Onota Lake
Long-Range Management Plan

Spring 2004

Prepared For:

The City of Pittsfield

Prepared By:

Berkshire Regional Planning Commission
1 Fenn Street, Suite 201
Pittsfield, MA 01201

Lake Onota Preservation Association, Inc.
PO Box 2884
Pittsfield, MA 01202

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Long-Range Management Plan
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City of Pittsfield Onota Lake Long Range Management Project
Project conducted from July 2002 to June 2004

Prepared by
Berkshire Regional Planning Commission
and
Lake Onota Preservation Association

Prepared for the
City of Pittsfield

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Executive Summary

Onota Lake is a 617-acre lake located entirely within the City of Pittsfield. Many recreational opportunities are provided by the lake and are enjoyed by area residents as well as those visiting the Berkshires. However, like many area lakes, Onota Lake is threatened. While these problems are not unusual or atypical they do require attention.

The Onota Lake Management Plan has been generated by the Lake Onota Preservation Association Incorporated (LOPA) and the Berkshire Regional Planning Commission (BRPC) with the City of Pittsfield. Funding for the development of the lake management plan was provided by the Berkshire Environmental Fund (BEF) through a Community Improvement Grant to the City of Pittsfield. The intent of the management plan is to serve as a guideline for lake management decisions in future years as the City of Pittsfield attempts to maintain the aesthetic and recreational attributes of this magnificent natural and economic resource.

This plan provides background information on the lake and its watershed, a brief review of past and current lake preservation initiatives, a review of previous lake management recommendations, and a brief description of local authorities and "stakeholders".

BRPC, LOPA and the City of Pittsfield facilitated a Technical Advisory Group to: a) identify the problems and concerns experienced by lake users; b) explore alternative feasible management approaches c) develop management goals and objectives; and d) draft a proposed five year action plan to present to the City of Pittsfield Administration and City Council.

The Technical Advisory Group was composed of volunteers and of people from agencies and municipalities, who were familiar with Onota Lake as well as technical and regulatory matters. Special thanks are due to the active members of the Technical Advisory Group Bob Race, Tom Armstrong, Dorothy Mara, Dick Laureyns, Jane Winn, Dennis Reagan, Jim McGrath, and Tom Matuszko. The Technical Advisory Group provided an assurance that the management plan stayed on track and was technically credible.

The Technical Advisory Group met to develop the lake management plan and to discuss management goals and objectives. Finally, the short range and long range management objectives were identified and the proposed five year action plan was developed.

The Technical Advisory Group considered a wide-range of problems and concerns. They did not limit their considerations to strictly water quality concerns, but rather identified concerns relative to the aesthetics, environmental quality and overall condition of the lake, both presently and projecting into the future. These problems and concerns form the basis for the development of management goals and objectives, which in turn form the basis for specific recommended management actions. The Technical Advisory Group then prioritized each of the identified problems and concerns. Identified problems and concerns included nuisance aquatic plants, drawdown/management of water level, watershed management, education and outreach, and recreation and regulations.

Chapter 1 - Onota Lake and its Watershed

Onota Lake is a 617-acre lake located entirely within the City of Pittsfield, (See Map 1). The watershed of Onota Lake is approximately 6,345 acres in area. Onota Lake is often described as "two lakes in one" because of the minimal water exchange between the north and south basins due to the old roadway that marked to north end of the original lake prior to the building of the dam. The outlet of Onota Lake, Onota Brook, flows southeast entering the West Branch of the Housatonic River, in Pittsfield. (Souza et al., 1991)

The *Housatonic River Basin 1997/1998 Water Quality Assessment Report* classified Onota Lake as mesotrophic. (DEP, 1998) Onota Lake is listed on the *Massachusetts Year 2004 Draft Integrated List of Impaired Waters* as being impaired by exotic species (EOEA, 2004). At the present time, the water quality at Onota Lake appears to be appropriate to its uses. However, the excessive growth of exotic aquatic plants threatens recreational options and other current uses of the lake. Onota Lake's eutrophication can be attributed to watershed urbanization and subsequent increases in sediment and nutrient loading. The most all-encompassing cause of Onota Lake's problems are a result of excessive sediment and nutrient loading. Non-point source pollution, including erosion must be controlled. (Souza et al., 1991)

Like any watershed, the Onota Lake watershed is vulnerable to the impacts of the land use patterns. The potential for accelerated sedimentation, the removal of vegetation filters and the increased pollutant loading of waterways that is associated with changing landscapes threatens the present conditions of Onota Lake. Future development within the lake's watershed could substantially accelerate the lake's eutrophication process. (Souza et al., 1991)

Rainfall & Climate

Precipitation is typically evenly distributed throughout the year and averages about 46 inches (117 cm) annually. The average monthly precipitation varies from a low of 2.7 inches (6.9 cm) in October to a high of 4.3 inches (10.9cm) in April. Much of the winter precipitation falls as snow, which averages about 75 inches (190.5cm) annually. The local climate is characterized as humid with temperatures ranging in the North Temperate Zone, with a 46 degree Fahrenheit average. (Souza et al., 1991)

Topography & Soils

Onota Lake is located in the Upper Housatonic River Basin, which is divided into a three-part physiographic system: the valley of the Housatonic River, which includes the main stem and its two major tributaries, the East and West branches. Elevations within the Upper Housatonic River Basin range from 2,625 feet (800m) above sea level at Brodie Mountain to 951 feet (290m) at Pittsfield. Onota Lake is located at an elevation of 1086 feet (331m) according to USGS topographic maps. However, the dam spillway is located at 1078.9 ft. (Souza et al., 1991)

The Onota Lake watershed is in the New England Province of the Appalachian Highlands, and has two distinct physiographic regions: the Taconic Mountains and the Berkshire Valley. The Taconic Range is composed of mostly quartz mica schistose rock with some garnetiferous schist formed 350 million years ago. This range generally forms the western boundary of the watershed. The Berkshire Valley, which contains Onota Lake, is underlain by carbonate rocks such as limestone, dolomite, and marble. Each of these types of bedrock contains subsurface water in fractures and faults, with the carbonate type typically exhibiting limestone solution cavities. (Souza et al., 1991)

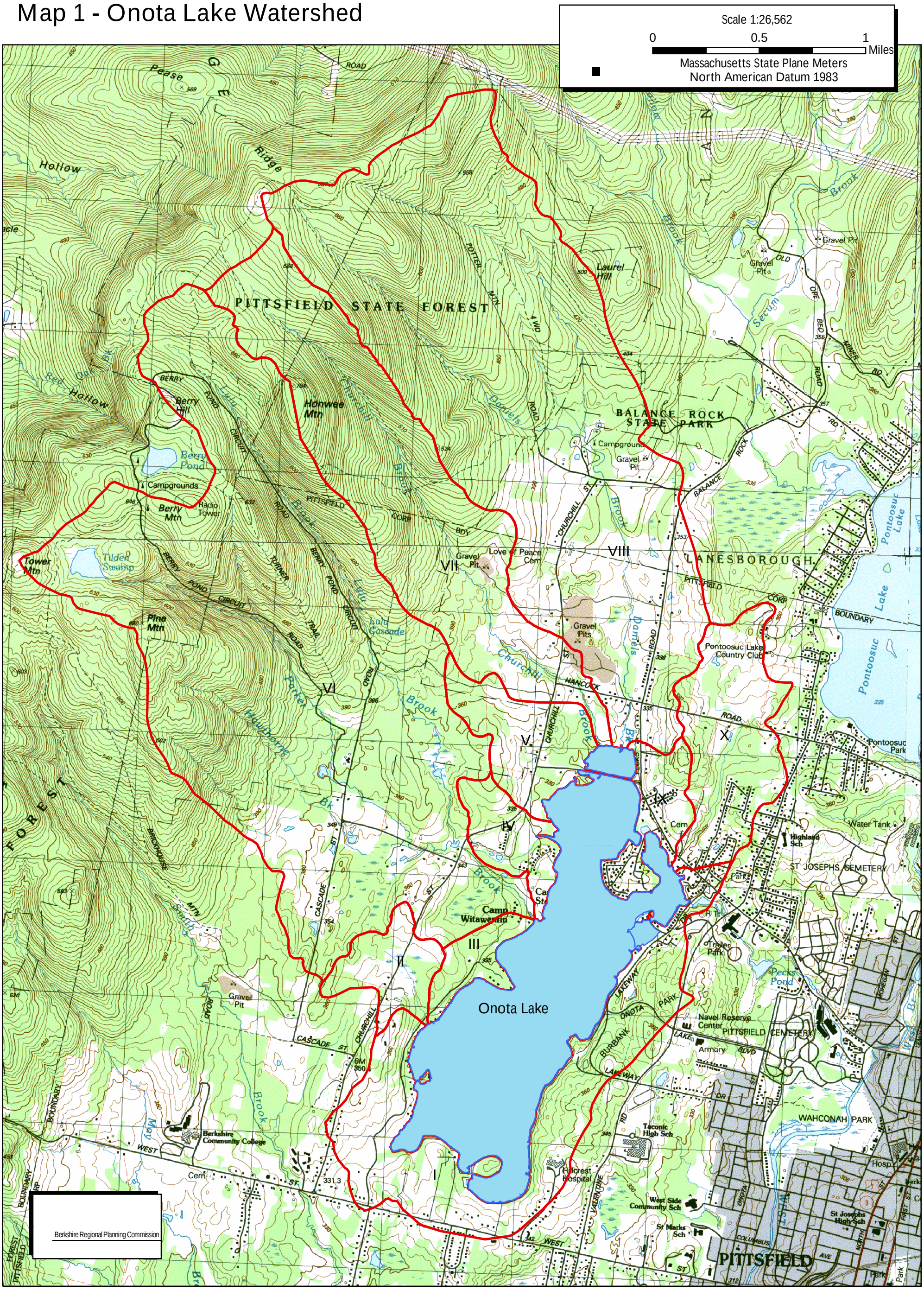
The surficial geology of the Onota Lake watershed can be broadly categorized into stratified glaciofluvial deposits serving as ground water recharge areas and unstratified glacial till. This till is composed of a mixture of boulders, stones, sand, silt, and clay in various mixtures formed 25,000 years ago. The limited porosity of these soils results in slow infiltration and minimal ground water recharge, with most precipitation lost through surface or lateral downslope subsurface runoff. The lateral subsurface runoff contributes hydrologically to the streams and brooks which drain into the lake. Stratified drift deposits and unstratified till overlay the carbonate rock surrounding Onota Lake to form a mosaic of sil types which include silty and sandy loams, very stony loams and rock outcrops with steep slopes. (Souza et al., 1991)

Land use

A variety of land uses are found within the watershed. These land uses include, among others, commercial, participation recreation, urban open land, agriculture, mining, and low, moderate, and high density residential. (MassGIS 1997 Land use Data) Although the majority of the watershed is not highly developed, the northeastern section of the lake is the most densely developed (See Table I). The vast majority of the development within the watershed has occurred around the shoreline of the lake, limiting forested and open land to the periphery of the watershed. A significant number of residences have converted from seasonal to year round occupancy with the average residence time currently eleven months per year.

The Onota Lake watershed includes a small amount of commercial land, which includes a commercial boat marina. In addition to commercial land the watershed supports two mining operations and several agricultural operations. The Pontoosuc Lake Country Club and its associated golf courses are within the watershed of Onota Lake along with Hillcrest Hospital. Residential development in the Onota Lake watershed consists primarily of lots greater than ½ acres, with the exception of the northeastern section of the watershed, which includes the densely developed Thomas Island. Several summer camps are also operated within the watershed some of which maintain lakefront property with lake access. Public access is provided through Burbank Park, a municipally owned park that includes a public boat launch, fishing pier, restrooms, and parking areas. Burbank Park serves as the primary access point for lake users that do not live on the lake. The park includes a fishing pier, a boat ramp, and the Controy Pavilion. (Souza et al., 1991)

Onota Lake Management Plan
Map 1 - Onota Lake Watershed



Berkshire Regional Planning Commission

Table 1 Land use by Sub-watershed in Acres										
Land Use	**Sub-watershed I**	**Sub-watershed II**	**Sub-watershed III**	**Sub-watershed IV**	**Sub-watershed V**	**Sub-watershed VI**	**Sub-watershed VII**	**Sub-watershed VIII**	**Sub-watershed IX**	**Sub-watershed X**
Cropland	2.31	0.00	0.00	5.46	33.32	57.04	21.29	205.08	0.97	7.99
Pasture	53.36	26.13	2.04	0.00	0.00	74.62	12.78	38.99	0.25	8.69
Forest	222.01	44.06	43.65	38.32	90.10	1880.97	675.88	1295.94	33.04	117.32
Wetland	8.02	0.00	0.00	0.00	2.24	16.03	3.44	4.86	0.15	0.00
Mining	0.00	0.00	0.00	0.00	0.00	0.00	2.63	27.02	0.00	0.00
Open Land	58.68	18.36	0.00	2.80	24.99	10.81	36.23	50.69	8.82	4.46
Participation Recreation	4.49	0.00	0.00	55.80	3.76	17.47	0.00	11.00	0.00	67.59
Spectator Recreation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Based Recreation	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88
Muli-family Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Smaller than .25 acre lot Residential	42.48	0.00	0.00	0.00	0.00	0.00	0.00	10.78	31.49	21.79
.25-.5 acre lot Residential	49.09	0.00	0.00	0.00	0.00	0.00	0.00	9.77	17.40	11.73
Larger than .5 acre lot Residential	88.46	20.68	21.57	0.00	18.11	44.53	11.57	106.96	11.62	15.87
Salt Wetland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	2.89	0.00	0.00	0.00	0.00	2.17	0.00	0.00	0.00	0.00
Industrial	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Urban Open	16.16	0.00	0.00	0.00	0.00	0.91	0.00	3.33	1.73	1.20
Transportation	3.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Waste Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.42	0.00	0.00
Woody Perennial	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Acres	**553.25**	**109.23**	**67.26**	**102.38**	**172.50**	**2104.54**	**763.82**	**1768.83**	**105.47**	**257.52**
Derived from MassGIS data, land use data circa 1997, and displayed in acres.										

