNECTICUT



September 1, 1991

Prepared By

The Subcommittee for Developing The

Highland Lake Management Plan

HIGHLAND LAKE MANAGEMENT PLAN

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ACKNOWLEDGEMENTS

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for
Developing the Highland Lake Management Plan

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Donald Donihue, Vice Chairperson

Bob Carbone, Secretary

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James Kloczko

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Bob Simmons

William Smyth

The Subcommittee wishes to sincerely thank the many people who attended our meetings to provide public input, perceptions from State agencies, technical advice or information from boards or commissions of the Town of Winchester:

Charles Fredette - Department of Environmental Protection, Bureau of Water Management

Charles Lee - Department of Environmental Protection, Bureau of Water Management

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Joseph Ligi - Chief of Police, Winchester

PREFACE

Highland Lake has long been considered a very important natural resource located totally within the borders of the Town of Winchester.

Over the past several decades the land around the perimeter of the lake has been intensely developed with housing. Many seasonal cottages have been converted for year-round use and thus the population of the lake has changed dramatically.

Highland Lake is also a priority recreational water body for the State of Connecticut, under the auspices of the Department of Environmental Protection, with public access through the State Boat Launch and Taylor Brook State Park (The Town of Winchester has public access for its residents through two town owned beaches; Resha Beach and Holland Beach).

The Town of Winchester has recognized the ever increasing complexity of managing Highland Lake and in 1983 created the Highland Lake Commission to focus specifically on lake issues. In 1989, Winchester also began to respond to the need to develop a 10-year Plan of Development for the entire Town. It was determined that a committee which could focus on developing a management plan for Highland Lake would be helpful due to the unique and complex issues germane to lake management.

On December 18, 1989, The Highland Lake Commission (HLC) and Inland Wetlands Commission (IWC) formed the 11 member Subcommittee for Developing the Highland Lake Management Plan. Appointed as "at large" members were Donald Donihue, Morgan Durant, Peter Miniutti, William Smyth and Clare Stevens. Liaisons from the Highland Lake Commission were Arnold Travaglin and Bill Kelsey; liaisons from the Inland Wetlands Commission were Bob Carbone and Bob Simmons. Also designated as members were the Town Manager and Public Works Director.

On January 10, 1990, there was a joint meeting of the Highland Lake Commission and Inland Wetlands Commission. It was determined that the Subcommittee should assess all lake issues and make recommendations which can become part of the IWC regulations.

The balance of the recommendations for lake management would need to be forwarded to the HLC and ultimately to the Board of Selectmen for their consideration and possible action into ordinances. The joint meeting identified 27 problem areas or issues it felt needed to be addressed by the Subcommittee.

On January 24, 1990, the Subcommittee held its first meeting. The list of 27 issues were grouped and the following goals developed:

1. To improve water quality
2. To improve public health and safety
3. To improve recreational use and safety
4. To improve public use of the lake
5. To develop an educational program and program for voluntary efforts
6. To formulate an appropriate land use policy
7. To develop an awareness of the importance of aesthetics at the lake

Monthly public meetings were held between January, 1990, and August, 1991. The Subcommittee invited a number of officials and experts to its meetings to provide technical information and advice. It also read hundreds of pages of studies regarding Highland Lake, lake management, other lake management plans and scientific water quality and land use studies (See Appendix E). In November, 1990 three members of the Subcommittee attended the annual conference of the North American Lake Management Society to gain a broader perspective on lake management.

In July, 1990 letters of invitation were sent to approximately 550 lake property owners asking them to attend public input sessions on Tuesday, August 7 or Saturday, August 18, 1990. Comments and perceptions on lake issues were solicited and incorporated into the final report of the Subcommittee.

Contact was maintained with Dennis Brown Associates to interface the work of the Subcommittee with the overall Plan of Development for the Town of Winchester.

On August 7, 1991 a meeting was held with representatives of the Highland Lake Commission, Inland Wetlands Commission, Planning and Zoning Commission, Zoning Board of Appeals, Plan of Development consultant and the DEP Water Management Bureau to review and comment on the preliminary recommendations of the Plan.

In order to work efficiently for writing purposes, the Subcommittee grouped all issues into four broad categories and the following people prepared these sections of the Plan:

1. Land Use in the Highland Lake Watershed
Donald Donihue, Chair; Peter Miniutti
2. Water Quality in Highland Lake
Clare Stevens, Chair; William Smyth, Morgan Durant
3. Lake Activities
Bob Carbone, Chair; Morgan Durant, Clare Stevens
4. Developing a Process to Manage Highland Lake Effectively
Clare Stevens, Chair; Donald Donihue

Monthly committee meetings allowed input and decision making regarding the content of each section of the report by all committee members. Each section of the Plan contains an overview of the topic, an evaluation of the current situation and recommendations.

The members of the Subcommittee endorse these recommendations and believe that their implementation will provide the initial steps needed to ecologically preserve Highland Lake for the future, provide safe and democratic recreational use of the lake and develop an effective method of long term management of Highland Lake.

We thank the Highland Lake Commission and Inland Wetlands Commission for the opportunity to help shape the future of Highland Lake which we so highly value.

We view the Highland Lake Management Plan as a comprehensive approach to combine the best scientific knowledge of lake ecology with social and political methods to manage the lake for the benefit of all people who use it.

I. LAND USE IN THE HIGHLAND LAKE WATERSHED

Introduction: The Influence of a Watershed On Water Quality

A lake is a reflection of its watershed. That land area which drains into any lake is the watershed. It is, therefore, the source of water for the lake. Water quality in the lake is determined in large part by qualities imparted to lake water by watershed land as the water drains into the lake.

While this seems obvious, it is fundamental to the approach utilized in this section of the report which stresses the significance of what is done on the land for the lake and its watershed.

Watershed management is aimed at identifying and controlling existing and potential watershed characteristics which ultimately influence a lake's water quality. Since phosphorus is the nutrient which governs the productivity of algae and aquatic plants, watershed management is first and foremost concerned with reducing phosphorus enrichment. Of equal importance is the reduction of sediment inputs which contribute to physical lake filling and the development of shallow shoal areas where tributaries and storm waters enter the lake.

Watershed management is imperative for every lake, regardless of the lake's water quality. Watershed management will serve to preserve its relatively superior quality and prolong its useful life for recreation.

In its 1980 Water Quality Study, the Connecticut State Department of Environmental Protection designated Highland Lake as a lake in its early middle age.

Existing Land Use Relationships

How can land-use be summarized in the Highland Lake watershed? The most recent descriptive summary available to the Lake Management Plan Subcommittee has been the following:

The predominant land use in the watershed is woodland, which accounts for 2,824 acres or 73 percent of the land area. A significant fraction is also legally defined wetlands. Properly managed woodland contributes less to lake eutrophication than other land uses.

Agricultural land is not an important factor in the watershed.

Residential land comprises approximately 11 percent of the watershed, most of it adjacent to the lake. Many of the homes were originally seasonal cottages. The residential land presents the potential for nutrient enrichment of lake waters from septic systems, fertilizers, and erosion. Much of the land adjacent to the lake has glacial till soils with severe limitations for on-site septic systems. Also, much of the land adjacent to the lake has steep slopes and is highly susceptible to erosion.

(Source: Land-use information developed in 1977 by the Connecticut 208 Areawide Waste Treatment Management Program quoted in Connecticut Department of Environmental Protection Water Compliance Unit, Diagnostic/Feasibility Study of Highland Lake, 1980, pages 42-43)

Planning and Highland Lake

There are certain principles of good planning which the Lake Management Subcommittee endorses. Five of those principles are outlined immediately below:

1. Classify land-use according to its suitability for the lake's watershed.

It is useful to refer at this point to the Connecticut State Department of Environmental Protection's and Department of Health Service's 1984 guidebook entitled "Protecting Connecticut's Groundwater: A Guide to Groundwater Protection for Local Officials".

The guidebook develops a hierarchy of land uses based upon the relative risk of contamination and is designed to assist in determining which land uses to prohibit and which to allow, subject to specific performance standards and special permit procedures. While the hierarchy is general, it points a direction in which a management plan seeking to protect and improve the watershed may go.

Five categories are designated in the report:

- A. Land uses which provide maximum protection to the watershed
- B. Land uses posing minimal risks to the watershed
- C. Land uses which pose slight to moderate risks
- D. Land uses considered to pose a substantial risk
- E. Land uses which pose a major threat and are not recommended

The above model provided by DEP and DOHS provides the basis for a similar, simpler model which is recommended for managing the Highland Lake Watershed.

- A. Good -Go for it
 - B. O.K. -Proceed with caution
 - C. Bad - Stop, red light
2. In establishing acceptable levels of population density, use the carrying capacity of the land as the determining factor.

The advantages and disadvantages of cluster housing should be weighed in relation to the lake's environmentally sensitive watershed.

3. A map of highly sensitive land areas should be developed.
4. An open space plan for the Highland Lake watershed should be created showing town owned land, wetlands, and existing recreation facilities.
5. Ridge lines as they now exist should be protected as a high priority item.

Recommendations

Focus Area: Land Use

Topic 1: Highland Lake District

Background: In the fall of 1989, the Highland Lake District was approved by the Planning and Zoning Commission in order to control development and protect the lake. The Subcommittee believes that all agencies with responsibility for the lake's welfare should resist relaxing the ordinances and regulations which are designed to protect the lake.

In December of 1990 the Planning and Zoning Commission approved an amendment that relaxes rules governing the construction of decks, balconies, and terraces within the Highland Lake District.

During 1990, and the first half of 1991 the Zoning Board of Appeals (ZBA) heard approximately 10 petitions to permit construction based on requirements related to setbacks and percent building coverage. The outcome of ZBA decisions has been the following:

Granted: 5

Denied: 3

Withdrawn: 1

Still Pending: 1 (as of 7-8-91)

Additional amendments to the District are pending as the Planning and Zoning Commission works on the overall Plan of Development for the Town.

Recommendation:

1. Strictly enforce and protect the zoning regulations outlined in the Highland Lake District in order to protect the District from over development.

Focus Area: Land Use

Topic 2: So-called Paper Road Area at Highland Lake

Background: To the south of First Bay is an area made up of a network of developed and undeveloped roads bearing the following names:

Alpha Avenue	Dedham Road	Phelps Road
Ann Street	Joan Road	Pine Street
Bayview Road	Ledge Trail	Roosevelt Trail
Belvidere Avenue	Lincoln Avenue	Sterling Trail
Birch Street	Mathew Road	St. Catherine Street
Carey Avenue	Norcross Road	Thomas Road
Coffee	Norwood Road	Tiffany Road
		White Oak Trail

While three of the roads are partially paved, the remaining roads fall into two categories:

- (1) Approximately half of the remaining roads are unpaved but passable, and
- (2) Approximately half are impassible due to no improvement at all.

At least two streams drain the area, flowing into the Lake.

The 1981 Land Use Study for Highland Lake conducted by the Planning and Zoning Commission indicated that:

"A substantial part of the land and lots on Thomas Street and Ledge Trail are designated Inland Wetlands, and are shown as reserved land on the Land Use Plan....The Plan recommends continued Town-ownership of this wetlands area for conservation and open space, and discontinuance of any interests the Town may have in the paper streets involved" (Pages 19-20).

The study recommends that the general guideline for Town-owned small lots scattered throughout the area is that where they (1) do not have severe limitations for development, and (2) are not designated for reservation as open space, or (3) are not otherwise designated as developable, these lots may be sold to adjacent property owners for purposes of creating lots which conform with zoning requirements.

This Subcommittee, working a decade after the 1981 Land Use Study by PZC, concludes that the continued sale of Town-owned property in this region does not benefit the lake and that a no-sale policy by the Town should be adopted.

The area continues to be an ambiguous one due to the mixed quality of roads, the exceedingly small lot sizes which prevail, and the inadequate posting of road signs. (In June of 1991 firefighters were able to respond to a burning house on Roosevelt Trail only after considerable difficulty in finding its location.)

Recommendations:

1. Maintain the present level of development of existing roads in this area, and do not undertake additional development of roads.
2. In keeping with the Plan of Development for the Town of Winchester (1991), consider abandoning the public rights to the abutting landowner for the majority of paper roads at the lake.
3. Discontinue the sale of town-owned lots in the watershed, preserving them as open space.
4. As with all roads at the lake, an effort should be made to have readily visible road markers.
5. Develop a plan for streamside management zones for the two streams flowing into the lake.

Focus Area: Land Use

Topic 3: The System of Water Bodies Created by Highland Lake, Crystal Lake, Winchester Club Pond, Rugg Brook Reservoir, and the Mad River (See Figure 1).

Background: The Crystal Lake-Rugg Brook reservoir system contains a diversion system designed to augment flow to the naturally small watershed of Crystal Lake which is the primary water supply for Winsted. The Mad River Diversion, a small dam and canal located approximately 2,000 feet west of the Rugg Brook Reservoir, diverts water from the Mad River to the Rugg Brook Reservoir. The Gilbert Tunnel, a 3,500 foot long unlined bedrock tunnel, diverts some water from the Rugg Brook Reservoir to Crystal Lake. These two diversions increase the size of the original Crystal Lake watershed by a factor of 10. The system was originally designed to raise and maintain the level of Highland Lake.

Sucker Brook, one of the two main tributaries supplying Highland Lake, drains Crystal Lake (as well as Winchester Club Pond).

The dependence of Highland Lake upon this hydraulic system for both water quality and quantity is obvious.

Recommendations:

1. Assure that long-range planning for the Town's water supply takes into account the effect of such planning on the amount and quality of water entering Highland Lake.
2. Secure assurances from the Town's Water Board that future flow of water from Crystal Lake into Highland Lake will not be reduced.
3. Support efforts to view and consider the contiguous water bodies as a system.

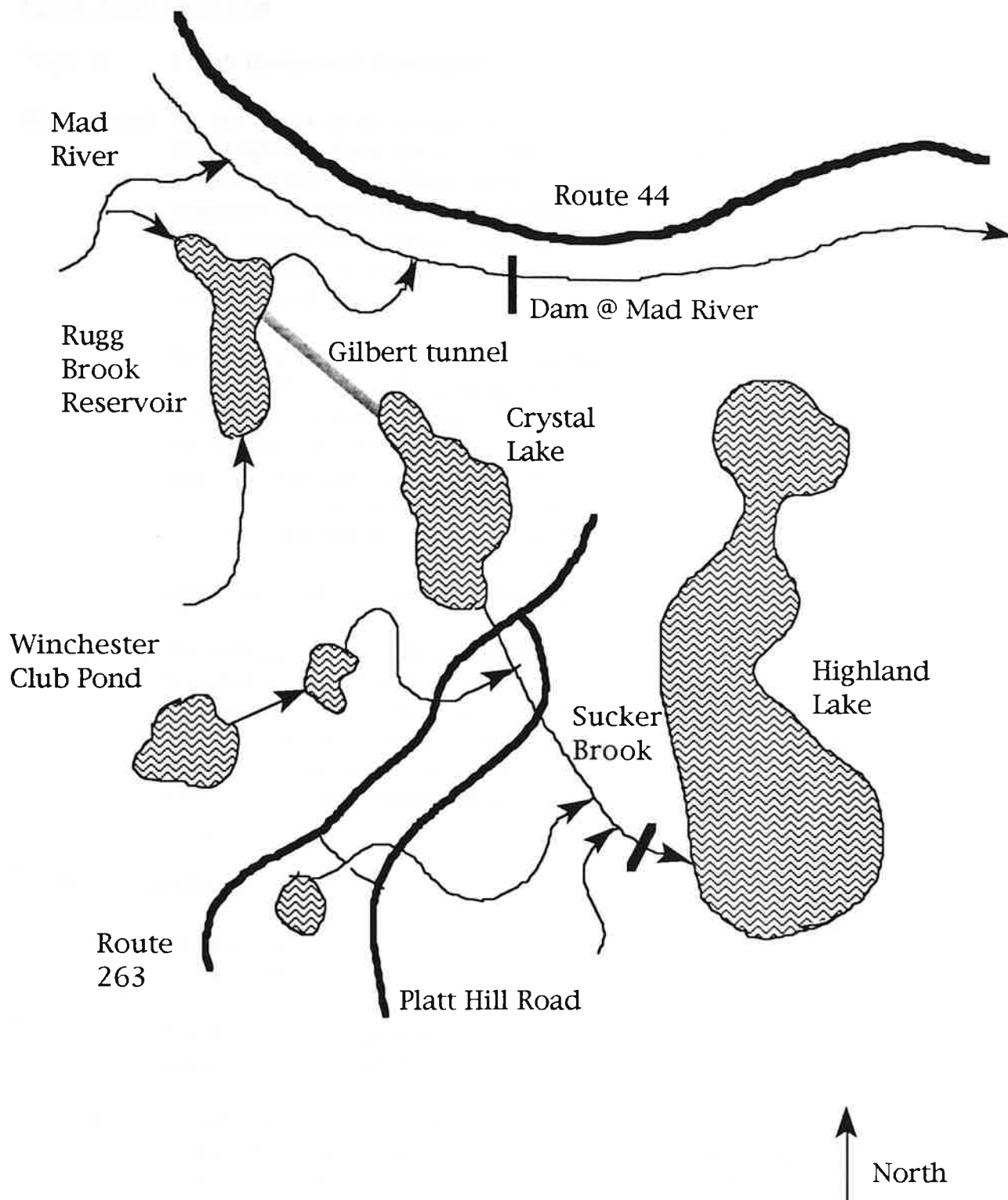


Figure 1 Highland Lake - A system of water bodies

Focus Area: Land Use

Topic 4: Catch Basins and Road Sand

Background: At the outlet of all streams and tributaries leading into Highland Lake there is evidence of substantial sedimentation. This condition is aggravated by the presence of storm drains and paved gutters where there should be properly maintained catch basins. Where catch basins exist, they are often full of sediment and debris.

Road sand during the winter accumulates on roads around and above the lake in quantities greater than is indicated by simple observation. One estimate of the amount of road sand deposited around the lake suggests that almost 250 cubic yards of sand (or about two inches deposited over one acre of land) has the potential for being washed into the lake each year if there were no road sweeping or cleaning of catch basins (See Appendix C).

As early as 1980 in its Diagnostic/Feasibility Study of the lake, the DEP recommended the installation of additional catch basins along with "a regular program of catch basin maintenance at the lake." At that time cost estimates for catch basin replacement ranged from \$400 to \$800 each (Page 113).

Recommendations:

1. Continue to sweep road sand as early as possible in the spring, depositing it a safe distance from the lake.
2. Establish a three-year program for replacing drains with catch basins around the lake.
3. Paved gutters (such as that on West Wakefield Boulevard at Taylor Brook), which expedite the flow of sediment and debris into the lake should be replaced by catch basins without delay.
4. Formulate and implement a clean-out timetable for catch basins and adhere to it.

Focus Area: Land Use

Topic 5: Streamside Management Zones (See Figure 2).

Background: Approximately 15 streams and tributaries flow into Highland Lake. If not properly managed, they will continue to be a major point source for nutrients flowing into the lake.

Proper management can include: maintaining the natural vegetation along a stream; limiting livestock access to the streams; and where vegetation has been removed, planting buffer strips (grass, trees, shrubs) between the stream and an area being disturbed by human activity.

Recommendations:

1. Develop a plan for streamside management zones (buffer strips) for all tributaries flowing into Highland Lake.
2. Work with property owners to implement such a management plan.
3. Consider Taylor Brook as a special area in special need of streamside management with specific reference to the peat bog upstream from Highland Lake and running along Taylor Brook Road.

(See also: "So-called Paper Road Area at Highland Lake").

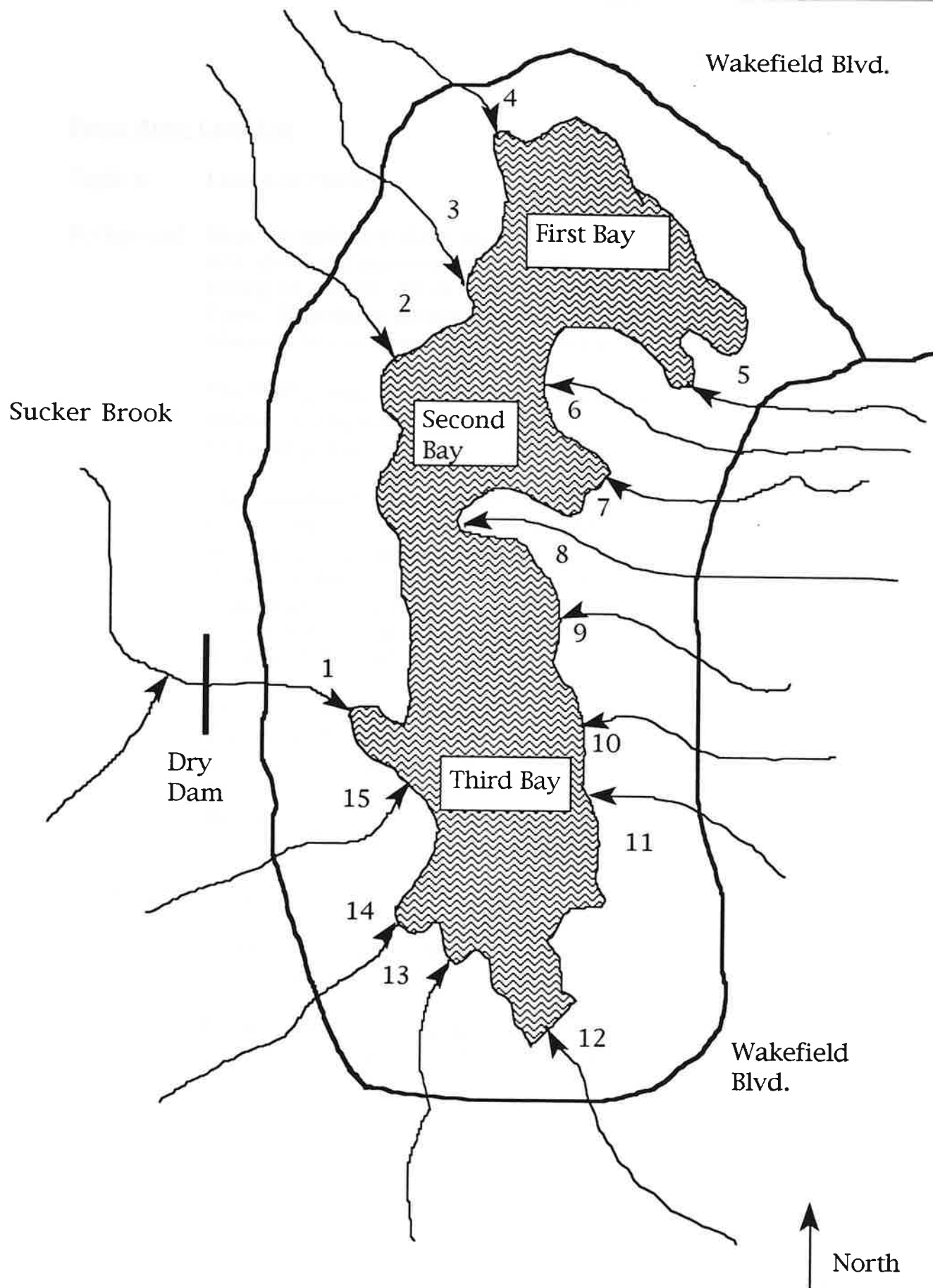


Figure 2 Highland Lake - Streams and Tributaries

Focus Area: Land Use

Topic 6: Land Use Density

Background: Since the institution of zoning, Winchester's Planning and Zoning Commission has used conventional zoning to control the density and growth of the Town. Historically, conventional zoning has been an adequate tool in controlling growth at the lake.

The 1990's, however, will require new techniques to balance ecological issues, individual rights and economic goals.

The watershed is comprised of land that is ecologically sensitive. Steep slopes, rocky conditions and primary drainage systems constitute large areas of the watershed. To maintain the existing equilibrium, future development needs to be guided by methods that identify the specific distinguishing features of the land.

The use of "Technical Performance Standards", is an alternative to conventional zoning practices. "Technical Performance Standards" based acceptable land densities on the carrying capacity of the land. Soil based zoning is one type of a "Technical Performance Standard".

Recommendations:

1. Modify zoning policies to combine the use of conventional practices with "Technical Performance Standards".
2. Re-evaluate all existing zoning policies against criteria established by "Technical Performance Standards".

Focus Area: Land Use

Topic 7: Open Space Land

Background: Open Space is an important component of overall land use patterns. Open space serves many functions. The functions range from recreational park lands to land used solely for conservation. Open space, to be beneficial, needs to be organized into a contiguous system of parcels.

The land parcels should include the following:

1. Wetlands, streams, and drainage areas.
2. Undeveloped public land.
3. Undeveloped private land.
4. Recreational land.
5. Extreme natural features (ie. steep slopes).

Recommendations:

1. Create an Open Space Plan.
2. Until the plan is accomplished:
 - a. Implement a no-sale policy on town-owned land in watersheds.
 - b. Maintain, unchanged, The Highland Lake District.

Focus Area: Land Use

Topic 8: Ridge Line Protection

Background: The natural beauty and rural character of the watershed is one of the lake's most important assets. Ridge lines are major components of this landscape. As development pressures mount, these valued qualities will be increasingly threatened. Preservation of ridge lines would seem to be a necessary and important component of the revised master plan for the Town. Implementation of creative zoning regulations that balance aesthetic concerns, individual rights, and economic goals should be undertaken.

The first step is to identify, define and map the visual elements that compose significant ridge lines. Techniques should then be investigated that will mitigate the negative visual impacts future development might have on these assets.

Recommendations:

1. Develop map of "Significant Ridge Lines".
2. Implement zoning regulations to enforce protection.

For Further Consideration

A number of additional topics related to land use were raised by citizens during public input sessions and by knowledgeable persons invited to meet with the Subcommittee. Those topics are listed here, however time does not permit the full development of the background and recommendations for action for each.