Macrophytes

Macrophyte surveys of Onota Lake conducted in 2002 and 2003 by Aquatic Control Technology (ACT) and GeoSyntec Consultants, respectively, have documented a relatively diverse macrophyte community with a minimum of twenty-two (22) species observed. (ACT, 2002; GeoSyntec 2003) These twenty-two species include four species designated as non-native, invasive species by the Massachusetts Natural Heritage and Endangered Species Program (NHESP). These noxious aquatic plants are Eurasian watermilfoil (*Myriophyllum spicatum),* Curlyleaf Pondweed (*Potamogeton crispus),* European Naiad (*Najas minor),* and Water Chestnut (*Trapa natans*). Unfortunately, Eurasian watermilfoil and Curlyleaf Pondweed are clearly the dominant species found in the lake as shown in Table 2, which documents early season 2003 findings. By mid-August of 2003, problematic densities, primarily made up of E. milfoil, covered the majority of the northern portion of the lake. (GeoSyntec 2003)

Natural Heritage and Endangered Species

In September 2003 two ponds within the Onota Lake watershed (Theodore Pomeroy Pond and the pond north of Dan Casey Causeway) were designated as Priority Habitat by the Massachusetts Natural Heritage and Endangered Species Program. This listing stems from the presence of two endangered species. Both species are macrophytes, the Comb watermilfoil (*Myriophyllum verticillatum*) and Ogden's Pondweed (*Potamogeton ogdenii*).

Wetland Ecosystems

Located along the lake's periphery are approximately twelve wetland systems. Most of these wetlands are along the northern half of the lake, and five of them are associated with inlet streams. These habitat systems include forested swamps, emergent shrub swamps, and freshwater marshes. Based on vegetation inventories and habitat evaluations performed on the area, three major wetland systems provide moderate to high quality wildlife habitat. (Wagner et al., 1996)

Water Quality

The water quality of Onota Lake supports its present uses. Water quality data indicates that the water quality of the deeper south basin is more desirable than that in the shallower north basin. (LOPA Annual Report, 2003) This is not surprising since the two largest subwatersheds drain into the north basin. With minimal water exchange between the two basins the water quality is expected to be better in the south basin. (Souza et a., 1991)

Both the north and south basin exhibit conventional behavior of winter isothermal condition, summer stratification with anoxic hypolimnion, and fall turnover. Onota Lake has displayed a pattern in which concentrations of oxygen in the metalimnion are in excess of saturation. This

phenomenon has occurred typically each year during stratification. This reflects oxygen production, which is suspected to be caused by either algae or dinoflagelites. As stratification intensifies Onota Lake experiences a decrease in the oxygen concentration of the hypolimnion. This decrease in oxygen is the result of the decomposition of organic sediments, detritus, and algal cells. The oxygen deficit is sufficient to cause anoxic conditions to persist towards the bottom of the lake in both basins. Under anoxic conditions changes in sediment chemistry allow phosphorus to become remineralized. The soluble phosphorus, which has been remineralized can potentially be circulated in the water column and available for algae and macrophytes. (Souza et al., 1991)

According to secchi disc transparency tests conducted by LOPA volunteers, the water clarity was reduced after the 1999 SONAR treatment. (LOPA Annual Report, 1999) Regular secchi disc transparency tests conducted by LOPA volunteers show an improvement in transparency toward pre-treatment conditions. One cove has exhibited reduced water clarity on rare occasions falling below the state mandated 1.4 meters for swimming. Secchi disc transparency averages between 3 meters depth to 6 meters depth. (LOPA Annual Report, 2003)

Blythewood Tributary is a small tributary located in the western portion of the watershed. The tributary is typically dry during much of the summer. This tributary originates in a wetland on either side of Churchill Street, and runs through farmland before crossing Blythewood Drive and flowing into Onota Lake. Volunteer water quality sampling conducted by LOPA in 2003 did not indicate any significant problems in this stream. However, residents along Blythewood have noticed a manure smell on occasion and it has been reported that cattails are growing in the area where the stream enters the lake. The new growth of cattails may indicate that increased nutrients and sedimentation are entering Onota Lake at the mouth of the tributary. (LOPA Annual Report, 2003)

Parker Brook flows through the northwestern portion of the watershed and is joined by Hawthorne Brook and Lulu Brook before flowing down the Taconic Hills through Pittsfield State Forest. Parker Brook then flows through farmland before entering a pond just west of Churchill Street. Volunteer water quality sampling conducted by LOPA in 2003 did not indicate any significant problems in this stream. (LOPA Annual Report, 2003)

Churchill Brook runs from the state forest under Churchill Street and Hancock Road before flowing into the north basin of the lake. Churchill Brook has been found to be cold and clear, and has demonstrated desirable water quality during volunteer sampling conducted by LOPA in 2003. However, the culverts under Hancock Road appear to create a barrier for fish passage upstream. (LOPA Annual Report, 2003)

Daniels Brook originates in the Pittsfield State Forest and flows into the north basin of Onota Lake. The Daniels Brook watershed is the largest watershed contributing to Onota Lake. (Souza et al., 1991) The Daniels Brook watershed is primarily forested. (MassGIS 1997 Land use Data) However, the watershed also supports land uses that include an auto wrecking yard,

gravel operations, and agriculture. During one sampling event conducted by LOPA volunteers in 2003, Daniels Brook displayed bacteria counts that indicated that it was not fit for swimming. (LOPA Annual Report, 2003) The highest concentrations of fecal coliform bacteria were observed during the summer months, suggesting contamination from animal and human wastes and/or runoff from fertilized fields. (Souza et al., 1991)

Water Quality Monitoring

LOPA volunteers conduct an active water quality monitoring program each year. The volunteer water quality monitoring program was established by LOPA in 1995. In 2001 a Quality Assurance Project Plan (QAPP) was approved by the USEPA and MADEP. The QAPP specifically addresses monitoring activities at specific sites designed to quantify the impacts of stormwater management techniques installed under a Section 319 Nonpoint Source Competitive Grant. However, the QAPP establishes protocols for routine monitoring practices that are followed at previously established sites of the volunteer water quality monitoring program. In 2002 LOPA initiated a program for tributary and storm drain monitoring. During the same year LOPA and BRPC began the process of developing a QAPP for tributary and storm drain monitoring. This QAPP will be integrated with in-lake water quality monitoring practices and will eventually govern all volunteer water quality monitoring.

Sediment Accumulation

Sediments may be derived from natural sources, anthropogenic sources, or a combination of these sources. In the case of Onota Lake, there are no known point sources of pollutants. The major vectors of nutrients and sediments are tributaries and runoff (nonpoint sources), atmospheric contributions and internal sources.

The north basin of Onota Lake has an appreciable accumulation of sediment (>0.3 meters appreciable accumulation). In the south basin, limited areas along the southwest shore were found to have deposits of organic sediments, primarily confined to the shoreline parallel to Blythewood Drive and ranging from 0.3 to 1.0 meters in depth. Deep deposits (1.8 – 2.0m) of sediment accumulation were measured in the northwestern shoreline of the lake. Along the northwestern shore of Thomas Island and within Thomas Island Cove 1 – 1.2m of sediment were observed. (Souza et al., 1991)

Nutrient Budget

A pollutant load analysis summarizes the kilograms per year of total phosphorus, total nitrogen, and total suspended solids entering the lake from each of the ten subwatersheds for the entire Lake Onota Watershed. (See Map 1) The results of that analysis, as summarized in Table 2, show that sub-watersheds VI, VII and VIII are responsible for the bulk of the lake's nutrient and sediment loading. (Souza et al., 1991) These watersheds correspond respectively to the

Parker/Lulu Brook, Churchill and Daniels Brook watersheds. However, these are the two largest sub-watersheds, and as such, their loading in itself is biased due to the size of the contributing watershed. Table 3 shows the predominant land cover type in all of the above three sub-watersheds is forested land. As such, although these data are useful in understanding from where the lake's pollutant loading originates, it is somewhat misrepresentative. Table 4 shows for each sub-watershed, the extent to which the impact load exceeds the base load. The greater the exceedance value the more the pollutant load to the lake is a function of land development and watershed disturbance. (Souza et al., 2004)

Table 2
Summary of Pollutant Lake Onota Watershed Pollutant Loading
As Reported in the 1991 Diagnostic Feasibility Report (Souza et al., 1991)

Sub-watershed	Area (acres)	Annual Load kg/yr		
		Total Nitrogen	Total Phosphorus	Total Suspended Solids
I	553.25	780.0	85.8	187,200
II	109.31	352.4	46.1	103,095
III	67.26	78.3	7.8	13,824
IV	102.38	56.3	5.6	5,625
V	172.50	192.5	15.4	19,019
VI	2,104.54	2,508.5	190.3	275,935
VII	763.82	1023.0	74.4	121,830
VIII	1,768.83	1914.0	151.6	255,270
IX	105.47	192.0	28.2	55,200
X	257.52	200.2	27.7	43,120
Total	6004.88	7297.0	632.9	1,080,118

Table 3 Loading Coefficients Utilized in the Computation of the 2003/2004 Lake Onota Watershed Pollutant Loads (Souza et al., 2004)			
Loading Coefficients	**TN**	**TP**	**TSS**
Forest	2.5	0.2	250
Agriculture	10.0	0.6	1600
High Density Res (includes commercial)	5	0.8	2000
Low Density Res	2	0.25	200
Open-Covered	5	0.3	400
Open-Disturbed	10	0.6	1600
Base Load Coefficient	2.5	0.2	250

Table 4 2003/2004 Lake Onota Watershed Pollutant Loads Total Load - Base Load And % Exceedence Per Sub-Watershed (Souza et al., 2004)							
Sub-Watershed	**Impacted Load (Total Load – Base load kg/yr)**				**% Exceedence**		
	TN	**TP**	**TSS**		**TN**	**TP**	**TSS**
I	390	54.6	148200		100.00	175.00	380.00
II	134.9	28.7	81345		62.02	164.94	374.00
III	10.8	2.4	7074		16.00	44.44	104.80
IV	-6.2	0.6	-625		-9.92	12.00	-10.00
V	0	0	-231		0.00	0.00	-1.20
VI	346	17.3	59685		16.00	10.00	27.60
VII	248	12.4	44330		32.00	20.00	57.20
VIII	326.5	24.6	96520		20.57	19.37	60.80
IX	42	16.2	40200		28.00	135.00	268.00
X	7.7	12.3	23870		4.00	79.87	124.00
Total	1499.7	169.1	500368				

Chapter 2 – Lake Planning & Management Efforts

A comprehensive Diagnostic/Feasibility Study of Onota Lake was completed by International Technology Corporation for the Massachusetts Department of Environmental Protection in 1991 to identify and quantify causes of lake degradation and recommend mitigation strategies. The study identified excessive macrophyte growth as a primary problem of the lake. Since that study, the dramatic increase in Eurasian watermilfoil throughout both basins of the lake in the early-mid nineties has been documented in two studies. The first was the *Environmental Impact Review and Management Implications for a Proposed Drawdown of Onota Lake* conducted by Dr. Ken Wagner, then of Fugro East, Inc. in 1996. Based on that EIR, the City of Pittsfield instituted an annual 3 foot drawdown. This was followed by a post drawdown monitoring program analysis by Sean Lonergan of American Lakes and Wetlands Services (ALWS) in 1997.