1. Explore with the Corps of Engineers the posting of the Sucker Brook Dam area, prohibiting off-road vehicle use causing erosion.
2. Continue to assure the proper calibration of equipment and application of de-icing materials during winter storms.
3. Encourage a conservative use of sand on public beaches and a more restrictive policy regarding the use of sand on private beaches.
4. Explore the possible purchase of the large tract of land east of East Wakefield Boulevard by the State of Connecticut for preservation as open space.
5. Continue to develop ongoing educational programs regarding the use of chemically-based insecticides and herbicides as well as chemical fertilizers in the Highland Lake Watershed.
6. Find a substitution for the oiling of roads surrounding the lake.
7. Evaluate the aesthetic impact of the increased fencing and screening of private beaches around the lake.
8. Enforce PZC regulations regarding maximum slope for driveways and paving the lip for 15 feet in order to reduce erosion.
9. Review commercial uses at the lake.
10. Consider the environmental and aesthetic impact of clearcutting trees on lots adjacent to the lake.
11. Consider the potential effectiveness and cost of installing very large settlement basins at the outflow of Sucker Brook and Taylor Brook.
12. Post all public owned property on the perimeter of the lake for convenient recognition by the public.

The Subcommittee recommends that these additional topics not be neglected in future planning for management at the lake.

II. WATER QUALITY IN HIGHLAND LAKE

Introduction to Water Quality Management

Water quality management is a multi-faceted exercise to make a lake attractive for recreational activities such as swimming, fishing and boating and at the same time to slow down the natural aging process of the lake.

There are two simultaneous ways to slow down the aging process. One is to control erosion and sedimentation, the actual filling in of the lake with sand and soil. The other is to reduce the growth of water plants and algae.

Growth requires the three chemicals oxygen, nitrogen and phosphorous. Oxygen and nitrogen are readily available in air and water, phosphorous is not. Therefore, the most important chemical to control from entering a lake is phosphorous.

Phosphorous is present in washing powders, fertilizers, sewage and attached to eroding soil. Recent research indicates that the control of nitrogen may also be useful in limiting the growth of larger aquatic plants. Phosphorous and nitrogen may dissolve in water or may be present on vegetation and sediments.

One of the most effective measures to control phosphorous in the lake is to encourage wetlands along the streams that flow into the lake. The loose phosphorous which comes downstream with the sediment is taken up by the green growth in the wetlands during the spring and summer and does not discharge into the lake until the vegetation dies in the fall and winter. By then it is too late in the season for the phosphorous to combine with the other chemicals and form algae blooms; the phosphorous just settles out of the water column. Therefore, it is important to understand the relationship between managing water quality and the use of the land on the watershed.

Status of Highland Lake Water Quality

Presently, Highland Lake is a middle-aged lake which needs to be used carefully in order to avoid rapid deterioration of its water quality. According to "A Watershed Management Guide for Connecticut Lakes" revised in 1991 by the DEP Bureau of Water Management, Highland Lake is classified as "mesotrophic" (p.27).

Mesotrophic lakes are good recreational lakes but are showing some decrease in water quality and impairment in its use. People must be made aware of how fragile a lake's health can be and educated to avoid damaging practices.

Thus, water quality management and improvement is a complex combination of the following: continual water quality testing, surveillance of the use of land on the watershed, strict enforcement of existing ordinances and regulations governing the use of watershed land and activities on the water, establishing further protective ordinances and the use of conservation practices. Public educational programs are an important factor in maximizing the effectiveness of water quality management.

Lakes such as Highland Lake, which are heavily developed, can have water quality change quite rapidly. An on-going program of water quality testing is needed in order to be aware of changes which indicate deterioration of water quality so corrective action can be taken immediately.

Scientific techniques for monitoring water quality are constantly being improved. There is need to stay current with new monitoring technology, use it continually and act on the data provided on a timely basis. As society changes, populations increase and knowledge of conservation practices is refined, new ordinances are reasonable ways to insure protection of a lake's fragile ecosystem.

In order to more thoroughly understand the recommendations regarding water quality, the Lake Management Plan Subcommittee asks you to read the two summaries in the appendix of this document. The summaries entitled "Understanding Lake Ecology as it Relates to Water Quality" and "History of Water Quality Testing at Highland Lake" are a synopsis of hundreds of pages of water quality testing reports and reports regarding effective lake management practices.

Recommendations

Focus Area: Water Quality

Topic 1: Water Quality Testing/Monitoring

Background: During the past five decades, there have been a number of water quality tests conducted at Highland Lake. The most comprehensive study was implemented by the Water Compliance Unit of the Department of Environmental Protection and compiled into "Phase I - Diagnostic/Feasibility Study Highland Lake Winchester, Connecticut 1980". There were also two follow-up studies conducted by the DEP in 1987 and 1988 to assess the impact on lake water of several lake management practices. Many of the recommendations based on the water quality data collected in these studies remain unimplemented.

In 1985 a Macrophyte Map (aquatic weeds) was prepared for the Highland Lake Commission and a follow-up Summer Monitoring Report was conducted, both by Ecosystem Consulting Service. The Department of Environmental Protection compiled updates on the 1980 report and forwarded them to the Highland Lake Commission in 1987 and 1988. Refer to the History of Water Quality Testing for a brief synopsis of the testing data (See Appendix B).

Recommendations:

1. The list of recommendations made in the 1980 Diagnostic/Feasibility Study should be implemented by the appropriate Town agency (P&Z, IWC, BOS) as soon as feasible. The recommendations represent problems which existed 11 years ago and still exist in 1991 (see Appendix D).
2. An ongoing program of water quality monitoring must be established by the Town of Winchester since state and federal monies are not available at this time. Monitoring is most effective when done on a regularly scheduled basis and year round to detect seasonal fluctuations. Water temperature, dissolved oxygen levels and transparency should be monitored yearly for indications of significant changes in water quality.

Weed mapping, monitoring of levels of phosphorous, nitrogen, pH, algae and alkalinity should be monitored on a schedule to be determined appropriate for effective lake management by a professional lake management consultant.

Continued cooperation with the Water Management Bureau and Bureau of Fisheries and Wildlife of the DEP is highly advisable. They should be contacted frequently for their professional expertise and a possible source of water quality testing and improvement projects.

3. Explore the possibility of using the laboratory at the sewage treatment plant to analyze water samples, as is done at Bantam Lake.
4. Analyze all data from water quality studies and determine what action should be taken, the appropriate town agency to act and a workable timetable.
5. Organize and implement a program, using a cadre of volunteers, to collect water samples for laboratory testing, secchi disc readings to monitor water clarity and any other tasks which would expedite the continuous monitoring of lake water and save town funds.
6. Contact Northwestern Connecticut Community College, Regional #7 High School and Gilbert High School and inquire about possible student involvement as volunteers to collect water samples and take part in other monitoring activities.
7. Establish and implement an educational program to cultivate awareness in all lake users about the environmental aspects of the lake and its watershed. It is important that individuals adopt an attitude of lake stewardship. Lake stewardship takes into account the need to better balance our lives and lifestyles with the needs of our lake.
8. Evaluate all testing programs to determine what follow-up testing may be appropriate.

Focus Area: Water Quality

Topic 2: Educational Program for Lake Property Owners/Watershed Residents

Background: Generally, there is lack of awareness among lake property owners and watershed residents regarding the ecological impact of their day to day activities on the Lake. There is considerable turnover in the resident population and thus, an ongoing educational program is needed. Lake users gaining access to the Lake through the State Boat Launch are also continually changing and need an education and information program. It is important that all lake users and watershed residents adopt an attitude of lake stewardship which takes into account the need to better balance lives and lifestyles with the needs of the lake.

Recommendations:

1. The Highland Lake Commission should develop and disseminate a booklet such as "Guidelines for Lake Property Owners" in which topics such as the following are discussed:
 - activities which need the approval of Inland Wetlands or Planning and Zoning Commissions,
 - proper use of fertilizers and use on no-phosphate soaps,
 - maintenance of septic systems,
 - testing well water for contaminants,
 - impact of feeding waterfowl,
 - regulations regarding dumping leaves, grass clippings etc. into the lake,
 - benefits of water conservation devices,
 - regulations regarding dumping sand into the lake to create beaches,
 - regulations regarding docks and moorings,
 - proper disposal of household wastes,
 - regulations regarding boats pumping oil into the lake, and
 - proper maintenance of retaining walls.

2. A similar booklet should be prepared for people who use the lake on a daily basis through public access points such as the State Boat Launch, Town beaches and Rights of Way.

Topics pertinent to daily lake users include proper disposal of trash, use of public toilets, discharge of oil into the lake from boat bilges (prohibited) and hazards of feeding waterfowl.

3. Another booklet should be prepared for owners of land that falls within the boundaries of the Highland Lake Watershed.
4. Methods to distribute informational booklets should be explored such as through Real Estate brokers, banks and lake associations.
5. A laminated plaque should be placed at the State Boat Launch on which guidelines for appropriate lake use could be posted.
6. Consider the possibility of conducting seminars to educate lake users regarding preservation of water quality. Other activities such as "Bottoms-Up Day" (scuba divers clean up debris from lake bottom) could help clean up efforts and heighten awareness of the need to maintain Highland Lake.

Focus Area: Water Quality

Topic 3: Water Level Policy

Background: A four-year water level policy was forwarded to the Management Plan Subcommittee by the Highland Lake Commission on August 1, 1990. It states that on October 15, 1990 the lake would be lowered four (4) feet ASAP. On December 1, 1990 the lake would be allowed to rise two(2) feet and this level would be held until ice-off. After ice-off, the water would be brought to 11.9 feet as measured at the spillway (this allows water to flow over the spillway). This same schedule would hold true for the years 1990 through 1993. The Subcommittee responded to this proposed policy in favor of the time-lines and depth of drawdown for three years.

The Subcommittee asked the HL Commission to consider the need of residents to repair retaining walls and plan for a deeper drawdown every fourth year.

Recommendations:

1. On recommendation from the DEP Water Management Bureau, the Subcommittee recommended that a deeper drawdown commence on September 30th every four years with a maximum drawdown of 8 feet. This would provide time during the warmer weather to repair or build retaining walls and allow the lake to refill prior to deep freeze. Refill should commence on December 1st to a level of 9.9 feet to avoid the detrimental situation of sediment being frozen into the ice, lifted with the rise of the lake level and deposited in new areas of the lake at ice-off.
2. Consideration should be given to recommendations regarding the timing of drawdown made by the DEP Bureau of Fisheries and Wildlife (Chuck Phillips - 295-9523).
3. It is imperative that lake property owners be informed of the Water Level Policy well in advance of implementation. It will be incumbent on property owners to plan ahead for repair or building of retaining walls or dock restoration including obtaining permits from Planning and Zoning and Inland Wetlands Commissions.
4. Monitor and evaluate the effectiveness of this policy for possible future refinement.

Focus Area: Water Quality

Topic 4: Pollution Control/Enforcement of Sewer Hook-up

Background: During recent discussions regarding extending sewers around the remainder of Highland Lake, it has been brought to light that some lake-side homes that presently have sewer service available have not tied into the trunk line.

As the Town proceeds with the extension of sewers, it is important that there is a strict enforcement of the requirement for all lake-side homes to be hooked into public sewers. In order to maximize the effectiveness of the sewerage project in reducing possible lake pollution and/or contamination of drinking water, the Water Pollution Control Authority must adopt a strict enforcement policy.

Recommendations:

1. The Water Pollution Control Authority should review, as soon as possible, any residents who have public sewers available and have not hooked into them. Such lake residents should be notified that they must comply with the requirement.
2. In proceeding with the project to extend sewers to the remainder of the lake residents, requests to delay immediate hook-up should be investigated thoroughly. Only those residents who can produce evidence of an engineered septic system which meets present code should be permitted to delay hook-up.
3. Contact the DEP Division of Conservation and Preservation (Tony Cantele - 485-0226) to explore the possibility of the State hooking Taylor Brook Campground into the sewer.

Focus Area: Water Quality

Topic 5: Pollution Control/Septic System Maintenance Program

Background: Unless properly designed, installed and maintained, on-site subsurface sewage disposal systems may fail and contribute contaminants to nearby surface and/or ground water supplies. A maintenance program should be created by the Board of Selectmen in cooperation with the Torrington Area Health District mailing out "notices to pump" to watershed residents. Records of septic tanks that have been pumped could be kept, as the TAHD has begun to do.

"Additionally, such a program could enlist the support of realtors to ensure that tanks are pumped and inspected prior to selling a house" (Watershed Protection Study, Litchfield Hills Council of Elected Officials, 1990, page 45).

Recommendations:

1. The Board of Selectman in concert with TAHD should initiate implementation of a septic system maintenance program for all residents in the Highland Lake, Crystal Lake and Rugg Brook Reservoir watersheds. The Selectmen should delegate to the proper department the responsibility of mailing "notices to pump" and keeping records of septic tanks that have been pumped.
2. The Board of Selectmen, or designee, should contact all area realtors to explore the feasibility of ensuring that all septic tanks are pumped and inspected prior to selling a house.

Focus Area: Water Quality

Topic 6: Dredging

Background: For many years sedimentation has been filling Highland Lake from sources such as road sand, streambelts, the peat bog and construction sites. Sedimentation is now seen as the potential cause of reduced water quality.

Investigation by the Highland Lake Commission (HLC) and the State of Connecticut Department of Environmental Protection (DEP) determined that one of the potential sources of these water quality problems is the deposition of unconsolidated sediments in the coves around the Lake. During the winter drawdown of the lake, when these sediments are exposed, they wash into the central lake area so that in the spring when lake activity is high these sediments become suspended in the lake water, thus reducing water quality. Additionally, these sediments contain organic materials which may be decomposing, thereby causing a reduction in oxygen levels in the lake water.

Wengell, McDonnell & Costello, Inc was selected by the HLC to prepare a report discussing the feasibility of dredging five coves on Highland Lake. The study was funded under a 75% grant program administered by the Connecticut DEP and a Final Report was submitted to the HLC in July, 1991. The results of the borings and the surface water pipe probes indicate that the depth of sediment in the coves averaged approximately three feet, while in some coves, particularly Sucker Brook and Taylor Brook Cove, the sediment depths reached in excess of five feet. Since the Lake can be drawn down approximately 8 feet to expose the lake bottom in the coves, the DEP recommended that the feasibility study focus on removing the sediment through dry excavation techniques.

Recommendations:

1. The Highland Lake Commission continue to work with the DEP and the consulting engineers to pursue the dredging project.
2. To be cost effective, dredging should be part of a preventative plan to curb the amount of sedimentation flowing into the lake. The HLC and DEP should make the dredging project contingent upon the replacement of drains with settlement basins.
3. The Highland Lake Commission make contact with state and federal legislators to seek funding through the Clean Lakes Act to bring this project to completion.
4. The Highland Lake Commission conduct appropriate public hearings to gain support for the dredging project and inform the public regarding its benefits and costs.
5. The Highland Lake Commission obtain all required Federal, State and local permits prior to the commencement of any excavation activities.

Focus Area: Water Quality

Topic 7: Retaining Walls to Control Erosion and Sedimentation

Background: The transport of eroded soils to a lake contributes to eutrophication in several ways. Most importantly, phosphorous and other plant nutrients associated with soil particles are introduced into the lake. Erosion and sedimentation is a dominant cause of phosphorus enrichment of lake waters.

Land surrounding Highland Lake is frequently steep which, through the natural process of erosion, will increase the nutrient loading of the lake. Also, wave action caused by winds, boating and other lake activities can cause shoreline erosion of soils if proper precautions are not taken by the landowner.

It is common practice for lakeside property owners to construct masonry walls along shorelines which are vulnerable to erosion. Retaining walls absorb shock of waves and prevent soil from moving off the land and into the lake. General guidance on the construction of retaining walls is provided in the Guidelines for Soil and Erosion Control. Additional help may be obtained from professional builders. Inland Wetlands and Building permits are required for construction or repair of a retaining wall.

Recommendations:

1. The Highland Lake Commission should educate lake property owners regarding the importance of maintaining retaining walls in proper condition to prevent erosion.
2. The Highland Lake Commission is the responsible agency for setting the timing and depth of lake drawdowns. Information must be communicated well in advance so as to insure the property owners' ability to take advantage of the drawdown to repair, replace or construct a new retaining wall. Consideration must be given to the amount of time it takes to obtain permits.
3. During the year of deep drawdowns, an agent of the Inland Wetlands Commission should conduct an onsite survey of the perimeter of Highland Lake. A letter should be mailed to any property owner whose shoreline indicates a significant erosion problem alerting them to the situation.

Focus Area: Water Quality

Topic 8: Pollution Control/Boats Pumping or Discharging Oil

Background: "It is a violation of the Federal Pollution Control Act to pump or discharge any kind of oil into navigable waters. Oil must not be dumped into the bilge of a boat. Skippers caught with oil in the bilge of their boats must be able to show how they intend to dispose of it properly", according to the Connecticut Boater's Guide 1990 (Connecticut Boater's Guide, 1990, Department of Environmental Protection, Boating Safety Division, page 50). Many users of Highland Lake appear to be inadvertently pumping oily water from their boats.

Recommendations:

1. The restriction regarding pumping oil into navigable waters should be incorporated into an information booklet and distributed to all lake property owners by the Highland Lake Commission and to all lake users by the guard at the State Boat Launch Area. Boat owners should be encouraged to clean the bilge of their boat.
2. The Highland Lake Marine Patrol should monitor any pumping activities vigorously and take appropriate action within their jurisdiction.

Focus Area: Water Quality

Topic 9: Pollution Control/Hazardous Materials Disposal

Background: Presently, Winchester has no regulations tailored to small quantity users and generators of hazardous materials. A collection program for household hazardous materials does exist. However, the frequency of such collections and lack of public awareness handicap its effectiveness.

Recommendations:

1. The Board of Selectmen should consider the development and implementation of regulations for storage and use of any substances which might contaminate groundwater.

The Town should develop and require the use of means by which town residents, businesses and other entities can safely dispose of materials which could contaminate groundwater (Watershed Protection Study, Litchfield Hills Council of Elected Officials, 1990, page 61).

2. The Board of Selectmen should determine an appropriate manner by which to raise public awareness of the impact on the environment of hazardous wastes and the proper manner for their disposal.
3. The Board of Selectmen should study the possibility of providing a holding site for household hazardous waste. Presently, collection at RRDD1 is infrequent. Since many Highland Lake property owners are seasonal residents, they are unable to avail themselves of RRDD1 collection dates. Alternatively, the Selectmen might make a recommendation to the RRDD 1 Board that consideration be given to providing household hazardous waste disposal at a time which would accommodate seasonal residents.

Focus Area: Water Quality

Topic 10: Pollution Control/Underground Fuel Storage Tanks

Background: Presently, Winchester has no regulations or ordinances that pertain to underground oil and gas fuel storage facilities. Many homes have buried heating oil storage tanks and transmission lines. The life expectancy of these storage and transmission facilities depends upon the type of storage tank and transmission lines, the moisture content and pH of the soil, and the method of installation. The average life expectancy of these facilities has been estimated to be 15 years. Leaks are often located where transmission lines pass through foundation walls. With this average frequency of failure and sheer number of such systems, the potential magnitude of the problem demands action.

Neither the State nor Federal Government regulates residential underground fuel storage facilities, nor does either agency regulate non-residential, less than 2,100 gallon capacity storage of heating oil or motor fuel for on-site consumption.

Recommendations:

1. The Board of Selectmen should direct the appropriate department to conduct an inventory of existing underground fuel storage tanks in the Highland Lake Watershed.
2. The Board of Selectmen should establish an ordinance regulating all residential, and unregulated non-residential, underground fuel storage and transmission systems. This ordinance should require "...fuel storage tanks and components to be located above ground in a basement or protective structure unless safety, health or site conditions warrant the use of an underground fuel storage system" (Groundwater Action Project Report for the Town of Litchfield, Connecticut, 1989, page 50). A 1988 DEP publication entitled "Underground Storage Tanks: A Guide for Municipalities" is a useful reference for developing a local management plan (Watershed Protection Study, Litchfield Hills Council of Elected Officials, 1990, page 60).
3. Underground oil and gas fuel storage tanks should be prohibited in the Highland Lake watershed.

III. LAKE ACTIVITIES

Introduction to Lake Activities

Throughout the history of Highland Lake, it has been a source of livelihood and recreation for the citizen of Winsted and the surrounding areas. Recently, the housing boom in Winsted and specifically the building of new homes and cottage conversions at Highland Lake have taken all but a few hundred feet of shoreline and made it the property lines of over four hundred households.

This fact and the presence of a state boat launch, one private marina, and two public beaches has led to an increase in the use of Highland Lake as a source of recreation. Along with a more intensive use of land surrounding the lake, it is becoming increasingly more congested on the water. The sizes of watercraft and their increased power have also created an added factor when considering lake activities.

Each person who lives at the lake feels a certain ownership of the lake, particularly at the shoreline. Each has his own idea of what should and should not be permitted. It is extremely important not to fractionalize responsible parties in lake management but rather to come to a viable compromise which first considers the condition of the lake, its wildlife resources, and the safety of the public. A philosophy of cooperation coupled with enforceable ordinances is an absolute requirement if effective lake management is to be maintained.

The following areas need to be addressed in a comprehensive plan of development for Highland Lake. They are the result of research and public input. They conform to current practices employed at other lakes of comparable size in Connecticut. It should be noted here that presently, Highland Lake has no restrictions beyond state boating regulations and a few local ordinances.

- Watercraft regulations
- Overnight mooring ordinance
- Dock and mooring regulations
- Operation of watercraft ordinances
- Use of marine patrol
- Neighborhood lake watch group
- Lake boating club
- Educational programs

Recommendations

Focus Area: Lake Activities

Topic 1: Watercraft Regulations

Background: Presently, there are no restrictions above state statute on the type, size or use of watercraft which operate on Highland Lake. By examining the state regulations and guide in the Connecticut State Boater's Guide, it becomes apparent that, to a Connecticut boater, Highland Lake is the perfect location for all types of boating without restriction.

Since early times pleasure boating and recreational use of the lake have been focal points for many people in this area of the state. Over the past few years, the numbers and sizes of watercraft have increased on the waters of Highland Lake. With this increased number of watercraft has also come an increase in operators who are unaware or disinterested in abiding by safe, courteous boating practices.

On the basis of public input to the subcommittee, limiting the size of watercraft on Highland Lake will help to control the types of boats used. Boats larger than twenty-two feet are commonly used on large rivers and oceans.

It has been generally accepted by the committee that we are dealing with a body of water which resembles, in many respects, a very short (three miles long) river rather than a round shaped lake. Much of the lake especially in first and second bays is narrow. Larger boats are also more likely to have "heads". Often these "heads" or lavatories on board discharge directly into the water.

Larger boats also tend to create larger wakes. It is recognized that certain hull displacement types even in smaller boats and the manner in which the boat is driven also contribute to large wakes. The larger the wake the rougher the water becomes as traffic increases. Large wakes can also tend to create waves which can more rapidly erode shoreline.

The exception to the twenty-two foot limit for pontoon type watercraft was recommended because in general, this type of watercraft is driven at slower speeds and its hull design minimizes wake.

Recommendations:

1. Establish an ordinance limiting sizes of watercraft permitted on Highland Lake as follows:
 - a. Watercraft, whether powered or under sail, shall not exceed twenty-two (22) feet.
 - b. The only exception to this ordinance would be a twenty-five (25) foot limit on pontoon type party boats.

Focus Area: Lake Activities

Topic 2: Overnight Mooring Ordinance

Background: It was felt that to allow overnight mooring on the lake would encourage boaters to spend weekends on the water. Without proper facilities to handle such overnight stays, there would be several safety and sanitary considerations which would have to be dealt with.

Recommendations:

1. Establish an ordinance prohibiting overnight mooring for the purpose of sleeping as follows:
 - a. The mooring of any watercraft for the purpose of overnight visits is prohibited unless the watercraft is moored at a private mooring registered with the Inland Wetlands and Watercourses Commission.

Focus Area: Lake Activities

Topic 3: Dock and Mooring Regulations

Background: Along with the increased numbers and sizes of boats using the lake comes the problem of how to deal with the docking and mooring of these watercraft when not in use. Highland Lake is crowded.

Many cottages and homes are in close proximity to each other. In some areas of the Lake several boats can be found tied to docks or moored out in front of each property.

Currently, with no regulation, individuals can construct docks of any size or shape. They can dock several types of watercraft at these docks and, or, moor them off shore. The maximum sizes recommended are suitable for docking three watercraft. It was felt that this was a reasonable number for cottages and homes around the lake. The sizes and lengths of runways and docks insures that they will not encroach on open water.

The measurements, however, are not to be construed as an attempt for uniformity. It is recognized that, in some areas of the lake, docks constructed to these standards would be too large or would encroach upon neighboring properties. Here, it would be the judgement of the Inland Wetlands and Watercourses Agency to further restrict dock size.

Recommendations:

1. Establish regulations dealing with docks and moorings as follows:

Guidelines for Issuing Dock Permits for: The Inland Wetlands and Watercourses Agency

- a. The Inland Wetlands and Watercourses Agency shall have the authority to issue permits for docks, floats swim floats or boat lifts on any of the watercourses under its jurisdiction.