Year	Activity	Funding Source
Annual	3 ft Drawdown	City of Pittsfield
Annual through 1998	Mechanical Harvesting	City of Pittsfield
1999	Whole-lake Herbicide Treatment	City of Pittsfield
2001	Spot-suctioning	LOPA
2002	Benthic barrier	DEM
2002	Diver hand-pulling	DEM
2002	Spot-herbicide	DEM/ LOPA
2002	Spot-suctioning	DEM
2003	Milfoil-eating weevils	DEM

The City, in partnership with LOPA, reviewed the above studies and recommendations and then generated the *Onota Lake Management Plan* (1999) which documents short term and long term plans for both watershed and in-lake preservation actions. The primary goal of the restoration/management plan was to decrease nutrient and sediment loading through a comprehensive, well-coordinated watershed management program. Elements of the plan included the installation of a culvert at Thomas Island, nutrient rich sediment removal, continued volunteer monitoring, the identification and remediation of erosion problems, winter drawdown, the installation of stormwater best management practices, public education and outreach, and herbicide treatment. This plan has provided basic guidance in the management of the lake since then.

The City of Pittsfield, LOPA, and the Berkshire Regional Planning Commission (BRPC) have worked to implement several mitigation strategies identified in the D/F study and the management plan. Due to the recreational importance of Onota Lake, the City determined that an intensive in-lake restoration and management program be implemented. Through such a program, immediate, user orientated improvements in lake quality could be realized.

In 1998, monitoring by the City and volunteers from LOPA showed that approximately one-third of the lake was so choked with milfoil as to be virtually unusable for recreational purposes. In 1999 due to the critical need to combat the milfoil, the City contracted Aquatic

Control Technology, Inc. to implement a whole lake treatment with the herbicide SONAR, a primary action recommended in the management plan. Follow-up spot treatment was conducted in 2000. The City of Pittsfield undertook the task of financing and managing the SONAR treatment at a total expense of $125,000 without the support of any state funding or grant funds. This program successfully "eliminated" well over the contractually required 90% of the milfoil and resulted in a final report, *Long-range Aquatic Vegetation Management Plan – Onota Lake – Pittsfield, Massachusetts, December 2000* prepared by Aquatic Control Technology, Inc.

The City of Pittsfield, LOPA, and BRPC have recently completed several management activities under the Lake Onota Preservation Strategy. This particular project has employed a multi-faceted approach involving biological and mechanical techniques, along with limited herbicide treatment to attempt to control milfoil re-growth after successful whole lake application of SONAR. Following the recommendations of the D/F Study and the Lake Onota Management Plan, a comprehensive assessment of bank stabilization, erosion control and storm drain treatment needs for Burbank Park has been conducted. This has resulted in the preliminary design of best management practices to be implemented at the park. Based on the recommendations of the D/F Study to install macrophyte barriers, a 21 x 200 foot benthic barrier has been installed at the Burbank Park public swimming beach and monitored for usefulness in creating clear swimming areas over multiple years. GeoSyntec Consultants has been contracted to manage the introduction of milfoil-eating weevils into Onota Lake. Weevils were introduced in the summer of 2003. GeoSyntec Consultnats completed the first monitoring survey in September 2003. A follow-up monitoring survey will be conducted in July 2004. This project will represent the first time in Massachusetts that a lake has been treated with aquatic weevils in response to the re-growth of Eurasian milfoil after a whole-lake herbicide treatment. The D/F Study listed biological controls, such as milfoil predators, as an in-lake management option for Onota Lake. Through this project a limited experiment of diver hand-pulling and spot suctioning that was conducted in the summer of 2001 was expanded.

Existing Documents and Plans

A significant amount of research and monitoring has been undertaken in Onota Lake. Copies of completed plans and studies can be viewed or obtained through the City of Pittsfield, BRPC or LOPA. To avoid duplication and maintain consistency with other relevant studies and policies this plan takes into account the findings and recommendations of these existing documents which include the:

- *Diagnostic /Feasibility Study for Onota Lake, Pittsfield, MA*
  IT Corporation, March 1991, Principal Investigator – Dr. Stephen J. Souza
- *Environmental Impact Review and Managerial Implications for a Proposed Drawdown of Onota Lake, Pittsfield, MA*
  Fugro East, Inc., July 1996, Principal Investigator – Dr. Kenneth Wagner
- *Onota Lake Monitoring Program, 1997*
  American Lakes & Wetlands Services, Inc., Principal Investigator – Sean Lonergan

- *Onota Lake Management Plan, 1999*
  Prepared by Lake Onota Preservation Association (LOPA)
- Quality Assurance Project Plan, 1999 (Rev. 2003)
  Berkshire Regional Planning Commission and
  Lake Onota Preservation Association (LOPA)
- *Long-range Aquatic Vegetation Management Plan – Onota Lake – Pittsfield, Massachusetts, December 2000* Prepared by Aquatic Control Technology, Inc.
- *LOPA Annual Report Years 1999 – 2003*
- Aquatic Control Technology Macrophyte Survey Report, 2002
- *2003 Lake Onota Aquatic Vegetation Assessment*
  Prepared by GeoSyntec Consultants, 2003
- *Field Guide to the Plants of Onota Lake*
  Prepared by GeoSyntec Consultants, 2003
- *Watershed Survey Final Report & Action Plan*
  Prepared by Riverways Program of the Massachusetts Department of Fish and Game, 2003
- *The Evaluation of Hypolimnetic Withdrawal and Deep-Water Aeration Management Alternatives for Lake Onota, Pittsfield, MA*
  Princeton Hydro, LLC, July 2003, Principal Investigator – Dr. Stephen J. Souza
- *Lake Onota Milfoil Weevil Project – First Monitoring Report*
  GeoSyntec Consultants, September 2003, Principal Investigator – Robert Hartzel
- *Housatonic River Watershed Five Year Action Plan 2002-2007*
  Executive Office of Environmental Affairs, 2003
- Final Report Eurasian Watermilfoil Re-growth Control Project at Onota Lake
  Berkshire Regional Planning Commission and
  Lake Onota Preservation Association (LOPA), 2003
- *Storm Drain & Erosion Assessment at Burbank Park*
  Berkshire Regional Planning Commission and Foresight Land Services, Fall 2003
- *An Integrated Approach to the Management of Stormwater Water Quality Within the Sub-Watersheds of Onota Lake Pittsfield, Massachusetts*
  Princeton Hydro, LLC., Berkshire Regional Planning Commission, and Lake Onota Preservation Association (LOPA), 2004

Existing Recommendations for Lake Management

In order to assess the ecological conditions of Onota Lake, a comprehensive limnological investigation was conducted by the IT Corporation and published in 1991. "The purpose of this study was to identify those factors which have contributed to the degradation of the lake, quantify their impact and determine what must be done to improve the condition of Onota Lake." (Souza et al., 1991) Findings from this investigation were summarized in the Executive Summary of the Study. The findings included the following:

1. The annual load of nutrients received by Onota Lake is substantial enough to promote the growth of aquatic weeds to nuisance densities throughout the north basin and in the shallow areas of the south basin.
2. Nonpoint source pollution makes up the majority of the nutrient source. However, at the time of the report a leaking sewer line and improperly functioning septic tanks were responsible for a portion of the annual nutrient load.
3. The dissolved oxygen is depleted in the deep water layer. This occurs primarily in the south basin and to a lesser extent in the north basin. This is a result of bacterial respiration, associated with decomposition of organic matter, combined with temperature and density differences that prevent mixing of the deep water layers throughout the summer.
4. Due to the loss of oxygen in the deep, cool waters during the summer months the total volume of cool, oxygenated water available to support cold water fisheries is reduced.
5. Within the north basin, ice cover and reduced water flow during the winter decreases the opportunity for oxygen exchange. This results in the potential for a winter fish kill due to oxygen depletion.
6. The lake's eutrophication could be substantially accelerated by future development in the currently forested areas.

Several management recommendations were made through the D/F Study. The recommendations were categorized by watershed management versus in-lake management techniques. Many of the recommendations that were made through this study have been implemented. The Blythewood Drive neighborhood has connected to the municipal sewer system and the leaking sewer line on Pecks Road has been repaired. Efforts have been made by LOPA to promote the use of non-phosphorus detergents and low phosphorus fertilizers. The City, LOPA, and BRPC have worked in partnership to conduct public education through seminars and educational materials to inform lake users and residents of how they can protect the lake. These and management recommendations requiring continued efforts and other watershed management recommendations contained within the D/F Study and are outlined below.

1. Decrease stormwater related contribution of pollutants and sediments through the use of passive treatment devices such as retention basins and catch basins.
2. Enforce existing soil erosion control ordinances to reduce soil transport and the subsequent filling of the lake.
3. Employ land use management techniques for the development of lake shore properties and land adjacent to the tributaries of Onota Lake.
4. Use non-phosphorus detergents and low phosphorus fertilizers.
5. Conduct public education through seminars and educational materials to inform lake users and residents of how they can protect the lake.

Many of the in-lake restoration techniques recommended within the D/F Study have been implemented or are currently in the process of implementation. The use of mechanical weed harvesters has been employed at Onota Lake, but was discontinued in 1998 due to commitment to the whole lake herbicide application conducted in 1999. The short circuiting of flow through the creation of a culvert under the Thomas Island causeway is currently under implementation through a Section 319 Nonpoint Source Pollution Grant awarded by the Massachusetts Department of Environmental Protection. (Project 00-01/319) The culvert is intended to divert nutrient rich waters out of the north basin of the lake and promote the flushing of currently stagnant waters. An analysis of the feasibility of aeration of the hypolimnion was conducted by Princeton Hydro, LLC in 2003. Aeration of the hypolimnion is a means of decreasing the annual regeneration of phosphorus from the lake's anoxic sediments during the summer. Addition recommendations from the D/F Study are as follows:

1. Dredge select areas of the lake to remove accumulated nutrient rich sediment.
2. Restore fishery habitat.
3. Restrict motor boat speed in certain areas of the lake to decrease the spread of *Elodea* and reduce the opportunity for nutrient release from shallow littoral sediment disturbed by propellers and wakes.

In 1996 an Environmental Impact Review and Management Implications Study for drawdown of Onota Lake was prepared for the City of Pittsfield by Fugro East. The report reviewed past documentation of lake features, defined existing conditions, evaluated possible drawdown impacts, and provided a basis for management decisions with an emphasis on the efficacy of drawdown. The report evaluated drawdown as a technique for flood control potential, shoreline damage control potential, and weed control potential. In each of these categories the report reviewed alternative control measures. In addition, the report evaluated the potential impacts of drawdown to emergent wetlands and aquatic fauna. A recommended drawdown plan suggesting a minimum drawdown of 4ft was suggested to provide adequate flood control, protect shoreline structures and reduce milfoil and curlyleaf pondweed over 257 acres of the lake. The recommended drawdown plan indicated that an addition drawdown to a maximum

possible depth of 8 ft may be warranted for additional benefit to flood control, structural protection, and aquatic plant management over 324 acres of area.

Drawdown Plan

- Minimum drawdown of 4ft
- Provide adequate flood control
- Protect shoreline structures
- 4ft drawdown will reduce milfoil and curlyleaf pondweed over 257 acres of the lake
- 8ft drawdown will provide additional benefit to flood control, structural protection, and plant management over 324 acres of area

LOPA drafted its first Lake Management Plan in 1999. The management plan was primarily based on recommendations of previously conducted studies and was modified to account for changes in lake conditions and the presence of a new dam structure. The management plan included both watershed management techniques and in-lake management techniques and was divided into sort term and long range elements.

Short Term Elements

1. Control of Eurasian watermilfoil
2. Thomas Island bridge/culvert
3. Winter drawdown
4. Nutrient-rich sediment removal
5. Weed harvesting
6. Continuation of the volunteer monitoring program

Long Range Elements

1. Reduce septic input
2. Identify and remediate existing erosion sites
3. Reduce stormwater inputs
4. Control regrowth of Eurasian milfoil
5. Public Education
6. Political action

Working with appropriate partners and authorities, LOPA has implemented or is in the process of implementing nearly all of the recommendations from the 1999 management plan. The 1999 whole-lake application was successful in eliminating well over 90% on the Eurasian watermilfoil within Onota Lake at the time. As stated earlier within this plan, the Thomas Island culvert is currently being designed under a project funded by the Massachusetts Department of Environmental Protection (MADEP). Onota Lake is annually drawn down 3ft in accordance with general guidelines developed by DEP and Massachusetts Fisheries and Wildlife. Harvesting

was discontinued in 1998 due to the herbicide application. The volunteer monitoring program has continued and expanded. Erosion sites have been identified and corrected through the Section 319 Nonpoint Source Pollution Competitive Grant Project awarded by MADEP (Project 00-01/319). Through grants awarded to the City of Pittsfield by the Massachusetts Department of Environmental Management (MADEM) and the Berkshire Environmental Fund, efforts have been made to prioritize stormwater inputs and develop designs for stormwater best management practices. Through the grant awarded to the City of Pittsfield by MADEM, a comprehensive program was undertaken to employ mechanical, chemical, biological, and physical techniques to address the re-growth of Eurasian water milfoil in select areas. An extensive education and outreach campaign was undertaken by LOPA and BRPC through this same project.