- b. Docks or floats, to which boats can be moored, shall not be constructed to float or be attached to the shore at a distance to exceed forty (40) feet, except that a swim float can be moored at a distance of no more than fifty (50) feet from the shore. The swim float may not be attached to the shore by any means or type of walkway
- c. No runway shall be constructed in such a way as to exceed a width of six (6) feet or a length of thirty (30) feet.
- d. No float or swim float shall be constructed in such a way as to exceed a maximum width of ten (10) feet or a maximum length of ten (10) feet.
- e. No more than three (3) watercraft will be permitted mooring at a dock or float constructed within these regulations. One boat lift device will be permitted housing one of three permitted watercraft.
- f. Watercraft may not be moored to any swim float.
- g. No more than one permit will be issued for a contiguous piece of property under one ownership for a dock, float, boat lift and swim float.
- h. Dock privileges may not be issued as of right to any persons not owning or renting property contiguous to the watercourse.
- i. Permits for placement, repair or replacement of docks, floats, swim floats, or boat lifts will be issued only under these regulations.
- j. All docks, floats, swim floats, and boat lifts will be registered with the Inland Wetlands and Watercourses Commission. Such registration will contain the sizes and locations of each.
- k. All docks, floats, swim floats and boat lifts shall be permitted use for a period of three (3) years from the date of the adoption of this regulation at which time they must be in compliance with the regulation.
- l. Prior to this regulation, there existed one section of the lake, near the spillways, which was permitted use as a marina. As of the date of the adoption of this regulation, no additional areas of the lake will be designated as marinas with exceptions to these regulations.

Definitions for Regulations:

- Boat Lift:** Any structure having permanent or temporary footings in the watercourse or attached to the shore designed to lift a boat out of the water for storage.
- Dock:** Any structure attached to the shore or having permanent footings in the watercourse.
- Float:** Any structure except a watercraft attached to the shore by lines or chains or anchored to the bed of the watercourse and attached to a walkway.
- Swim Float:** Any structure except a watercraft anchored to the bed of the watercourse and not attached by any means to the shore.
- Watercraft:** Any boat or other watercraft (powered or otherwise) required to be registered by the State of Connecticut.

Focus Area: Lake Activities

Topic 4: Operation of Watercraft Ordinances

Background: Many of the proposed ordinances listed under this section are already mandated by State Statute. It was felt that the Town should reinforce its commitment to safety by creating ordinances which conform to Statute and take into consideration the unique qualities and limitations of Highland Lake.

Upon advice from the public, it was felt that a speed limit should be imposed at a maximum of forty miles per hour. It is recognized that monitoring of this is difficult at present. However, as technology permits, we feel that eventually speed limits can be monitored more accurately. The speed limit does not impede the ability to water-ski or any other activity which can be safely done at the Lake. High speed racing on the Lake with its narrow horseshoe configuration was not considered a safe activity by this committee. The Town already has a six mile per hour speed limit at night.

While it is recognized that some of the coves and inlets of Highland Lake are greater than two hundred feet across from shore to shore at their wider points, many areas of these coves and inlets have distances far less than that. In an effort to promote safe boating practices, and rather than leave the decision up to the boater, it is recommended that from the first point where the minimum distance from shore to shore is two hundred feet or less buoys be placed to indicate reduced speed requirements.

Travelling counterclockwise is also another method of providing for safe movement around the lake. If all boaters travel or approach the shore from the same direction it is much easier for the operator to maneuver safely. It is recognized that there are some areas in the coves or inlets where this is next to impossible. However if speed is restricted as mentioned above, safe movement should be possible.

It was also felt at public sessions and by the committee that some form of quiet time should be developed as a means for non-powered boaters or swimmers to enjoy the lake safely especially on weekends. It was felt that the times proposed were fair to all concerned.

The more stringent requirement for personal watercraft was a request made at public sessions and endorsed by the committee.

It was also felt at public sessions that vehicles using the lake when frozen should show more respect for activities such as ice skating. As a final note to this section it was decided to make these ordinances apply not only to watercraft but also to vehicles such as snow mobiles or ATVs which use the lake's frozen surface during the winter months.

Recommendations:

1. Establish an ordinance dealing with operation of watercraft on the waters of Highland Lake as follows:
 - a. No watercraft or other powered vehicle shall travel at a speed of over forty (40) miles per hour on the waters of Highland Lake.
 - b. When taking off or landing a water skier, all powered watercraft on the waters of Highland Lake shall travel in a counterclockwise pattern within one hundred (100) feet of shore.
 - c. During the hours of 10:00 A.M. AND 2:00 P.M. on all Sundays during the year, no watercraft or other vehicle shall travel at greater than steerage way or 6 MPH (whichever is greater).
 - d. No watercraft or other vehicle shall travel at a speed greater than 6 MPH from the hours of sunset to sunrise any day of the year. (present regulations permit 1/2 hour before sunrise to 1/2 hour after sunset)
 - e. No watercraft described as a personal watercraft by Connecticut State Statute shall be permitted use on the waters of Highland Lake on any Saturday or Sunday from sunrise to 2:00 P.M., Memorial Day to Labor Day.
 - f. Vehicles using the Lake when frozen shall leave and approach the shore at an angle perpendicular to the shore.

Definitions for Regulations:

Personal

Watercraft: Any watercraft designated as a personal watercraft by Connecticut State Statute.

Vehicle: Any motorized vehicle, snowmobile or ATV.

Watercraft: Any boat or other watercraft (powered or otherwise) required to be registered by the State of Connecticut.

Further recommendations to reaffirm State Boating Regulations:

- a. Water craft or other powered vehicles shall travel at no more than steerage way or 6 MPH (whichever is greater) within one hundred (100) feet from any shoreline or dock or swim float or moored watercraft unless taking off or landing a waterskier.
- b. Movement in coves or other shoreline areas where the distance from shore is less than two hundred (200) feet shall travel at no more than steerage way or 6 MPH (whichever is greater).
- c. Travel through the area of the Lake known as the narrows between second and third bays shall be at no more than steerage way or 6 MPH whichever is greater. These areas shall be marked with buoys indicating the mid-point of a distance one hundred (100) feet from each opposing shore in both second and third bays.

This recommendation must be implemented if it is found, through accurate measurement, that the distance between the land bodies at the narrows is two hundred feet or less. Regardless of the distance at this location, a determination should be made as to whether safe passage can be made through the narrows at greater than steerage way or 6 mph or not.

Focus Area: Lake Activities

Topic 5: Use of Marine Patrol

Background: Observation of lake use prompted the committee to recommend changes in the operation of the Town Marine Patrol. During the week, morning and early afternoon use of the lake is usually light. This holds true especially in Third Bay. Boat traffic during the week usually picks up in the mid to late afternoon and continues until sunset, and sometimes beyond. Hours for the marine patrol should be reduced during light times and stepped up during heavy lake use.

In particular, it was felt that unscheduled late night patrols should be made to discourage the current practice of water-skiing and high speed boating after sunset. This coupled with the restrictions listed in section four of this report should make the lake much safer and more enjoyable to use.

Recommendations:

1. The Marine Patrol in conjunction with the Winsted Police Department should:
 - a. Operate between the hours of 3:00 P.M. and one half hour after sunset on weekdays from July 1 through Labor Day.
 - b. Operate between 9:00 A.M. and one half hour after sunset on weekends from July 1 through Labor Day.
 - c. Stage unscheduled patrols at least ten times from July 1 through Labor Day until 11:00 P.M.
 - d. Indicate by travelling the length of the lake with lights flashing the official time of sunset.
 - e. Issue warnings and arrests for violations in accordance with State Statute and Lake Ordinances.

Focus Area: Lake Activities

Topic 6: Neighborhood Lake Watch Group

Background: Many local neighborhoods in Winsted have instituted neighborhood watch groups to keep their streets safe. It was felt that this type of procedure should be looked into for the Lake as well. It is recognized that there are problems inherent to this type of organization but further investigation into its creation could prove valuable.

Recommendations:

1. Investigate the formation of a neighborhood lake watch group whose responsibilities would be as follows:
 - a. Assist the Marine Patrol by positioning spotters (at least one in each bay) equipped with two-way communication with the patrol boat during times of peak lake use by boaters. These lake spotters would not have powers of arrest or power to detain anyone. Rather they would be the eyes and ears of the Marine Patrol to insure that the entire lake is being checked regularly for violations. They would radio the Marine Patrol to report any possible violations for action taken by the Marine Patrol.

Focus Area: Lake Activities

Topic 7: Lake Boating Club

Background: One of the most positive aspects of this report would be the formation of a Lake Boating Club, sponsored by the Parks and Recreation Department. Public awareness and education are at the center of safety at the lake. All the rules and regulations are useless if public commitment to them is not fostered. Knowledge of boating regulations and local ordinances is vital. Such an organization would be of great value in promoting boating safety and improved use of the lake for all residents.

Recommendations:

1. Formation of a Highland Lake Boaters' Club, sponsored by the Park and Recreation Dept., whose purpose would include the following:
 - a. Conduct safe boating courses for all lake users.
 - b. Promote boating activities of all kinds throughout the season.
 - c. Be a forum for the promotion of safe water use practices.

Focus Area: Lake Activities

Topic 8: Educational Programs

Background: Along with the Boating Club, the Town must make available for all lake users the rules and regulations so that ignorance of the law does not become a factor. The recommendations listed under this section are just two suggestions to see that Highland Lake is used by an informed public.

Recommendations:

1. Development of educational and informational materials concerning Highland Lake by the Highland Lake Commission including the following:
 - a. Posting of a large permanent map and the regulations on Highland Lake at the State Boat Launch by the DEP.
 - b. Development, by the Highland Lake Commission, of a brochure to be mailed to all residents with property at Highland Lake and given to all users of the Lake at the State Boat Launch.
 - c. Summaries of local Ordinances and regulations unique to the Lake to be mailed to all property owners at Highland Lake.

SUMMARY OF CURRENT LOCAL ORDINANCES:

- SEC. 43 OPERATION OF BOATS AT HIGHLAND LAKE REGULATED
- SEC. 45 CONSUMPTION OF INTOXICATING BEVERAGES IN PARKS
REGULATED
- SEC. 77 OPERATION OF SNOWMOBILES AT HIGHLAND LAKE
REGULATED
- SEC. 114 ORDINANCE CREATING AN INLAND WETLANDS AND
WATERCOURSES AGENCY
- SEC. 128 REGULATION OF CONDUCT AT RECREATION FACILITIES
- SEC. 131 HIGHLAND LAKE COMMISSION

ADDITIONAL ORDINANCES OR REGULATIONS NEEDED PER
RECOMMENDATION OF THIS REPORT:

GUIDELINES FOR ISSUING DOCK PERMITS FOR THE INLAND WETLANDS
AND WATERCOURSES AGENCY. NOTE: ALL REVISED AND NEWLY
PROPOSED REGULATIONS MUST BE ACTED UPON BY THE APPROPRIATE
LOCAL AGENCY OR THE BOARD OF SELECTMEN.

FURTHER, NEW BOATING REGULATIONS MUST BE SUBMITTED TO THE
CONNECTICUT STATE DEPARTMENT OF ENVIRONMENTAL PROTECTION,
BOATING DIVISION FOR THEIR APPROVAL.

ALL PROPOSED ORDINANCES WILL BE SUBMITTED TO THE BOARD OF
SELECTMEN FOR CONSIDERATION AND ACTION.

IV. DEVELOPING A PROCESS TO MANAGE HIGHLAND LAKE EFFECTIVELY

After eighteen months of intensive work to gather information from studies, experts and the public, the Highland Lake Management Plan Subcommittee has developed a keen sense of how complex the management of a lake is.

After reading documents such as the Lake Waramaug Watershed Management Plan, Lake Area Task Force Recommendations for Lake Pocotopaug and articles published by the North American Lake Management Society (NALMS), the subcommittee has given considerable thought to what needs to be done to manage Highland Lake effectively.

Highland Lake has been mentioned as Winchester's most valuable natural resource. It has become both heavily populated and extensively used for recreation. At this point, Highland Lake's condition is fragile and needs to be watched very carefully in order to avoid the need for expensive restoration projects that we have seen on Lake Waramaug and Bantam Lake. Conservation and protective efforts are far more effective and less costly than clean-up activities.

Looking at Highland Lake from a financial perspective, it generates approximately \$1,000,000 (one million dollars) in tax revenue per year from the property that directly borders the perimeter of the lake. Thus, Highland Lake property is the largest contributor to Winchester's property tax revenue or it contributes 10% of the total property taxes (1990-91 figures). Further decrease in lake water quality which affects the recreational use of Highland Lake could mean significantly reduced tax revenues. It may also mean very expensive restoration projects.

The Management Plan Subcommittee believes that it is prudent and necessary to give serious thought to these facts and act preventatively.

The Subcommittee is aware of the need to coordinate lake management decisions with many other town agencies i.e. Board of Selectmen, Inland Wetlands Commission, Planning and Zoning Commission, Zoning Board of Appeals, Police Department, Public Works Department, Water Pollution Control Authority and Recreation Department. This alone makes management complex. Add to that the need to interact with a set of State/Federal agencies i.e. Department of Environmental Protection (Water Management Bureau, Bureau of Games and Fisheries, Bureau of Conservation and Preservation), U.S.D.A. Soil Conservation Service, Litchfield County Soil and Water Conservation District, Torrington Area Health District, Connecticut Association of Lake Management and many other agencies too numerous to mention, we can begin to realize what a time-consuming task it is to manage any lake.

On October 13, 1983, the Board of Selectmen passed an ordinance creating the Highland Lake Commission. Consisting of seven members, the HLC was so charged..."The board shall have the power to adopt rules and regulations for the conduct of all business within its jurisdiction...shall have responsibility for preserving and promoting Highland Lake as a valuable, natural resource...have the power and authority to regulate the level of the lake water in the interests of both preservation of private property abutting same, as well as flood control, and further regulate, through ordinance duly adopted, the use of said waters by boaters and others in the interest of public safety and welfare."