Through a 2002 Massachusetts Department of Environmental Management Lake and Pond Grant award, BRPC conducted a stormdrain and erosion control assessment of Burbank Park.

In 1998, Burbank Park was the focus of a large rehabilitation project funded by a Massachusetts Self-Help grant award and Public Access Board funds. In addition to improvements made to parking, beach area, and boat launch, the design called for significant improvements to the stormwater control systems through the use of accepted structural stormwater BMP's, or Best Management Practices. Though the improvements to the Park did not specifically address erosion issues on the Point at Burbank Park, a project undertaken in 2001 with assistance from BRPC sought to correct these problems. This project addressed erosion issues related to access, and sought to stabilize trails and other areas.

BRPC utilized design plans produced by Okerstrom-Lang Landscape Architects for the City of Pittsfield, 1996, City of Pittsfield engineering maps and records and field investigation to conduct the assessment. Through this assessment several recommendations were made for improvements to the stormwater infrastructure at Burbank Park. Recommendations included the elimination of two point source discharges into Onota Lake and improvements to runoff control in south parking lot.

1. Convert existing catch basins1-4 along access drive to south parking lot into deep sump basins and ensure cross connections are open
2. Discharge runoff from two catch basins along Lakeway Drive into a stone lined trench and eliminate discharge pipe
3. Connect 1SD so that it feeds to 2SD (that is, reverse feed direction)
4. Discharge runoff from a catch basin in the south parking lot over a strip of land between the parking lot and woods in the direction of a sediment trap. This strip will act as a stone swale conveyance to a sediment trap.
5. Rehabilitate sediment basin over additional catch basin in south parking lot. Remove built up sediment to reclaim storage volume.

6. Rehabilitate discharge outlet in south parking lot. Install small sump at outlet to capture sediment, install new riprap to proper width and depth, revegetate appropriately.
7. Review the slopes in the parking lots, and if necessary devise methods to direct stormwater runoff to the sediment traps. This may require creating breaks in the curbing as was originally specified.

Utilizing this report, Foresight Land Services drafted recommendations and conceptual designs for stormwater improvements at Burbank Park. Foresight Land Services prepared a report in which stormwater improvements have been prioritized, estimated costs have been calculated, and anticipated local, state, and federal permit requirements are outlined.

The recommendations presented by Foresight Land Services can be segmented into multiple phases, each with significant environmental benefits. The south parking lot at Burbank Park is heavily used year round by cars, trucks, and trailers, making the lake vulnerable to leaking automobile fluids and potential spills. In addition, the lake is vulnerable to the impacts of the sand and salt used to treat the parking lots. Each recommendation has been outlined in priority order based upon its ability to directly benefit Onota Lake and its surrounding resources. This report proposed the following:

1. Install a trench grate drainage structure and a deep sump catch basin with an oil hood at the public boat ramp at Burbank Park.
2. Replace six existing catch basins that were not included in previous improvement projects at Burbank Park with deep sump catch basins with oil hoods.
3. Retrofits two existing sedimentation basins with oil hoods and improved drainage.
4. Repair of the outlet structures and headwalls for two of the stormwater discharge pipes.
5. Two new deep sump catch basins with oil hoods are recommended at the southern end of Lakeway Drive with a drainage manhole on Lakeway Drive and a drainage manhole in the vegetated area northwest of Lakeway Drive.
6. Install a Stormceptor© device, or other proprietary stormwater treatment system to work with the catch basins and trench grate at the south parking lot.
7. Install a third deep sump catch basin with an oil hood, pipe and outlet structure on the northern end of Lakeway Drive between the north and south parking lots.

Through a Berkshire Environmental Fund grant award in 2002, BRPC contracted Princeton Hydro, LLC to conduct a thorough hydrological analysis and generate a preliminary design, including cost estimates, for installing a hypolimnetic withdrawal system for removing low dissolved oxygen water from the deep holes in the south and/or north basins of the lake. In addition, a preliminary design, including construction and operating cost estimates was prepared for a deep hole aeration system for both the north and south basins in accordance with the recommendations of the 1991 D/F Study. The assessment indicated that the problems with lake stratification and the subsequent depletion of dissolved oxygen and the liberation of phosphorus have been substantiated, quantified and discussed in several reports pertaining to the management and restoration of Onota Lake. The control of the internally regenerated phosphorus, and associated water quality problems could potentially be controlled through the implementation of either a deep-water aeration or hypolimnetic withdrawal management approach.

Hypolimnetic withdrawal is an in-lake restoration technique whereby the water discharged from a reservoir or lake is taken from hypolimnion rather than from the surface. In a conventional system, excess water flows over the crest of the dam. In lakes and reservoirs equipped with structures capable of withdrawing or discharging water from the hypolimnion, deep water, as opposed to surface water is released. The assessment states that, in theory, by strategically timing a withdrawal of anoxic hypolimnetic waters, large volumes of phosphorus rich water can be removed from the lake before becoming available. (Souza et al., 2003)

Of the various techniques that could be used to draw off the anoxic and phosphorus rich deeper layers of the lake, siphoning was determined to be the only feasible option for Onota Lake. The deepest portion of the northern basin is within a proximity to the lake's outlet. The assessment concluded that the pipe lengths needed to create a functional siphon system were not expected to be extensive (approximately 3,000 feet). However, there were several reported reasons that weighing strongly against attempting to withdraw hypolimnetic waters from this basin. (Souza et al., 2003)

Based on Princeton Hydro's review of the water quality data, lake morphometry and potential risk to recreational lake uses, it does not appear that the design and operation of a hypolimnetic withdrawal system is practical for Onota Lake. Withdrawal of water from the northern basin will have no significant impact on the lake's internal phosphorus load. (Souza et al., 2003) Although a significant portion of the load could be removed by withdrawing water from the southern basin's hypolimnion, doing so could:

1. Disrupt the lake's thermal profile (resulting in impacts to the lake's cold water fishery)
2. Result in too great a drawdown in the middle of the summer when lake use is at its peak, and
3. Cause downstream water quality impacts due to the release of water containing excessive amounts of phosphorus, metals, minerals and ammonia,

Based on the examination of the thermal, dissolved oxygen, bathymetric and hypsographic attributes of the lake, it was determined to be feasible to develop a general specification for an aeration system. Dissolved oxygen depletion occurs in both the deepest portions of the northern and southern basins. However, to be cost effective, the installation and operation of an aeration system was focused on the management of the southern basin's conditions. (Souza et al., 2003)

Aeration systems of the type considered for Onota Lake require the use of large compressors. The compressors create an airlift that transports cold, dense water temporarily into the warm, well oxygenated surface layers of the lake. Reoxygenation is accomplished through the mixing of the well oxygenated surface water and the dissolved oxygen (DO) depleted, deep cold water. Once mixed, the reoxygenated cold water is returned to the appropriate depth zone. This is accomplished through aeration columns and intake and discharge gates in the column. (Souza et al., 2003)

The assessment reported the overall cost to construct and install the above zone aeration system was estimated to cost at least $330,000. The annual operating cost would be expected to be in the range of $40,000. Although the installation and operation cost are significant, a deep-water aeration approach was determined to be the best technique for the management of the lake's internal phosphorus load and the maintenance of trout and zooplankton habitat. The design and installation of such a system was recommended. (Souza et al., 2003)

Recommended Deep-Water Aeration Approach for Onota Lake

- In-lake components (three columns, air lines, and ballast) = $190,000 to $205,000
- Land-based elements (compressor house, compressor, ventilation system, electric circuitry and air valving system) = $80,000 to $110,000
- Three-phase power, trenching of airlines at the shoreline, and the connection of all the equipment, which will likely require a licensed electrician, plumber and HVAC contractor = $15,000
- Annual Maintenance and Operation = $35,000
- Service Contract = $5,000 annually

A comprehensive survey of the watershed of Onota Lake was conducted in the Spring of 2003. The survey originated under the auspices of the Massachusetts Watershed Initiative (MWI) Housatonic River Basin Team Leader Tom O'Brien as part of his FY 2003 Annual Work Plan. It was organized under the leadership of Chris Carney, Coordinator, Lake/Watershed Stewardship Program, Massachusetts Riverways Programs of the Department of Fisheries, Wildlife and Environmental Law Enforcement (DFWELE) working in conjunction with the City of Pittsfield, BRPC, LOPA and Berkshire Community College (BCC). Onota Lake was fortunate to be selected as one of the last of 10 lake/watersheds to participate in this pilot

project conducted by the Riverways Program under a federally funded s.319 grant from the Environmental Protection Agency (EPA).

The survey process was initiated through an informational meeting, coordinated and led by Tom O'Brien in 2002 which included representatives of the major "stakeholders" in the lake, the City of Pittsfield, MWI, Mass DEP, LOPA and BRPC, and Chris Carney of the Riverways Program. This was followed by an organizational meeting during which a Steering Committee was formed to be chaired by Tom O'Brien (later replaced by Jim McGrath of the City of Pittsfield). Letters were written and distributed to abutters and other interested parties, the team of volunteers was organized and the volunteer training session was arranged leading up volunteer surveys conducted in early May 2003. An action planning meeting involving the Steering Committee and the volunteers was held on May 14, 2003. (DFWELE, 2003)

This report generated an action plan which identified reporting issues and immediate actions, short-term actions, long-term actions, and ongoing actions in several goal areas. The recommended actions of this plan are as follows.

Roads and Town Lands	
Goal:	To reduce nonpoint source pollution in stormwater pollution from roads and town lands.
Reporting Issues & Immediate Actions:	1. To Pittsfield Department of Public Works (DPW) • Street Sweeping: Work with City to regarding street sweeping policy, including setting priorities for streets that drain directly to Onota Lake. • Improve Stormwater Management: Recommend construction of structural stormwater BMPs at identified hotspots, either with grant funding where available, or at the time of next upgrades for those locations. Includes recommended replacement of paved swales with vegetated buffer to allow infiltration and removal of nonpoint source pollutants. 2. To Pittsfield Parks Department • Lake level: During study of annual drawdown procedures, consider impact of lake level management on lakeshore erosion. Work to improve water level management to reduce erosion. • Dan Casey Causeway: Work is needed to assist friendly uses of the Causeway - need to reduce pet waste and human defecation, discourage littering and discourage inappropriate use of waste receptacles.
Short Term Action:	Construct vegetated buffer along lakeshore at the Controy Pavilion. Work with the Parks Department to consider planting options for bank stabilization and pollution attenuation, and explore grant funding opportunities. Funding may be available through grants from the Natural Resource Conservation Service (NRCS) from their EQIP and WHIP programs.

Pittsfield Sate Forest – Nonpoint Source Pollution	
Goal:	To reduce nonpoint source pollution in stormwater pollution from residential lands.
Reporting Issues & Immediate Actions:	To the Department of Environmental Management (DEM) • Road runoff: Request attention to stormwater runoff from park roads, especially at stream crossings. • Trail Conditions: Report instances of sediment loading to streams within the park at trail crossings. Trails near these stream crossings display substantial erosion problems because of heavy use by ATVs. • Trash found along stream corridors near and downstream of camping areas. • Dumping site found along park road at trail access.
Ongoing:	Each year, students from Berkshire Community College (BCC) participate in local cleanups. Work with BCC to connect with students on cleanups at problem spots identified in the survey.
Long Term Action:	Cooperative planning between the park staff, concerned residents, and the ATV clubs to explore better rider education programs and better trail use management options.

Residential – Nonpoint Source Pollution	
Goal:	To reduce nonpoint source pollution in stormwater pollution from residential lands.
Reporting Issues & Immediate Actions:	1. Reported residential dump – follow-up on reporting to proper authorities 2. Discarded home oil tank found on the bank at edge of wetlands. Make friendly contact with the homeowner to get more information and to provide educational material on hazardous materials. Inquire with Pittsfield Fire Department about city policy and education materials on home hazardous materials.

Commercial	
Goal:	To reduce nonpoint source pollution in stormwater pollution from commercial areas.
Reporting Issues & Immediate Actions:	1. Hospital Parking Area: Investigate whether Hillcrest Hospital is required to complete a Stormwater Management Plan under EPA Phase II Requirements or if the have an Operation and Maintenance Plan for stormwater of their parking lot and/or grounds. 2. Potter Mountain Road: A large area of trash and junk was found along Potter Mountain Road. Contact landowners to investigate the situation further. Consult Lanesborough Board of Health. 3. Trash Barrels: Work with the City for regular maintenance of trash barrels in Burbank Park.
Short Term Action:	1. Hospital Parking Area: Conduct follow-up site visit during wet weather to the parking lot to observe stormwater runoff and conditions of reported broken pipe. Work with hospital to improve stormwater management, including possible construction of structural BMPs. 2. Potter Mountain Road: Follow-up contact with landowners. Possibly arrange for a site visit to the area to determine the extent of the problem. Work with Lanesborough Board of Health, and potentially the Department of Environmental Protection. 3. Gravel pit owners: Provide educational materials on good practices for stormwater management and maintenance of gravel roads. Possibly plan site visits to walk the grounds. 4. Campground - riparian vegetated buffers: Encourage campground to re-grow vegetated cover between basketball courts and stream corridors. 5. Farms: Work with farmers to improve runoff and bank stabilization through constructed BMPs. Potential sources include grants from the Natural Resource Conservation Service (NRCS), such as the WHIP and EQIP.

Education and Outreach	
Goal:	Expand awareness of lake watershed ecology and educate watershed residents, businesses and municipalities about watershed-friendly management.
Short Term Actions:	Homeowner Education Efforts: Plan and develop education and outreach programs to inform residents of the common household and landscaping sources of nutrients and other nonpoint pollutants to Onota Lake. Introduce residents to simple and inexpensive steps they can take to reduce impacts from their home and lawn. • General information on lake-friendly landscaping, the use of low and no-phosphorus fertilizers. • Information about storage and disposal of household hazardous materials. • Riparian vegetated buffers as pollution buffers and geese barriers. • Information for horse owners and horse farms regarding manure storage and good maintenance practices to reduce nonpoint source pollution. Dan Casey Causeway: Educational signs needed at the causeway • On the impacts of goose, pet and human waste on water quality, • Discouraging bird feeding, and • Prohibiting dumping, littering, and leaving household trash in receptacles.

Habitat and Wildlife	
Reporting Issues and Immediate Actions:	Contact HVA to report findings from survey section that included Onota Brook downstream from the dam. Reported problems included eroding stream banks carrying runoff, invasive emergent plants (Phragmites and Purple Loosestrife), and potential dumping site with landscape debris.
Short Term Actions:	Stands of invasive Phragmites and Purple Loosestrife have infested sections of Onota Lake's shoreline and the stream banks of Onota Brook below the dam. Combine site visits to assess the growth and early management to remove both invasive plants before they spread further.

Land Use Planning	
Long Term Action:	Land Protection Plan: Work with land protection groups, state agencies, and city and town officials to develop watershed land use plan to protect open space and farm lands. Keep goals consistent with existing land use plans. Protect Farms: Work with the Berkshire Natural Resource Council and NRCS to provide technical assistance and funding to farmers to aid in land protection.

The *Housatonic River Watershed Action Plan* (EOEA, 2003) was developed with input from state and federal agencies, Regional Planning Agencies, watershed groups, former watershed team members, and with extensive public involvement throughout the reaches of the watershed. This unique approach helps us focus on the problems and challenges that are identified with stakeholders and community partners in each watershed, rather than being decided solely at the state level.

The 5-Year Watershed Action Plan for the Housatonic River Watershed will be used to guide local and state environmental efforts within the Housatonic River Watershed over the next five years, as well as implement the goals of the Executive Office of Environmental Affairs. These goals include improving water quality; restoring natural flows to rivers; protecting and restoring biodiversity and habitats; improving public access and balanced resource use; improving local capacity; and promoting a shared responsibility for watershed protection and management.

The priority issues and action strategies identified in the plan include:

- Ensure the Remediation and Restoration of the Housatonic River

- Work to Improve Water Quality and to Mitigate Accelerated Eutrophication of Lakes and Ponds
- Enhance Environmental Education and Natural Resources Stewardship
- Support Environmentally Sustainable Growth
- Protect and Increase Biodiversity Conservation

One of the goals identified within the plan is to work to improve water quality and to mitigate accelerated eutrophication of lakes and ponds. An objective to achieve that goal is to conduct an assessment for Onota Lake and its watershed and continue efforts to implement the use of non-chemical maintenance alternatives.

The *Housatonic River Watershed Action Plan* reported that several projects have or are currently being implemented following the recommendations of the D/F Study (Souza et al., 1991), including a S.319 flow alteration project. It was recommended that an analysis of herbicide treatment success, macrophyte mapping and monitoring, and a review of non-chemical maintenance alternatives, be conducted to better understanding nutrient sources, and that the Lake Onota Management Plan be updated.

Housatonic River Watershed 5-Year Action Plan Recommendations

- Conduct an analysis of herbicide treatment success
- Complete macrophyte mapping and monitoring
- Review non-chemical maintenance alternatives
- Update the Lake Onota Management Plan

In 2003 GeoSyntec Consultants completed the Lake Onota Aquatic Vegetation Assessment with funding through the Massachusetts Department of Environmental Protection (DEP Project# 2003-15/MWI). The purpose of this project was to conduct a comprehensive mapping and assessment of the aquatic vegetation in Onota Lake, provide training to volunteers from LOPA in macrophyte identification and mapping, and provide recommendations for a long-term approach for control of invasive aquatic plants and a literature review of non-chemical plant management techniques. The recommendations of the assessment are summarized as follows.

1. Artificial Circulation and Aeration is not warranted at Onota Lake. The lake has a well-defined hypolimnion that becomes anoxic during summer stratification. Monthly sampling data collected by LOPA volunteers from the deep holes indicate consistently low total phosphorus levels that are not indicative of conditions that require these techniques.
2. Dredging is feasible for the north basin of Onota Lake. However, the feasibility is significantly constrained by high costs and environmental permitting requirements.

3. Drawdown provides an inexpensive and relatively effective macrophyte control within the littoral zone exposed by the drawdown. It may be beneficial to increase the drawdown depth to expose additional densely vegetated areas of the north basin.
4. Mechanical harvesting is not an appropriate long-term invasive plant control strategy since mechanical harvesting is non-selective in nature and Eurasian watermilfoil is broadly distributed in Onota Lake.
5. Hand-harvesting may be appropriate for providing species-specific control in limited areas and small pioneer infestations.
6. Hydro-raking is most effective at controlling plants with large/well-defined root systems.
7. Biological control could be an appropriate part of a long-term integrated strategy for Eurasian milfoil control at Onota Lake and could include milfoil-eating weevils.
8. Benthic barriers can provide effective macrophyte control over high-use areas of limited size.

In 2004 Princeton Hydro, LLC., BRPC and LOPA completed *An Integrated Approach to the Management of Stormwater Water Quality Within the Sub-Watersheds of Onota Lake Pittsfield, Massachusetts.* The overall goal of the integrated assessment report is to generate a prioritized plan for stormwater management activities in the Onota Lake Watershed. In order to prioritize future stormwater management activities it is prudent to reevaluate the recommendations for stormwater management within the Diagnostic / Feasibility Study. The Diagnostic / Feasibility Study report recommended that stormwater quality management be accomplished in part through the construction of low gabion weirs in Parker Brook, Churchill Brook, Daniels Brook, and the small tributary which passes under Blythewood Drive. An objective of this assessment was to generate a preliminary design, including cost estimates, for the construction of gabion weirs, or similar technique, to provide nutrient and sediment reduction at the major tributaries feeding the lake. In addition, an objective of this assessment is to inventory the stormwater infrastructure within the Onota Lake Watershed. The Diagnostic / Feasibility Study did not include water quality data for stormwater runoff entering the watershed through stormwater conveyances and did not include recommendations for stormwater management that included retrofit of existing stormwater infrastructure. However, the existence of stormwater collection and conveyance systems presents the ability of implementing some of the more typical stormwater quality enhancement techniques. The assessment includes stormwater infrastructure as a factor in prioritizing the stormwater management activities for the Onota Lake Watershed.

This assessment generated the new information on nutrient loading within the Onota Lake watershed. Princeton Hydro conducted modeling that reflects for each sub-watershed, the extent to which the impact load exceeds the base load. The greater the exceedance value the more the pollutant load to the lake is a function of land development and watershed disturbance. This is depicted within Table 4 of this plan. Each of the ten sub-watersheds were then prioritized by the number of direct discharges, the number of catch basins draining to direct discharges, and the ranking of nutrient loading by corrected pollutant load.

Onota Lake Sub-watershed Prioritization	
Sub-Watershed	**Priority**
Sub-Watershed I	High
Sub-Watershed II	Med
Sub-Watershed III	Low/Med
Sub-Watershed IV	Med
Sub-Watershed V	Low/Med
Sub-Watershed VI	Med
Sub-Watershed VII	Low/Med
Sub-Watershed VIII	Med/High
Sub-Watershed IX	Med/High
Sub-Watershed X	Med/High

The prioritization component of this assessment was intended to provide direction for stormwater management within the Onota Lake Watershed by:

- Prioritizing each of the sub-watersheds based on pollutant load
- Prioritizing each of the sub-watersheds based on the stormwater infrastructure inventory
- Identifying management options for improved stormwater management
- Identifying steps that the City of Pittsfield toward stormwater management

In characterizing each sub-watershed, information was provided to identify stormwater issues, impacts and options, the sum total of which will form the basis for the formulation of stormwater management recommendations. At the watershed level, the prioritization establishes priorities for stormwater management and outlines steps that the City of Pittsfield and LOPA can take to educate, regulate and maintain stormwater management. Stormwater management options and actions suggested for each of the sub-watersheds are displayed in the following table.

Management Options & Action Strategy				
Sub-watershed	Type of Problem	Type of Solution (BMP)	Priority	Actions
I	Direct discharges at Burbank Park, a heavily used area with two parking lots Runoff from parking lot to boat ramp	Install a trench grate drainage structure and a deep sump catch basin with an oil hood at the public boat ramp at Burbank Park. Replace six existing catch basins at Burbank Park with deep sump catch basins with oil hoods. Retrofit two existing sedimentation basins with oil hoods and improved drainage. Repair the outlet structures and headwalls for two of the stormwater discharge pipes. Install two new deep sump catch basins with oil hoods at the southern end of Lakeway Drive with a drainage manhole on Lakeway Drive and a drainage manhole in the vegetated area northwest of Lakeway Drive. Install a Stormceptor© device, or other proprietary stormwater treatment system to work with the catch basins and trench grate at the south parking lot. Install a third deep sump catch basin with an oil hood, pipe and outlet structure on the northern end of Lakeway Drive between the north and south parking lots.	High	Determine funding source for design, permitting and construction of recommended BMPs. These efforts recommendations could be implemented through a City of Pittsfield budget appropriation or through grant funding.
II	Runoff into brook from bridge and potential impacts from horse farm	Monitor the water quality of the brook Provide educational materials to owners/operators of horse farm	Med	Determine if improvements to the bridge are feasible through the City of Pittsfield Public Works Department Work with the owners of the horse farm and the Natural Resource Conservation Service for potential grant funding to assist agricultural operations in reducing nonpoint source pollution Permission may need to be sought for further implementation
III	1 pipe discharges into lake it is unclear what the purpose is of this pipe	Contact residents of area for further information NPS Education for property owners	Low/Med	Private property Permission may need to be sought for further implementation
IV	2 pipes discharge into lake it is unclear what the purpose is of these pipes	Contact landowner for more information NPS Education for property owners	Med	Private property Permission may need to be sought for further implementation
V	No identified problems	NPS Education for property owners	Low/Med	Distribute NPS educational materials for property owners
VI	Pipe discharges into brook plus 3 paved channels direct runoff into brook	Create roadside drainage ditches and vegetated swales to capture and infiltrate runoff Create an infiltration trench to capture and infiltrate runoff Install new subsurface stormwater treatment systems	Med	Determine amount of land available for alternative treatments Work with City of Pittsfield Department of Public Works
VII	Paved runoff at bridge and ATV trail eroding into brook	Create roadside drainage ditches and vegetated swales to capture and infiltrate runoff Create an infiltration trench to capture and infiltrate runoff Block trail stabilize banks and create vegetated buffer Provide educational materials to ATV users Work with ATV groups to stabilize and maintain trail or relocate trail to preferable location	Low/Med	Determine amount of land available for alternative treatments Work with City of Pittsfield Department of Public Works Distribute educational materials Work with ATV groups
VIII	3 pipes drain 6 catch basins more information is needed to determine connections	Conduct water quality monitoring of discharge from pipes	Med/High	Pipes can be monitored without accessing private property. Work with City of Pittsfield Department of Public Works for potential retrofit of existing catch basins
IX	Drain densely populated, steeply sloped sub basin	Retrofit existing catch basins to provide pre-treatment	Med/High	Work with City of Pittsfield Department of Public Works
X	Need to confirm connections	Conduct water quality monitoring of discharge from pipes	Med/High	Pipes can be monitored without accessing private property. Work with City of Pittsfield Department of Public Works for potential retrofit of existing catch basins

The assessment included specific recommendations and conceptual designs for Sub-watershed VII, which is associated with Churchill Brook. Examination of the stormwater collection system along the section of Churchill Drive that transects this sub-watershed showed evidence of flooding, scour and sediment deposition. This was most apparent at the intersection of Churchill Drive and Hancock Road. Pollutant loading to the stream at this location is exacerbated by the steep hill to the north of the intersection. Evidence of heavy sanding of this roadway was observed. This sand and grit runs into the stream and eventually in to the lake, transporting with it a variety of contaminants.