Since 1983, the Highland Lake Commission has met monthly and grappled with the many, sometimes volatile, issues concerning the lake. Based upon testimony from Commission members, attempting to manage Highland Lake has been difficult and frustrating.

Several facts have made the Commission's work difficult. Among them, the following could be mentioned:

- The Commission's budget for 1990-1991 is only \$1,140.00, scarcely an amount which demonstrates a commitment to the concept of best management principles.
- The Commission has had to rely on technical assistance as available from small town-funded projects such as the 1986 "Summer Monitoring Report" conducted by Ecosystem Consulting Service, Inc., or help from the Bureau of Water Management of the State Department of Environmental Protection. While such activities have provided some assistance, they have not had a long-term impact on the management of the lake.
- Communication among Town boards and commissions sharing responsibility for the lake has frequently been insufficient.
- There are no clearly stated short- and long-term objectives for management of the lake. Such are essential for both planning and continuity in management. The Subcommittee considers the absence of such a statement of objectives to be a serious obstacle to effective lake management.

It is in light of all these considerations that the Highland Lake Management Plan Subcommittee makes the following recommendations:

Recommendations

I. ORGANIZATION OF THE HIGHLAND LAKE COMMISSION

- A. Secure the services of a Professional Lake Manager
 - 1. The Board of Selectmen should provide the services of a qualified professional lake manager on at least a half-time basis or as a consultant with enough time to be readily available to the HLC. Such a professional should have wide knowledge and experience in lake management.
 - 2. Some of the responsibilities of the Professional Lake Manager which could help the Highland Lake Commission would be to:
 - a. Research ways to get funding for lake projects through Federal and State grants, foundation grants, private gifts from corporations and individuals. Work with the Town Manager to write grant applications and follow through.
 - b. Provide professional advice to the Highland Lake Commission regarding hiring consultants to conduct an on-going water quality testing program. Review, analyze and advise the HLC regarding the implementation of recommendations of water quality studies.
 - c. Draft proposed ordinances regarding recreational use of the lake or land use and forward to Board of Selectmen, Planning and Zoning or Inland Wetlands. Work with those commissions to complete the process of developing and publicizing such ordinances.
 - d. Draft and oversee the printing and distribution of educational literature for lake property owners, daily users of the lake and watershed property owners regarding the environmental impact of lake use, watershed issues and safe recreational practices.

- e. Conduct surveys designed to solicit input from lake property owners and lake users regarding all lake issues. Disseminate this information for use by the HLC and general public.
 - f. Provide technical assistance to the HLC in developing and evaluating long and short term goals and objectives.
 - g. Network with State and Federal agencies/organizations pertinent to lake management. Lobby with other lake managers in Connecticut for increased state funding for lakes with public access. Share scientific knowledge regarding best watershed management practices.
 - h. Develop and implement a volunteer program for projects such as water quality monitoring, lake "spotters" to augment the Marine Patrol, seminars regarding proper use of lake property, organizing clean-up efforts such as "Bottoms-Up Day".
 - i. Act as a catalyst to move lake projects forward and coordinate the many recommendations of the Highland Lake Management Plan.
- B. Reorganize the membership of the Highland Lake Commission.
- 1. The Board of Selectmen should revise the ordinance creating the Highland Lake Commission to be composed of members filling the following positions: Chairperson, Vice Chairperson, Secretary, liaison to Board of Selectmen, liaison to Inland Wetlands Commission, liaison to Planning and Zoning and Zoning Board of Appeals to promote inter-commission communications. Liaisons would receive all minutes and reports sent to regular members of that board or commission, be knowledgeable of all issues regarding the lake, attend meetings and give input when appropriate and report back to the HLC any pertinent information.
 - 2. Selection of members for the HLC should be based on interest in and knowledge of lake issues, possible knowledge of the commission to which they would be liaison and without regard to whether they are town or lake residents. (Presently, the residency requirement appears to be a problem in filling vacancies on the HL Commission).

- C. Establish goals and objectives.
 - 1. The Highland Lake Commission should annually develop short and long term goals and objectives. Management by objectives can create a clearer focus for activities, a system of priorities, a more organized approach to the many aspects of lake management and a way to evaluate results.

II. FUNDING OF THE HIGHLAND LAKE COMMISSION

- A. The Town Manager and Board of Selectmen should increase the funding of HLC beyond the present amount in the Highland Lake Commission line item in the Town Budget in order to properly implement the recommendations in the Highland Lake Management Plan.
- B. The Board of Selectmen should consider additional sources of revenues to defray costs of maintaining Highland Lake and the Marine Patrol.
 - 1. The Town should designate all boat registration revenues received from the State for lake management activities. Investigation should be made regarding why the amount of money received from the State for boats registered in Winsted has remained constant over the past several years while the number of boats registered in the Town have increased. All lake residents should be encouraged to register their boats at their Winsted address so Winsted would receive more State funding.
 - 2. The Board of Selectmen should consider making docks part of lake property owners' taxable property. Such additional tax revenue (possibly \$30.00 per dock) should be earmarked for lake management. Besides providing funds for the lake, docks would become a part of the permanent record of a property and would enable the Planning and Zoning and Inland Wetlands Commissions to check records prior to issuing permits.
 - 3. The Board of Selectmen should consider establishing a fee for lake property owners who install boat lifts or swim floats adjacent to their property.

APPENDIX A

UNDERSTANDING LAKE ECOLOGY AS IT RELATES TO WATER QUALITY

I. EUTROPHICATION

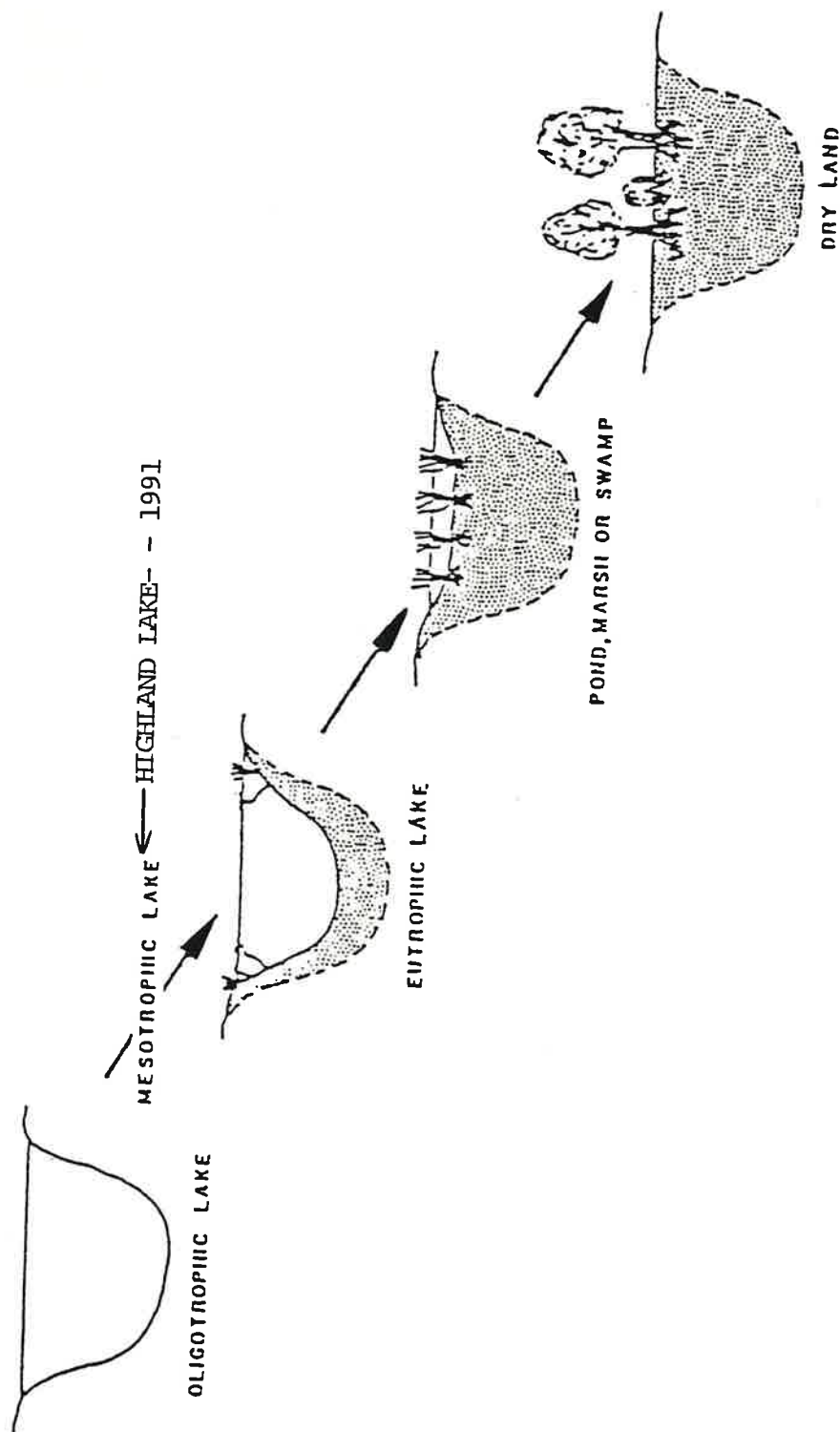
Eutrophication is the process of lake aging, caused by enrichment of the lake with plant nutrients and sediments from its surrounding watershed land. During the aging process many lake characteristics undergo dramatic changes. Changes observed include algae blooms, beds of aquatic plants, sediment deposits accumulating, the lake becoming shallower and the oxygen content of bottom waters declining. As these conditions become pronounced, recreation opportunities become seriously impaired. During the latter stages of the eutrophication process, the lake evolves to a wetland (a swamp, marsh or bog) and no longer can support its former recreation uses.

The rate at which eutrophication advances is determined by the rate at which the lake is fertilized by its watershed. Under natural conditions, nutrient inputs from a forested watershed are minimal and it may take many centuries for a lake to change in appearance. However, development and use of watershed land inevitably results in greater nutrient export from the watershed, and an acceleration in the rate of eutrophication. If watershed activities are not controlled, severe lake eutrophication can be brought about in a matter of decades.

There are three basic stages of eutrophication. Oligotrophic refers to lakes in the early stages of the eutrophication process. Such lakes are deep with clear, infertile waters, are low in biological productivity and have sparse amounts of algae and aquatic plants. They have minor accumulations of bottom sediments, and have well oxygenated bottom waters. Mesotrophic lakes exhibit a mid-range of fertility, productivity, depth and sedimentation. According to "A Watershed Management Guide for Connecticut Lakes", Highland Lake is classified as "mesotrophic" (A Watershed Management Guide for Connecticut Lakes, Connecticut Department of Environmental Protection, Bureau of Water Management, Revised, 1991, page 27).

Eutrophic refers to lakes in the late stages of aging. They are relatively shallow with fertile, turbid waters. They are high in biological productivity, have dense algae blooms and beds of vascular aquatic plants. Eutrophic lakes have substantial accumulations of bottom sediments and have poorly oxygenated bottom waters. Eutrophic lakes have limited recreational utility (A Watershed Management Guide for Connecticut Lakes, Connecticut Department of Environmental Protection, Water Compliance Unit, Revised 1988, pp. 2-3).

The diagram on the following page illustrates this process and Highland Lake's present condition.



**FIGURE 3 - EUTROPHICATION - THE PROCESS OF AGING
BY ECOLOGICAL SUCCESSION**

(Greeson, 1969)

Figure 3

II. CONTROLLING EUTROPHICATION

The key to controlling eutrophication is to reduce the supply of the growth "limiting nutrients" and sediments running into the water from the watershed. When the limiting nutrient becomes depleted, growth stops even though other nutrients are still available. Any increase in the supply of the limiting nutrient will result in a corresponding increase in growth. Carbon, nitrogen, and phosphorus are the three basic plant nutrients which could hypothetically be limiting to the growth of algae and aquatic plants in a lake. Surface waters have an abundant supply of carbon because carbon dioxide gas (CO_2) readily dissolves in lake waters from the atmosphere. Similarly, nitrogen gas (N_2) readily dissolves in lake waters from the atmosphere and is present in abundance. Thus, carbon and nitrogen are not generally limiting to the eutrophication process.

Phosphorus has been found to be the growth limiting nutrient in the eutrophication process of most lakes. The key to controlling the eutrophication process is controlling phosphorus enrichment. Recent research indicates that the control of nitrogen may also be useful in limiting the growth of larger aquatic plants. Phosphorous and nitrogen may dissolve in water or may be present on vegetation and sediments (A Watershed Management Guide for Connecticut Lakes, Connecticut DEP Water Compliance Unit, Revised 1988, p.5).

III. WATERSHED MANAGEMENT TO CONTROL EUTROPHICATION

The watershed of a lake is that land area which drains to the lake. The watershed is therefore the source of water for the lake. Water quality of a lake, to a large extent, is determined by qualities imparted to water by watershed land as the water drains to the lake.