A preliminary routing assessment of this area suggests that a relatively large pre-manufactured treatment device will be needed to manage the runoff generated by this intersection and adjacent lands. This could be a unit such as the 9400 Vortechnic or the larger version of the SunTree Nutrient Removing baffle box. It may be possible to install such a structure within the road right-of-way, specifically along the eastern shoulder of Churchill Drive, immediately north of the Hancock Road intersection.

Runoff appears to be entering the brook at the bridge over Churchill Brook. A nearby ATV trail may be resulting in the transport and loading to the brook of significant amounts of sediment. Simple berming or the implementation of soil and sediment control practices similar to those sued at construction sites may alleviate this problem.

Requirements under NPDES Phase II

The City of Pittsfield is required to comply with the recently promulgated National Pollutant Discharge Elimination System, Phase II regulations regarding stormwater management. The ultimate goals of this program are to improve the water quality in the Housatonic River and its tributaries in Pittsfield, by preventing nonpoint source runoff and illicit stormwater discharges.

The City of Pittsfield will comply with the federal regulations for the National Pollution Discharge Elimination System Phase II Stormwater Regulations. To do so, the City will develop, implement and enforce a program to reduce the discharge of pollutants from the municipal separate storm sewer system (MS4) to the maximum extent practicable; protect water quality, and satisfy the water quality requirements of the Clean Water Act and Massachusetts Water Quality Standards

As part of the Stormwater Management Program, the City will:

a. Identify the person or department responsible for each stormwater control measure;
b. Identify the Best Management Practice (BMP) for the measure;
c. Identify measurable goals for each BMP, including time lines and milestones for implementation;
d. Present a Year-by-Year implementation plan.

All elements of the storm water management program will be implemented by the expiration date of the permit (5 year permit, effective March 10, 2003). The storm water management program developed by the City will implement the six minimum control measures required by the NPDES general permit. The six minimum control measures are Public Education and Outreach, Public Involvement/Participation, Illicit Discharge Detection and Elimination, Construction Site Stormwater Runoff Controls, Post-construction Stormwater Management, and Pollution Prevention/Good Housekeeping for Municipal Operations.

Minimum elements of the plan must include the following.

1. Public education and outreach. The City must implement a public education program to distribute educational material to the community. The public education program must provide information concerning the impact of storm water discharges on water bodies. It must address steps and/or activities that the public can take to reduce the pollutants in storm water runoff.

   The following should be included in the education and outreach efforts:
   a) information regarding both industrial and residential activities including illegal dumping into storm drains.
   b) coordination with local groups (i.e. watershed associations, or schools)
   c) materials for outreach/education may include, but are not limited to, pamphlets; fact sheets; brochures; public service announcements; storm drain stenciling and newspaper advertisements.

2. Public involvement and participation. All public involvement activities must comply with state public notice requirements and local public notice requirements.
   a) The City must provide an opportunity for the public to participate in the implementation and review of the storm water management program.
   b) Activities may also include volunteer stream monitoring or formation of a storm water management committee.

3. Illicit discharge detection and elimination. The City must develop, implement and enforce a program to detect and eliminate illicit discharges. An illicit discharge is any discharge to a municipal separate storm sewer that is not composed entirely of storm water. Exceptions are discharges pursuant to a NPDES permit
   a) The City must develop a storm sewer system map. At a minimum, the map must show the location of all outfalls and the names of all waters that receive discharges from those outfalls. Additional elements may be included on the map, such as, location of catch basins, location of manholes, and location of pipes within the system. Initial mapping should be based on all existing information available to the City including city records

and drainage maps. Field surveys may be necessary to verify existing records and locate all outfalls.

b) To the extent allowable under state or local law, the City must effectively prohibit, through an ordinance or other regulatory mechanism, non storm water discharges into the system and implement appropriate enforcement procedures and actions. If a regulatory mechanism does not exist, development and adoption of such a mechanism must be included as part of the storm water management program.
c) The City must develop and implement a plan to detect and address non -storm water discharges, including illegal dumping, into the system.
d) The City must inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper waste disposal.
e) The non-storm water discharges must be addressed if they are identified as being significant contributors of pollutants to the small MS4.

4. Construction site storm water runoff control. The City must develop, implement, and enforce a program to reduce pollutants in any storm water runoff to the MS4 from construction activities that result in a land disturbance of greater than or equal to one acre. The City must include disturbances less than one acre if part of a larger common plan.

   At a minimum, the program must include:

   a) To the extent allowable under state or local law, an ordinance or other regulatory mechanism to require sediment and erosion control at construction sites. If such an ordinance does not exist, development and adoption of an ordinance must be part of the program.
   b) Sanctions to ensure compliance with the program. To the extent allowable under state or local law sanctions may include both monetary or non-monetary penalties.
   c) Requirements for construction site operators to implement a sediment and erosion control program which includes BMPs that are appropriate for the conditions at the construction site, including efforts to minimize the area of the land disturbance.
   d) Requirements for the control of wastes, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter, and sanitary wastes.
   e) Procedures for site plan review including procedures which incorporate consideration of potential water quality impacts. The site plan review should include procedures for preconstruction review.
   f) Procedures for receipt and consideration of information submitted by the public.
   g) Procedures for inspections and enforcement of control measures at construction sites.

5. Post construction storm water management in new development and redevelopment. The City must develop, implement and enforce a program to address storm water runoff from new development and redevelopment projects that disturb greater than one acre and discharge into the municipal system. The program must include projects less than one acre

if the project is part of a larger common plan of development which disturbs greater than one acre.

The post construction program must include:

a) To the extent allowable under state or local law, an ordinance or other regulatory mechanism to address post construction runoff from new development and redevelopment. If such an ordinance does not exist, development and adoption of an ordinance must be part of the program.
b) Procedures to ensure adequate long term operation and maintenance of best management practices.
c) Procedure to ensure that any controls that are put in place will prevent or minimize impacts to water quality.

6. Pollution prevention and good housekeeping in municipal operations.

The City must

a) Develop and implement a program with a goal of preventing and/or reducing pollutant runoff from municipal operations. The program must include an employee training component.
b) Include, at a minimum, maintenance activities for the following : parks and open space (areas such as public golf course and playing fields); fleet maintenance, building maintenance; new construction and land disturbance; and road way drainage system maintenance and storm water system maintenance.
c) Develop schedules for municipal maintenance activities described in paragraph (b) above.
d) Develop inspection procedures and schedules for long term structural controls.

Chapter 3 - Jurisdictions & Authorities

There are multiple jurisdictions and authorities that influence the management of Onota Lake. Onota Lake is located entirely within and is owned by the City of Pittsfield. The City is the primary management authority with responsibility for the maintenance and operation of the dam, permitting authority, and enforcement responsibilities. In addition, the Massachusetts Environmental Police have enforcement authority on the lake. The Lake Onota Preservation Association, Incorporated (LOPA) is a stakeholder group that was originally established by the City of Pittsfield. The City and LOPA have worked effectively in many partnerships utilizing the expertise of local groups such as the Berkshire Regional Planning Commission, the Lake and Ponds Association of Western Massachusetts, and the Housatonic Valley Association.

City of Pittsfield

Pittsfield was incorporated as a City in 1861. (City of Pittsfield Parks, Recreation and Open Space Plan, 1994) The Pittsfield Parks Department manages a large waterfront park, Burbank Park, at Onota Lake. This municipally owned park serves as the primary access point for lake users that do not live on the lake. The park includes a fishing pier, a boat ramp, restrooms and the Controy Pavilion. There are three swimming areas on the lake. Supervised swimming with lifeguards is provided for a ten week period, during the summer, from 10 am to 6 pm, seven days a week. The other two swimming areas are unsupervised. One is called the old beach area along the southern portion of the park and the other is the open, grassed shoreline, north of the supervised swimming area. All these areas are open to residents and non-residents alike and no fee is charged. Many organized events are held at Burbank Park including Wednesday night summer concerts.

The Department of Community Services for the City of Pittsfield is designated as the overall management authority for Onota Lake and its dam. This Department is responsible for all lake management decisions. In addition, this Department is responsible for conducting lake management activities and securing all applicable local, state, and federal permits. The Pittsfield Conservation Commission is the local permitting authority for management activities conducted at the lake under the jurisdiction of the Wetlands Protection Act.

The City of Pittsfield conducts an annual 3ft drawdown at Onota Lake and conducts regular dam maintenance, such as cleaning of the fish screen. The City has been instrumental in all aspects of lake management including whole-lake herbicide treatment, spot herbicide treatment, installation of a benthic barrier at the supervised swimming area, introduction of milfoil-eating weevils, spot suctioning of milfoil, and diver hand-pulling of milfoil. The City operates a successful mechanical harvesting program at Pontoosuc Lake, which lies in the boundaries of both Pittsfield and Lanesborough. The mechanical harvesting program and hydroraking through

the City of Pittsfield is available to Onota Lake if not n conflict with other lake management activities.

Lake Onota Preservation Association, Incorporated (LOPA)

LOPA was established in 1985 as a citizen support group to the City of Pittsfield as the City pursued funding under the Clean Lakes Program. LOPA's first president was the City of Pittsfield's Community Development Director. LOPA's By-laws state its mission in support of the City of Pittsfield to "promote the welfare of Lake Onota, to enhance the quality of the water and to establish and promote programs to improve the lake". An initial task of LOPA was the formation of a review and selection committee to select a contractor to conduct a Diagnostic/Feasibility Study (D/F Study) in 1987/88. The committee ultimately selected the IT Corporation to conduct a one year D/F Study, which has set the stage for the efforts to preserve the lake. Several recommendations from that study have been completed and others are in various stages in the process of being completed. The Clean Lakes Program funding was discontinued after the completion of the Diagnostic/Feasibility Study resulting in the temporary inactivity of LOPA. LOPA was revitalized in 1995 when a volunteer monitoring program was created in connection with the USGS Satellite Monitoring Program. The volunteer monitoring program has since become an integral part of the lake management effort.

LOPA currently has over 300 members, representing lakefront landowners, citizens, and citizen groups. LOPA is representative of both stakeholders that own property around the lake and those that simply value the lake as a natural resource. Many public spirited organizations join in this effort. For example, Girls, Inc. has for decades operated summer programs for young girls on their 88 beautiful acres on the lake and is an active supporter of the effort to protect a treasure of the Berkshires. Also the Onota Boat Livery, a local small business marina on the lake which provides additional public access to many hundreds of local residents and seasonal visitors annually, has been an active participant in the efforts to preserve the recreational value of the lake. The Berkshire Rowing and Sculling Society (BRASS) recognizes the importance of both short and long-term preservation actions and is considered a partner in the stewardship of this resource and actively supports current endeavors. There are annually ten to twelve fishing derbies and/or tournaments run by various sportsmen and fishing organizations. These four are but examples of the great number of people and organizations in the community that not only benefit from the lake, but also actively engage in the efforts to protect and maintain its historic natural environment. LOPA's Board of Directors meets quarterly in open meetings and elects Directors and Officers bi-annually. Board membership includes representation of several lakefront owner associations around the lake. LOPA has standing committees for Water Quality & Weed Control, Fish & Wildlife, Lake Recreation & Water Safety, and Citizen Education & Public Relations. In 2003, LOPA completed incorporation as a 501(c)3 non-profit organization.

Other Jurisdictions and Authorities

Established in 1966 under Chapter 40B of the Massachusetts General Laws, the Berkshire Regional Planning Commission (BRPC) is the official regional planning agency for the 32 municipalities in Berkshire County. As such, BRPC is active in environmental, land use, transportation, economic and community development, and other comprehensive planning issues throughout the county. Over a period of many years, BRPC has been responsible for much of the water quality planning work and local planning work in the region. BRPC has a long history of lake management and has worked effectively in a partnership with LOPA and the City of Pittsfield.