Watershed management is aimed at identifying and controlling existing and potential watershed characteristics which ultimately influence a lake's trophic condition. Since phosphorus is the nutrient which governs the productivity of algae and aquatic plants, watershed management is primarily concerned with reducing phosphorus enrichment. An important secondary consideration is the reduction of sediment inputs which contribute to physical lake filling and the development of shallow areas where tributaries and storm waters enter the lake.

A. Sources of Water Pollutants

Sources of phosphorus and sediment are divided into two broad categories, point sources and non-point sources. Point sources are concentrated, localized discharges such as outfalls from sewage treatment plants.

Non-point sources are diffuse and are not easily identified because they do not enter a watercourse at a single point. Rainstorm runoff from a residential area and drainage from a cornfield are examples of non-point sources. In Connecticut, Water Quality Standards prohibit point source discharges into lakes and their tributaries. Thus, the primary concern for management of eutrophication in lakes is the identification and control of non-point sources (A Watershed Management Guide for Connecticut Lakes, Connecticut DEP Water Compliance Unit, Revised 1988, p.5).

1. Non-point Sources

- a. Erosion and Sedimentation

The transport of eroded soil to a lake contributes to eutrophication in several ways. Most importantly, phosphorus and other plant nutrients associated with soil particles are introduced into the lake. Another important effect is the physical presence of solid particles in the lake. Sedimentation reduces water depths, creating shoals which are conducive to the growth of aquatic plants.

In addition, organic matter associated with soil particles is decomposed by microorganisms, contributing to the depletion of oxygen in waters overlying the lake sediments.

Serious natural erosion can occur on land with steep slopes, along streambanks, and along lake shorelines. Common man-made sites of erosion are cultivated fields, roadway embankments, roadway drainage ditches, timber harvesting, and construction sites (A Watershed Management Guide for Connecticut Lakes, Connecticut DEP Water Compliance Unit, Revised 1988, p.8).

- b. Residential Land

An acre of residential land will contribute much more phosphorus to a lake than an acre of woodland in the same location.

Sources of phosphorus associated with residential land include construction site erosion, failing septic systems, properly functioning septic systems, fertilization of lawns and gardens, disposal of vegetation from yard upkeep, and stormwater runoff (A Watershed Management Guide for Connecticut Lakes, Connecticut DEP Water Compliance Unit, Revised 1988, p.10).

c. Agricultural Land

An acre of agricultural land will contribute less phosphorus to a lake than an acre of residential land in the same location, but more phosphorus than an acre of woodland. The most effective agricultural Best Management Practices include use of cover crops, field border filter strips, critical area planting, diversions, grassed waterways, streambank protection, animal waste management, optimum manure and fertilizer application rates, and changing from cultivated crops to permanent vegetation (A Watershed Management Guide for Connecticut Lakes, Connecticut DEP Water Compliance Unit, Revised 1988, p. 13).

d. Woodland and Timber Harvesting

Harvesting of timber is a land disturbance activity which has the potential to cause serious erosion and sedimentation (A Watershed Management Guide for Connecticut Lakes, Connecticut DEP Water Compliance Unit, Revised 1988, p. 14).

e. Wetlands

Scientific research has demonstrated that wetlands in a lake watershed play a vital role in regulating the timing of transport of phosphorus to the lake. During the spring and summer biological growth period, wetlands remove significant amounts of phosphorus from overlying waters and effectively withhold that phosphorus from transport downstream.

During the fall and winter, wetlands release phosphorus as decomposition of wetland vegetation takes place. Thus, transport of this phosphorus to downstream waters and to the lake occurs at a time of the year when the phosphorus is least likely to contribute to nuisance algae blooms and weed growth (A Watershed Management Guide for Connecticut Lakes, Connecticut Department of Environmental Protection, Water Compliance Unit, Revised 1988. p.15).

f. Stormwater Runoff

Runoff from residential areas and roadways to a lake results in the transport of sediments, phosphorus and other pollutants to lake waters (A Watershed Management Guide for Connecticut Lakes, Connecticut Department of Environmental Protection, Water Compliance Unit, Revised 1988. p.16).

g. Roadway Runoff

State highways, town streets, and unpaved roads can be significant sources of sediments in lake watersheds (A Watershed Management Guide for Connecticut Lakes, Connecticut Department of Environmental Protection, Water Compliance Unit, Revised 1988. p.17).

h. Waterfowl

Large numbers of migratory waterfowl which spend considerable periods of time on a lake can contribute appreciable loadings of phosphorus and nitrogen to lake waters (A Watershed Management Guide for Connecticut Lakes, Connecticut Department of Environmental Protection, Water Compliance Unit, Revised 1988. p.17).

i. Streambanks and Shorelines

Streambanks and shorelines are sites where erosion can cause sedimentation which immediately impacts a lake. Activities which disturb the land surface should be avoided in these areas and maintenance of a zone of natural vegetation should be encouraged. It is common practice for lakeside property owners to construct retaining walls absorb the shock of waves and prevent soil from eroding into the lake (A Watershed Management Guide for Connecticut Lakes, Connecticut Department of Environmental Protection, Water Compliance Unit, Revised 1988. p.18).

j. Lake Sediments

Under certain conditions, sediments on the lake bottom can release phosphorus and nitrogen to overlying waters. Depending on lake mixing characteristics and algae bloom sequences, these recycled nutrients may contribute to nuisance algae blooms (A Watershed Management Guide for Connecticut Lakes, Connecticut Department of Environmental Protection, Water Compliance Unit, Revised 1988. p.18).

k. Household Pets

Excrement from household pets, especially dogs, is a source of pollution that should be managed in lake watersheds. Pet manure contains organic matter, plant nutrients and bacteria which can be transported from paved surfaces to lake waters by stormwater runoff. Pet droppings should be collected and properly disposed of (A watershed Management Guide of Connecticut Lakes, Connecticut Department of Environmental Protection, Bureau of Water Management, Revised 1991. p.16).

1. Recreational Beaches

Erosion by wave action and stormwater runoff may wash sand from recreational beaches into a lake. Lost sand is usually replaced with new sand, which is subsequently lost and replaced again. This cycle results in filling-in of the lake and increasing habitat for nuisance aquatic weeds.

Beaches should be designed to have sand stabilized by vegetation and/or by retaining walls. Where feasible, dry dredging should be implemented to recapture sand washed into the lake (A watershed Management Guide of Connecticut Lakes, Connecticut Department of Environmental Protection, Bureau of Water Management, Revised 1991. p.16).

APPENDIX B

HISTORY OF WATER QUALITY TESTING AT HIGHLAND LAKE

The water quality of Highland Lake has been studied for many decades which allows us to make comparisons and identify trends. The earliest study which we found record of was conducted in 1938 by the state Board of Fisheries and Game and entailed testing the water temperature and amount of dissolved oxygen only.

A number of tests have been conducted since that time on such aspects of water quality as aquatic weeds, nutrient loads of phosphorous and nitrogen, transparency, degree of coliform bacteria, fish populations and levels of Ph (Phase I Diagnostic/Feasibility Study, Highland Lake, Winchester, Connecticut, 1980, Connecticut Department of Environmental Protection Water Compliance Unit, page 55).

Water Temperature and Oxygen Levels

In 1938, the State board of Fisheries and Game conducted water temperature and dissolved oxygen tests. The water temperature and amount of dissolved oxygen were recorded at depths from 0 to 18 feet. Similar tests were conducted in 1976 by the Department of Environmental Protection and again in 1980. The 1938 water temperatures were comparable to the 1976 data but were cooler than the 1980 samples. The most notable difference was that hypolimnetic dissolved oxygen supplies were not depleted in 1938 as they were in 1976 and 1980.

This data comparison suggests a deterioration in water quality due to the advancement of eutrophication between 1938 and 1980, manifested as increased oxygen demand of lake sediments (Phase I Diagnostic/Feasibility Study, Highland Lake, Winchester, Connecticut, 1980, Connecticut Department of Environmental Protection Water Compliance Unit, page 55).

In 1986, Ecosystem Consulting Service, Inc. compiled a "Summer Monitoring Report" which indicates a " progression of oxygen loss during summer 1986...these values (metabolic oxygen consumption) place Highland Lake at a borderline mesotrophic-eutrophic classification. By August 28, 1986, all three basins (bays) exhibited anoxia throughout the hypo (lower, cooler) and metalimnetic (middle) layers.

Coolwater fishery habitat was severely limited. This condition may lead to a reduction in the piscivorous fish (fish eating fish) population...(which) may have a very serious consequence relative to the trophic state and overall quality of Highland Lake" (Highland Lake: 1986, A Summer Monitoring Report, Ecosystem Consulting Service, Inc. page 4).

In 1987, the DEP Water Compliance Unit report on water quality trends stated "Dissolved oxygen levels in Highland Lake have fluctuated widely with 1979 and 1980 being very good years and 1985 being an especially bad year...Improvement was found in 1986 and 1987, with anoxic conditions being limited to the bottom 7 meters and 5 meters for the more recent years." (DEP Water Compliance Unit Report on Water Quality Trends at HL, 1987, page 3).

According to the DEP 1988 Highland Lake Report, "1988 was the second of two years without a drawdown. These two years would allow the lake sediments to stabilize and some bottom vegetation to develop to prevent further subsurface erosion which would improve water clarity and dissolved oxygen...In 1988 the amount of oxygenated water increased by 3 meters to a level of 8 meters...The most important information of this report is the oxygen in the thermocline during 1988, therefore improved trout habitat". (DEP 1988 Highland Lake Report, Water Compliance Unit, page 1).

Since oxygen content and temperature effect a lake's ability to support fish and prevent algae blooms, continued monitoring of these aspects of water quality would be a prudent management practice.

Nutrient Data

The Diagnostic/Feasibility study of Highland Lake completed by the DEP in 1980 provides the first record of nutrient data. The amount of phosphorous and nitrogen and their ratios were recorded after samplings of water were taken 7 times from April, 1980 through November, 1980.

Summaries of the data state "the nutrient data for First Bay indicate low to moderate enrichment, with no appreciable recycle of nutrients from sediments to bottom waters during the summer months. The surface waters were phosphorus limited" (Phase 1 Diagnostic/Feasibility Study, Highland Lake, Winchester, Connecticut, 1980 Connecticut DEP Water Compliance Unit, page 57).

The summary for Second Bay states "the random variability in the phosphorous measurements makes interpretation of nutrient data difficult. The elevated phosphorous measurements were not correlated with nitrogen, algae, or transparency data, suggesting that phosphorous measurements may not have been representative of conditions prevailing in the lake. Hypolimnion samples suggest moderate recycle of nutrients from sediments during the late summer period. Thermal resistance to mixing could prevent these nutrients from contributing to the growth of epilimnetic algae in the summer months" (Phase I Diagnostic/Feasibility Study, Highland Lake, Winchester, Connecticut, 1980 Connecticut DEP Water Compliance Unit, page 62).

The summary for Third Bay states "phosphorous concentrations in all samples collected were consistently low and generally within the range of those Connecticut lakes which are oligotrophic. The majority of the total nitrogen values fell into the range of concentrations found in mesotrophic to eutrophic lakes in Connecticut" (Phase I Diagnostic/Feasibility Study, Highland Lake, Winchester, Connecticut, 1980 Connecticut DEP Water Compliance Unit, page 62).

In 1987, the DEP reported "Nutrients are still low, ranging from 0.01 ppm to 0.05 ppm total phosphate, showing a gradual increase over the levels ten years ago, but averaging about the same as 1980" (DEP Water Compliance Unit Report of Water Quality Trends at HL, 1987, page 3).

Aquatic Weeds

Aquatic macrophytes (weeds) have been surveyed since 1953 when the State Board of Fisheries and Game recorded data.

The results of this survey revealed that 60 % of the shoal area (that area under 3 feet), was inhabited by submerged vegetation. Approximately 20% of the shoal area possessed emergent weeds. Weed growth sampling was also conducted by the DEP in 1980.

Sampling began in April, 1980 and was completed in November, 1980. The data was summarized " Highland Lake exhibited phytoplankton communities which are characteristic of lakes low in fertility. The consistent dominance of the flagellate *Dinobryon sertularia* is a strong indication of generally low levels of nutrient enrichment. The lake was free from nuisance blooms of bluegreen algae which are typical of enriched lakes" (Phase I Diagnostic/Feasibility Study, Highland Lake, Winchester, Connecticut, 1980, Connecticut DEP Water Compliance Unit, page 82).

According to the 1987 DEP Report, "By 1984, dense macrophyte growth in the shallow bays of Highland Lake led to the decision to lower the water level over the winter of 1984-85. This drawdown of about 7 feet was successful in decreasing the density of *Myriophyllum verticillatum* which was the nuisance species the drawdown was targeted to control...Subsequent drawdowns took place the next two winters. ...Aquatic weed problems have apparently been controlled by these drawdowns" (DEP Water Compliance Unit Report on Water Quality Trends at HL, 1987, page 2).

In 1985, the Highland Lake Macrophyte Map was compiled by Ecosystem Consulting Service, Inc. for the Highland Lake Commission. The study updated macrophyte populations and the effectiveness of the winter drawdown for the control of nuisance weed growth. Winter drawdown was deemed effective in controlling the spread and increase of water milfoil, the species which offers the greatest potential to be a nuisance. It was suggested that such drawdowns be conducted every two to three years (Highland Lake Macrophyte Map, Ecosystem Consulting Service, Inc. 1985 Executive Summary/Abstract).

Fish Population

"Highland Lake's fish populations have been surveyed several times since the publication of the 1942 Fishery Survey. The results of the 1942, 1959 and 1969 surveys are compared with the most recent survey in 1972 with fish such as yellow perch, largemouth bass and common bullheads being present during all samplings. Lake trout and landlocked salmon were not present during the 1972 survey. The lake is presently managed for and stocked with brown and rainbow trout" (Phase 1 Diagnostic/Feasibility study, Highland Lake, Winchester, Connecticut, 1980, Connecticut DEP Water Compliance Unit, page 97).

Coliform

Regarding coliform bacteria, in-lake levels were low during each sampling occasion in 1980. The highest coliform counts were in samples taken in Taylor Brook though a much lower count was recorded in late September. This seasonal variation appears to be correlated with activity levels at the State Park land adjacent to Taylor Brook.

pH Count

The pH of Highland Lake was measured on several occasions during the 1980 sampling period. "It is apparent from these results that the pH of the lake has not changed appreciably in 42 years" (Phase I Diagnostic/Feasibility study, Highland Lake, Winchester, Connecticut, 1980, Connecticut DEP Water Compliance Unit, page 97).

In 1986, Ecosystems reported "All (Ph) values were "typical" for a softwater lake, generally about 6.1 to 6.6" (Highland Lake: 1986, A Summer Monitoring Report, Ecosystem Consulting Service, Inc., page 5).

Finally, according to the 1980 DEP study, "the water quality data demonstrates that Highland Lake is an early mesotrophic lake, relatively low in fertility and primary productivity. Nutrient levels were generally low and transparencies were generally high. Comparisons with historical monitoring data suggest that the lake has advanced slightly in eutrophy during the past few decades, but that aquatic macrophytes have changed little in the past 30 years" (Phase I Diagnostic/Feasibility Study, 1980, page 102).

APPENDIX C

EFFECTS OF EROSION AND SEDIMENTATION ON WATER QUALITY

Winter Road Sand

All sand spread on portions of roads that drain into the Lake is potential sedimentation. We do not know how much sand is spread but an experiment was made on a typical portion of Moore Avenue in the spring of 1990. before the Town sweeper came by, the sand was dug up and measured on a fifty (50) foot segment of shoulder and it extrapolated into a figure of 20 cubic feet (cf) of sand per one hundred (100) feet of road. This figure undoubtedly varies from place to place and from year to year, but it is used in this text only to provide a concept of potential sedimentation if nothing is done about it.

Wakefield Boulevard has about 29,000 feet of pavement that drains eventually into the Lake.

Taylor Brook Road drains about 3,000 feet of road into the Lake

Sucker Brook drains over 1,700 feet of various highways into the Lake.

At 20 cf of sand per 100 feet of road, the above equals 6,740 cf of sand, or 249.6 cubic yards (cy), or about 2 inches deposited over an acre, or would fill about nine 8' X 12' rooms up to an 8 foot ceiling. This is an approximation of the potential winter road sand that would be washed into the Lake each year if there was no road sweeping or cleaning of catch basins.

The salt put down would be one seventh of this figure, but is less likely to be swept up as it melts and runs off into the Lake with the rain and snow water.

Sedimentation From Stream Erosion

A map by Joe Cadrain shows 15 streams flowing into Highland Lake; some are quite small but all erode and carry sediment into the Lake. Two streams are special cases; Taylor Brook and Sucker Brook.

Taylor Brook flows through a drained pond area that has been worked for peat. The operation is not going on now, but in high water, much silt is carried downstream.

Sucker Brook is the principle source of surface water for the Lake. It rises in the overflow of Crystal Lake and two steep streams and flows through the Government Flood Control Dam into Highland Lake.

Sedimentation From Lake Shore

Storm waves and boat wakes erode the shore where it is unprotected.

Beaches

Sand from public swimming places gets washed down into the Lake during the summer and has to be replaced in the spring.

Some land owners put sand in front of their places and this also washes down.

Recommendations

1. To prevent most of the winter road sand and stream erosion from flowing into the Lake, settlement detention basins are needed at all points where streams cross Wakefield Boulevard and where drainage from the Boulevard goes into the Lake (these are not totally lacking but are not presently adequate). These basins need frequent cleaning.

Taylor Brook is a special case. High water brings down heavy siltation from the peat bog. It enters the Lake across State property and the topography just before it goes under Wakefield Boulevard would lend itself to the construction of a large settling basin and culvert. Presently, the road sometimes floods out at this point. If any attempt is made to reopen the peat operation, the Wetlands Commission should enforce existing sediment and erosion regulations to protect the Lake.

Sucker Brook is another special case because of its consistent high flow. It flows across Government Land which topographically lends itself to the construction of a large settlement detention basin. These large basins must be designed to be easily and frequently cleaned.

The whole system of retention basins should be top priority and in place before any consideration is taken of dredging.

Off-road vehicle use on the Flood Control property causes erosion and sedimentation into Sucker Brook. This land should be posted against such use.

2. Early spring road sweeping of Wakefield Boulevard and Taylor Brook Road helps reduce sedimentation of the Lake.

3. Around the Lake shore, where appropriate, the building of retaining walls should be encouraged or required. Lake front owners should be required to maintain existing walls just as owners in Town must maintain sidewalks.

Boats should be required to operate at a no-wake speed when within 100 feet of shore.

4. An underwater barrier to contain sand on the public beach is not advised because of the potential danger to bathers. replenishing this sand should be done sparingly. The prohibition of placing sand on private beaches should be enforced.

APPENDIX D

SUMMARY OF WATERSHED MANAGEMENT RECOMMENDATIONS

Phase 1 Diagnostic/Feasibility Study, Highland Lake, Winchester, Connecticut, 1980. Connecticut Department of Environmental Protection Water Compliance Unit.

1. It is recommended that the local health officials of the town of Winchester ensure the proper management of existing adequate sewage disposal systems in the Highland Lake watershed. The town should develop an information and education program for watershed residents to explain proper use and maintenance of septic systems.
2. It is recommended that local health officials exercise exceptional care in overseeing the design and construction of any new on-site sewage disposal systems in the Highland Lake watershed, especially for sites near the lake and its associated watercourses. Proper administration and enforcement of the State Public Health Code in the watershed is essential.
3. It is recommended that the Winchester Conservation and Inland Wetlands Commission utilize, to the extent possible, the authorities of Connecticut's Inland Wetlands and Watercourses Act (Sections 22a-36 through 22a-45 Connecticut General Statutes) to maintain the wetlands in the watershed in their natural states. The wetlands agencies should give due consideration to wetlands functions which enhance Highland Lake's water quality when acting on permit applications for regulates activities in legally defined wetlands.
4. It is recommended that the town of Winchester strictly enforce zoning regulations requiring erosion, sediment, and runoff controls for future construction activities in the watershed.
5. It is recommended that timber harvesting operations in the watershed utilize the erosion control practices described in the Connecticut 208 Forestry Advisory Committee report entitled Logging and Water Quality In Connecticut- A Practical Guide for Harvesting Forest Products and Protecting Water Quality.

6. It is recommended that residents near Highland Lake have soils tested so that fertilizer applications can be matched to soil nutrient requirements. It is also recommended that residents near Highland Lake avoid applying fertilizers when heavy rains are forecast.
7. It is recommended that residents near Highland Lake voluntarily use non-phosphate laundry detergents in order to reduce phosphorus loadings to septic systems by 30 to 40 percent.
8. It is suggested that lakeside landowners dispose of all material from yard maintenance activities, such as leaves and grass clippings, at a suitable site away from the lake and its watercourses so as not to become a source of nutrient enrichment of lake waters.
9. It is recommended that the Town implement a regular program of street sweeping of streets near the lake in the spring time. It is also recommended that the Town implement a regular program of catch basin maintenance. Sediment and debris trapped in the catch basin should be removed following the street sweeping. A suitable site for disposal of this material should be located a safe distance away from the lake or its watercourses. Installation of additional catch basins should be conducted, ideally wherever storm drains are discharging to the lake or its watercourses.
10. In order to quantify the potential nutrient loading from waterfowl to Highland Lake, it is recommended that accurate records be developed for population counts, feeding habits, resting habits, and periods of occupancy.

APPENDIX E

GUEST SPEAKERS PRESENTING TO HL PLAN SUBCOMMITTEE

1. February 7, 1990: Charles Fredette, Chuck Lee, Sanitary Engineers, Department of Environmental Protection, Lake Management Bureau - Review of Water Quality Studies.
2. March 7, 1990: James Rokos, Director, Torrington Area Health District - Review of septic/well activities at HL since 1983.

Gary Dufel, Stearns and Wheler - Review of 1987 Feasibility Study for Sewering Highland Lake.

3. April 4, 1990: Review of telephone contacts:
 - a. Apley Austin-First Selectman of Morris-Bantam Lake re: sewerage.
 - b. Tony Cantele-DEP Division of Conservation and Preservation re: State interest in hooking Taylor Brook Campground into sewer.
 - c. Steven Allaire-Town Attorney re: "concept of grandfathering".
4. April 25, 1990: Joint meeting with Subcommittee for Plan of Development-Dennis Brown; coordination of Highland Lake Management Plan with Town Plan.
5. May 2, 1990: Emille Nalette, Chairman Water Pollution Control Authority - Review of proposed sewer project for Highland Lake.

Joanne Williams, Building Inspector - Perception on development at HL.

6. June 6, 1990: Tom Carey, Planning and Zoning Commission Vice Chairman - Review of P&Z activities pertaining to HL.
7. July 10, 1990: Pat Wass, Inland Wetland Commission Chairperson - Review of IWC activities pertaining to HL.

David Battista, Lenard Engineering - Review of information regarding sewer districts, long range plan for Town water system.

Bob Simmons, IWC & HLMP - Report regarding Army Corps of Engineers involvement with HL.

8. August 7, 1990: Public Input Session (2 hours).
9. August 18, 1990: Public Input Session (2 hours).
10. November 7, 1990: Major Randolph Dill, DEP Director of Boating Safety Division - Review of statewide trends in regulating boating for increased safety.

Joseph Ligi, Chief of Police - Review of Marine Patrol activities for summer of 1990.
11. January 2, 1990: Bob Simmons, IWC & HLMP - Review of Watershed Protection Study (LHCOE) 1990.

**LIST OF DOCUMENTS REVIEWED BY THE SUBCOMMITTEE
FOR DEVELOPING THE HIGHLAND LAKE MANAGEMENT PLAN**

1. 1978: Lake Waramaug Watershed Management Plan (Lake Waramaug Task Force-Northwestern CT Regional Planning Agency).
2. 1980: DEP Diagnostic Feasibility Study (Conducted by DEP Water Compliance Unit for Town of Winchester).
3. 1981: Land Use Study-Highland Lake Area (Conducted for Planning and Zoning by TPA).
4. 1984: Letter from Highland Lake Commission to Litchfield County Soil and Water Conservation District and their response.
5. 1985: Highland Lake Macrophyte Map (Prepared for Highland Lake Commission by Ecosystem Consulting Service).
6. 1986: A Summer Monitoring Report (Prepared for Highland Lake Commission by Ecosystem Consulting Service).
7. 1986: Highland Lake Survey (Conducted by Clare Stevens and Leya Edison).
8. 1987: DEP Highland Lake Report (To Highland Lake Commission from DEP-follow up on 1980 study).
9. 1987: Highland Lake Watershed Study (Conducted by Litchfield County Soil and Water Conservation District).
10. 1987: Feasibility for Extension of Sewer Service to Highland Lake (Prepared for Town of Winchester by Stearns and Wheler).
11. 1988: DEP Highland lake Report (To Highland Lake Commission from DEP-follow up on 1987 study).
12. 1988: A Watershed Management Guide for Connecticut Lakes (Prepared by DEP Water Compliance Unit).
13. 1988: Lake Pocotopaug Area Task Force Recommendations (Prepared by Lake Area Task Force for Town of East Hampton).

14. 1990: Inland Wetlands and Watercourses Regulations for the Town of Winchester (Original Regulations with revisions through 1990).
15. 1990: Zoning Regulations for the Town of Winchester (Originally adopted-1956; revised through 1990).
16. 1990: Dredging Feasibility Study for Highland Lake (Prepared for the Town of Winchester by Wengell, McDonnell & Costello, Inc.).
17. 1990: North American Lake Management Society Journal (Article on a variety of topics regarding lake management).
18. 1990: Watershed Protection Study-Crystal Lake-Rugg Brook Reservoirs-Regional Planning Bulletin (Commissioned by Litchfield Hills Council of Elected Officials).
19. 1991: A Watershed Management Guide for Connecticut Lakes (DEP Bureau of Water Management).onnecticut DEP Water Compliance Unit, page 97).