The Lakes and Ponds Association of Western Massachusetts (LAPA-West) was formally established in 1999. The primary goal of LAPA-West is to develop an active and effective network of stewards interested in improving water quality in the lakes and ponds of the watersheds of Western Massachusetts. LOPA has represented the interests of Onota Lake to LAPA-West since their formation. LAPA-West has successfully assembled key stakeholders interested in developing and implementing lake management programs and has coordinated their activities and has worked with LOPA to conduct water quality monitoring workshops. In addition, Onota Lake has regularly been featured in the LAPA-West Annual Workshops and quarterly newsletter.

The Housatonic Valley Association (HVA) was founded in 1941. The HVA mission includes, "to reclaim the Housatonic River and its watershed from past abuses, preserving the region for all our children and future generations and encouraging everyone to enjoy and understand all the treasures that it holds. HVA works to preserve those special natural places throughout the Housatonic River Valley that offer solace and comfort, and renew our spirits. HVA works to conserve the natural character and environmental health of our communities in the Housatonic River watershed by restoring and protecting our lands and waters for this and future generations." HVA has been a regular member of the LOPA Technical Advisory Committee since 2001.

Chapter 4 - Development of the Onota Lake Management Plan

The Berkshire Regional Planning Commission, LOPA and the City of Pittsfield facilitated a Technical Advisory Group to develop this management plan. The charge to the Technical Advisory Group was to: a) understand the problems and concerns experienced by lake users; b) explore alternative feasible management approaches c) develop management goals and objectives; and d) draft a plan to present to the City of Pittsfield Administration and City Council.

The Technical Advisory Group was composed of volunteers and of people from agencies and municipalities, who were familiar with Onota Lake as well as technical and regulatory matters. The active members are as follows; Bob Race (LOPA/LAPA-West), Tom Armstrong (LOPA), Dorothy Mara (LOPA), Dick Laureyns (BRASS/LOPA), Jane Winn (LOPA), Dennis Reagan (HVA), Jim McGrath (City of Pittsfield), Tom Matuszko (BRPC), and Melissa Jette (BRPC). This provided an assurance that the management plan stayed on track and was technically credible.

The Technical Advisory Group held a series of meetings between October 2003 and May 2004. The meetings were intended to provide a general overview of the lake management planning process and to discuss management goals and objectives. In addition, and outline of the management plan and a draft plan were presented at two separate open meetings of the LOPA Board of Directors. Finally, the short range planning objectives were discussed and a final review of the draft final report was concluded.

Problems and Concerns

The Technical Advisory Group considered a wide-range of problems and concerns. They did not limit their considerations to strictly water quality concerns, but rather identified concerns relative to the aesthetics, environmental quality and overall condition of the lake, both presently and projecting into the future. In this vein, recreational use for example, is relevant to the management of the lake and therefore is addressed in this management plan. These problems and concerns form the basis for the development of management goals and objectives, which in turn form the basis for specific recommended management actions.

A. Nuisance Aquatics

Eurasian watermilfoil (*Myriophyllum spicatum*) is a non-native, exotic species and has been identified as the dominant species in the north basin by Souza et al., 1991 and subsequently as the dominant species throughout the lake by Wagner et al., 1996 and in subsequent macrophyte surveys conducted by Aquatic Control Tecnology, Inc and GeoSyntec Consultants. E. watermilfoil was identified as the primary nuisance species of concern at Onota Lake by the Technical Advisory Group. E. watermilfoil is documented to grow in dense stands throughout the water column and form surface mats when fully grown. It tends to outcompete the native

plant assemblage and become the dominant species. Its dense growth interferes with boating as well as fishing, swimming, and aesthetics. Other aquatic plants are also found at nuisance levels in Onota Lake. In particular, Curlyleaf Pondweed (*Potamogeton crispus*) is becoming problematic in the early season before dying down in July. (GeoSyntec, 2003) A whole lake herbicide treatment involving SONAR was conducted in 1999. In recent years, however, Onota Lake has experienced a re-growth of milfoil despite several localized herbicide applications, as documented in macrphyte surveys conducted by Aquatic Control Technolgy, Inc. and GeoSyntec Consultants. (ACT, 2002; GeoSytec, 2003) In addition, there is the potential for new exotic species introductions into Onota. A pioneer infestation of Water Chestnut (*Trapa natans*) was recently discovered in an isolated area of the lake north of Dan Casey Causeway. Efforts to prevent the introductions of other exotic species are desirable. Efforts should be focused on the control of nuisance aquatic vegetation particularly invasive species.

It is important to acknowledge that many waterfront property owners are willing and able to exert individual efforts to help control nuisance aquatic species along their own shorelines. Assistance should be provided to waterfront property owners in their efforts to manage nuisance aquatic vegetation along their shoreline. A streamlined comprehensive permit process should be developed for responsible shoreline lake management activities conducted by individual landowners.

In addition, there is a new concern regarding the management of rare and endangered species in the lake, along the shore and within the greater watershed. Efforts must be made to better understand the new rare and endangered species habitat designation and its implications for lake management. Of particular concern is the affect of the rare and endangered species habitat designation on management of nuisance aquatic plants. Also of concern is the threat to rare and endangered aquatic plants from the pressure of competition by the established exotic, nuisance species.

B. Drawdown

An annual drawdown of 3 ft is utilized to protect against flooding during spring runoff, protect against shoreline destruction from ice, and to provide limited control of invasive species. The current ability to drawdown the lake is limited by the size of the existing outflow pipe. During reconstruction of the Onota Lake dam in 1995, the 4 foot diameter outlet pipe previously in place was replaced with a 2 foot diameter pipe. This, inevitably, reduced the maximum outlet flow to twenty five percent (25%) of the previous capacity. With the current outlet pipe it has been difficult to achieve drawdown within the ideal timeframe and climate. There are concerns regarding flooding, property damage and increased shoreline erosion due to limited drawdown capacity and time required to drawdown the lake.

In addition, drawdown is a potentially effective means of controlling nuisance aquatic species within shallow areas of Onota Lake. (Wagner, 1996) Since nuisance plants such as E.

watermilfoil, and Curlyleaf Pondweed are most problematic in shallower areas, this management technique may be particularly effective for the control of nuisance plants. An annual drawdown of 4 ft would be expected to reduce milfoil and curlyleaf pondweed cover over 257 acres of the lake. Additionally, a drawdown of 8ft would be expected to increase the aquatic plant management area to over 324 acres of total coverage area. (Wagner, 1996) The LOPA Drawdown Committee reviewed lake bathymetry and existing data in 2003. The committee estimated that an annual drawdown of 6ft would approximately double the aquatic plant management area. The committee recommended that periodic deep drawdowns should be considered. The infrastructure necessary for deep drawdown as well as appropriate permitting will be required and are under consideration.

C. Watershed Management

The Onota Lake watershed is not densely developed. The watershed is rural, primarily forested with a mix of residential uses and agriculture. (MassGIS 1997 Land use Data) It is important to recognize that the Onota Lake watershed is evolving. There is the potential for change within the watershed overtime especially with the increased development pressures. Large parcels of land currently forested, operated as farmland, or utilized by camp grounds could potentially become host to a variety of alternative land uses and may ultimately become more densely developed.

Onota Lake's eutrophication can be attributed to watershed urbanization and subsequent increases in sediment and nutrient loading. The most all-encompassing cause of Onota Lake's problems are a result of excessive sediment and nutrient loading. Non-point source pollution, including erosion must be controlled. (Souza et al., 1991)

Like any watershed, the Onota Lake watershed is vulnerable to the impacts of the land use patterns. The potential for accelerated sedimentation, the removal of vegetation filters and the increased pollutant loading of waterways that is associated with changing landscapes threatens the present conditions of Onota Lake. Future development within the lake's watershed could substantially accelerate the lake's eutrophication process. (Souza et al., 1991)

Point sources of pollution are regulated and many nonpoint sources of pollution, such as septic systems have been virtually eliminated. Overall the water quality of Onota Lake is desirable. Nonpoint sources of pollution have the potential to have a cumulative impact on water quality over time. If nonpoint sources of pollution are left untreated the water quality of Onota Lake will likely deteriorate exponentially over time. Sedimentation and siltation are already having a negative impact on Onota Lake. (Souza et al, 1991) Many areas of the lake are reportedly much shallower than they were historically. It has been reported that a delta is forming at the mouth of Parker Brook with a smaller plume forming at the mouth of Blythewood Tributary. Nonpoint sources of pollution, including sediment and nutrients, should be addressed to

prevent the deterioration of present conditions. Efforts should be made to manage stormwater including the implementation of land use regulations and best management practices (BMPs).

It is also important to consider the larger watershed. The impacts from the outflow of Onota Lake to the Housatonic River should be considered. This includes flooding, streambank erosion, and fisheries.

D. Education & Outreach

Education and outreach are lake management concerns critical to the effective management of Onota Lake. Onota Lake is used by varied and various user groups. Membership within LOPA is not limited to lakefront property owners. An effort is being made to increase public awareness and knowledge through enhanced education and outreach efforts. In 2002 LOPA established the Citizen Education and Public Relations Committee. This committee is heading outreach efforts, citizen education, public relations, and membership. Though still in its early stages, the committee began efforts to establish a web page through LAPA-West, has collected mailing information for all lakefront property owners, and has worked with BRPC to complete a mailing campaign designed, in part, to increase membership. BRPC, working with LOPA, sent letters to over 400 lakefront and watershed landowners encouraging membership in LOPA to help preserve Onota Lake. However, this committee should adopt a mission and formally establish goals and objectives each year. Efforts should be made to increase media attention to the management issues at Onota Lake. In addition, a greater level of campaigning should be done with regard to product modification and behavior modification within the watershed.

E. Recreation & Regulations

Recreation and enforcement are lake management concerns critical to the effective management of Onota Lake. Efforts should be made to increase the coordination of various lake users. Meanwhile, the City's commitment to both lake management and the enforcement of existing safety and environmental protection regulations should be supported and strengthened.

Wakes caused by large boats and 'boogie boards' were noted as a serious concern with respect to shoreline erosion and causing unpleasant conditions on the lake. Further, wake jumping by personal watercraft was viewed as dangerous and inconsiderate. Boater behavior was noted as a concern, especially the practice of exceeding safe speeds and boating in and around established swimming lanes.

Concerns exist with regard to boat speed, wakes, traffic direction and congestion and are amplified by the number of users. Enforcement of existing rules and regulations was seen as substantially lacking. More support is needed for instituting lake surface use ordinances on the lake is necessary.

Concern was expressed regarding the poor visible appearance of Burbank Park. Garbage, unattended restrooms, off-road vehicles, and loose dogs were mentioned as particularly problematic. Concerns were expressed regarding the need for improved trash pick up and attended restrooms. Efforts should be made to support City ordinances regarding the control of off-road vehicles and unleashed dogs. Previous attempts at improving landscaping have met with limited success do to the lack of volunteers and the theft or destruction of landscape materials, including plants. Recent collaboration between LOPA and the City of Pittsfield has been successful and is improving the situation. Collaboration has included organized volunteer trash and debris clean-ups and landscaping maintenance efforts. Overall Burbank Park provides many resources to the community at large including a fishing pier, boat ramp, and hiking/walking trails.

Chapter 5 - Management Goals, Objectives & Recommended Actions

Management goals, objectives and recommended actions were developed by the Technical Advisory Group to address the problems and concerns identified in the previous section.

Effective management plans have meaningful and measurable goals and objectives leading to management actions. The goals and objectives also provide a framework so the results of management actions can be objectively evaluated. Management plans contain specific statements that result in meaningful action.

A. Nuisance Aquatics

Goal #1 - Conduct sound, comprehensive aquatic plant management that a) maintains and improves healthy native aquatic plants; b) addresses the extent of the re-growth of milfoil in Onota Lake that is reaching nuisance levels for the current uses of the lake; c) provides quality fish and wildlife habitat; d) minimizes the ecological impacts and recreational impacts of nuisance aquatic plants; e) effectively coordinates with other ongoing management efforts; and f) addresses the recent designation as rare and endangered species habitat.

Short-Term Objectives & Recommended Actions

- Expand milfoil-eating weevils as applicable, based on the success of the 2003 trial
- Hand pulling and/or "Armstrong Rake" removal of invasive, non-native plant species
- Pursue drawdown of 4 – 8 ft to reduce milfoil and curlyleaf pondweed cover over between 257 – 324 acres of total coverage area
- Pursue hydroraking of inshore areas
- Reuse existing and/or additional use of a benthic barrier
- Work with the City Conservation Commission and Parks Department to provide waterfront property owners with an opportunity for individual alternative plant management activities along their shoreline.
- Continue annual volunteer macrophyte survey.
- Monitor Onota Lake for new invasive, exotic species infestations.
- Use every reasonable means to prevent new invasive, exotic species from entering Onota Lake.
- Determine the impact of the recent NHESP designation as Priority Habitat upon lake management planning and decision-making.

Long-Term Objectives & Recommended Actions

- Conduct efforts focused to reduce, control, and/or manage Eurasian watermilfoil, Curlyleaf Pondweed, and Water Chestnut. Develop and implement a comprehensive aquatic plant management plan that protects and restores beneficial native plants and minimizes the nuisances and ecological impacts of non-native plants.
- Consider herbicide spot treatment with either SONAR PR or Renovate 3 or newer herbicide
- Investigate the development of a "spot suction" boat/barge further
- Consider whole-lake or regularly yearly herbicide treatment as primary control technique for nuisance aquatic plants
- Consider re-institution of mechanical harvesting as primary control technique for nuisance aquatic plants

B. Drawdown

Goal - Manage water level to the maximum extent feasible to control flooding, reduce shoreline property damage, and control nuisance aquatic species while minimizing negative impacts on emergent wetlands, native flora, and fauna.

Short-Term Objectives & Recommended Actions

- Continue to conduct 3ft drawdown as historically permitted by local and state authorities
- Evaluate existing infrastructure at Onota lake dam outfall

Long-Term Objectives & Recommended Actions

- Design and installation of infrastructure necessary for controlled drawdown (expected to include 3-4 foot diameter outlet pipe and control valve around the dam)
- Pursue permit for 4 – 8ft drawdown on periodic basis (every 3-4 years) to reduce milfoil and curlyleaf pondweed cover over between 257 – 324 acres of total coverage area

C. Watershed Management

Goal #1- Manage nonpoint source pollution through such items as stormwater management, including structural best management practices to prevent the deterioration of present in-lake water quality conditions in the lake and downstream receiving waters.

Short-Term Objectives & Recommended Actions

- Redesign Thomas Island culvert and install southwest of Theodore Pomeroy Pond including appropriate achieve flow

- Install BMPs as recommended in *An Integrated Approach to the Management of Stormwater Water Quality Within the Sub-Watersheds of Onota Lake Pittsfield, Massachusetts* conducted by Princeton Hydro, BRPC, and LOPA, 2004
- Install BMPs at Burbank Park as recommended in the *Storm Drain and Erosion Assessment at Burbank Park* conducted by BRPC and Foresight Land Services, 2003

Goal #2 - Minimize the negative impact on lake, the lake watershed, and downstream receiving waters from nonpoint source pollution through non-structural best management practices, such as through land use regulation.

Short-Term Objectives & Recommended Actions

- Continue and expand volunteer water quality monitoring of in-lake and tributary/storm drain systems

Long-Term Objectives & Recommended Actions

- Review land use regulations and ordinances applicable to the Onota Lake watershed
- Research and support appropriate revisions to existing and/or additional land use regulations and City and Town ordinances to prevent lake deterioration
- Preserve and protect open space within the watershed
- Monitor erosion sites and remediate as necessary
- Prioritize and implement recommended actions of the *Watershed Survey Final Report & Action Plan* Prepared by Riverways, Spring 2003 as appropriate

Goal #3 - Manage the internal recycling of phosphorus within the lake.

Long-Term Objectives & Recommended Actions

- Consider deep hole aeration as recommended by Souza et al., 2003
- Consider dredging to remove nutrient rich sediments

D. Education & Outreach

Goal - Increase public awareness and knowledge through enhanced education and outreach efforts.

Short-Term Objectives & Recommended Actions

- Strengthen efforts of LOPA's Citizen Education and Public Relations Committee.
- Promote product modification and behavior modification within the watershed.
- Work with appropriate groups to disseminate educational and outreach materials throughout the watershed. Educational and outreach topics under consideration include

- Land protection
- BMPs for agriculture
- Riparian vegetated buffers as pollution buffers and geese barriers
- Storage and disposal of household hazardous materials
- Low-phosphate detergents
- Lake-friendly landscaping and the use of low and no- phosphorus fertilizers
- Agricultural best management practices including information for horse owners and horse farms such as manure storage

Long-Term Objectives & Recommended Actions

- Increase use of media for the dissemination of information and solicitation of new members.
- Continue to strengthen LOPA with new members from all user groups and stakeholders.
- Increase outreach to property owners within the watershed, including camps, farms, gravel operations, and Hillcrest Hospital.
- Increase outreach to individual neighborhood associations within the watershed.

E. Recreation & Regulations

Goal #1 - Increase the City's commitment to both lake management and enforcement of City regulations within the watershed.

Short-Term Objectives & Recommended Actions

- Work with Pittsfield Parks Department and Environmental Police to post regulations, distribute educational materials, and report violations.

Goal #2 - Work with the proper local and state authorities to increase the enforcement of existing safety and environmental protection regulations to a) reduce user conflicts; b)minimize nonpoint source pollution resulting from use activities, such as ORV's, trash, and pet waste; and c) assure that boating activities are safe, courteous and do not add to shoreline erosion.

Short-Term Objectives & Recommended Actions

- Enforce surface regulations to promote safe and courteous boating.

Long-Term Objectives & Recommended Actions

- Lobby at the state and local level for improved water safety law enforcement
- Consider City ordinance provisions in addition to applicable state-wide boating regulations, that may include:
  - Speed Limit: Motorboats are not to be operated at a speed greater than is reasonable and proper having due regard to safety of other boats and persons.

- Water-Skiing or Surfboarding: No motorboat shall be used for the purpose of water-skiing, surfboarding or other similar device, unless such operation is performed in a manner so that neither the boat nor the skier or surfboard rider come within 150 feet of the shoreline, docks, swimmers or other boats.
- No Wake Zone: No person shall operate a motorboat or be towed on water skis or similar device at greater than slow-no wake speed within 150 feet of shore, except when launching or landing a skier, to limit wakes addition to or increase of the natural shoreline erosion from wind generated waves.

Chapter 6 - Summary of the Vision for Onota Lake

The Lake Onota Preservation Association, Inc. will work with the City of Pittsfield and will share responsibility for the administration, coordination and oversight of this management plan. In order to simply and effectively assure that the management actions are implemented the partners in this effort have developed a Five Year Action Plan that summarizes the proposed management actions, identifies the agency responsible for taking the lead in implementing each action, identifies partners and cooperators, and identifies funding needs or requirements. If adopted by the City of Pittsfield, the Five Year Action Plan will be a tool for the City and LOPA in monitoring the performance of the partners and cooperators.

Much of the work reflected in the Goal, Objectives and Recommended Actions can be accomplished by focusing the efforts of existing programs. However, success will require coordination among those programs as well as special watershed wide initiatives. The success of the Long-Range Management Plan will depend on leveraging local government, state government, private sector and nongovernmental organization involvement and resources. A major component of success will require engaging local government, whose authority and local decision making collectively have a significant impact on the natural resources and sustainability of communities throughout the Onota Lake watershed. All of these steps require institutionalized coordination and strong communication among government agencies and stakeholders. Therefore, the Action Plan will present an Onota Lake Long-Range Management Plan implementation process and roles for not only participating governmental agencies, but also LOPA, other basin stakeholders, and the general public. The Five Year Action Plan will further enable the City, LOPA, and other basin stakeholders to monitor the results of various action items to guide the continued management of this valuable natural and recreational resource.

Five Year Action Plan

A. Nuisance Aquatics

Goal #1 - Conduct sound, comprehensive aquatic plant management that a) maintains and improves healthy native aquatic plants; b) addresses the extent of the re-growth of milfoil in Onota Lake that is reaching nuisance levels for the current uses of the lake; c) provides quality fish and wildlife habitat; d) minimizes the ecological impacts and recreational impacts of nuisance aquatic plants; e) effectively coordinates with other ongoing management efforts; and f) addresses the recent designation as rare and endangered species habitat.

Strategy	Objective/Action	Lead Committee or Agency	Year	Funding/Cost (estimated)
Biological	Expand milfoil-eating weevils as applicable, based on the success of the 2003 trial	City of Pittsfield/ LOPA	1,2	$17,000 - $20,000
Mechanical	Hand pulling and/or "Armstrong Rake" removal of invasive, non-native plant species	LOPA	1-5	TBD
Hydrologic	Pursue 4-8ft drawdown	City of Pittsfield	2-5	City of Pittsfield Annual Budget
Mechanical	Pursue hydroraking of inshore areas	City of Pittsfield/ LOPA	1,2	Fee for service to interested shoreline property owners
Physical	Reuse of existing and/or additional use of benthic barrier	City of Pittsfield/ LOPA	1,2	$500 / $5,000
Regulatory	Work with the City Conservation Commission and Parks Department to provide waterfront property owners with an opportunity for individual alternative plant management activities along their shoreline.	City of Pittsfield/ LOPA	1-5	TBD
Monitoring	Continue annual volunteer macrophyte survey.	LOPA	1-5	Volunteer
Monitoring	Monitor Onota Lake for new invasive, exotic species infestations.	LOPA	1-5	Volunteer
Monitoring/	Use every reasonable means to prevent	LOPA/	1-5	Volunteer

Education	new invasive, exotic species from entering Onota Lake.	City of Pittsfield		
Planning	Determine the impact of the recent NHESP designation as Priority Habitat upon lake management planning and decision-making.	City of Pittsfield/ LOPA	2	TBD
Planning	Conduct efforts focused to reduce, control, and/or manage Eurasian watermilfoil, Curlyleaf Pondweed, and Water Chestnut. Develop and implement a comprehensive aquatic plant management plan that protects and restores beneficial native plants and minimizes the nuisances and ecological impacts of non-native plants.	LOPA/BRPC	2-5	Volunteer
Herbicide	Consider herbicide spot treatment with either SONAR PR or Renovate 3 or newer herbicide	City of Pittsfield/ LOPA	2,3	$20,000 - $40,000
Mechanical	Re-investigate the development of a "spot suction" boat/barge	LOPA	2,3	$5,000
Herbicide	Consider whole-lake or regularly yearly herbicide treatment as primary control technique for nuisance aquatic plants	City of Pittsfield/ LOPA	2-5	$200,000+
Mechanical	Consider re-institution of mechanical harvesting as primary control technique for nuisance aquatic plants	City of Pittsfield	2-55	$30,000 - $60,000 per year

B. Drawdown

Goal - Manage water level to the maximum extent feasible to control flooding, reduce shoreline property damage, and control nuisance aquatic species while minimizing negative impacts on emergent wetlands, native flora, and fauna.

Strategy	Objective/Action	Lead Committee or Agency	Year	Funding/Cost (estimated)
Hydrologic	Continue to conduct 3ft drawdown	City of Pittsfield/ LOPA	1-5	City of Pittsfield Annual Budget
Planning	Evaluate existing infrastructure at Onota lake dam outfall	City of Pittsfield	1,2	$2,000
Structural	Design and installation of infrastructure necessary for controlled drawdown (expected to include 3-4 foot diameter outlet pipe and control valve around the dam)	City of Pittsfield	2,3	TBD
Regulatory	Pursue permit for 4 – 8ft drawdown on periodic basis (every 3-4 years) in an effort to expose more than 100 additional acres of invasive species infected lake bottom to freezing.	City of Pittsfield	3,4	TBD

C. Watershed Management

Goal #1- Manage nonpoint source pollution through such items as stormwater management, including structural best management practices to prevent the deterioration of present in-lake water quality conditions in the lake and downstream receiving waters.

Strategy	Objective/Action	Lead Committee or Agency	Year	Funding/Cost (estimated)
Structural	Redesign Thomas Island culvert and install southwest of Theodore Pomeroy Pond including appropriate achieve flow	City of Pittsfield/ BRPC/LOPA	1	s.319 and City of Pittsfield match contribution
Structural	Install BMPs as recommended by Princeton Hydro, BRPC, and LOPA, 2004	City of Pittsfield	3,4	TBD
Structural	Install BMPs at Burbank Park as recommended in the Storm Drain and Erosion Assessment at Burbank Park conducted by BRPC and Foresight Land Services, 2003	City of Pittsfield/ BRPC	1,2	Phase I - $32,500 ($26,963 awarded by BEF) Phases II & III - $80,800

C. Watershed Management

Goal #2 - Minimize the negative impact on lake, the lake watershed, and downstream receiving waters from nonpoint source pollution through non-structural best management practices, such as through land use regulation.

Strategy	Objective/Action	Lead Committee or Agency	Year	Funding/Cost (estimated)
Monitoring	Continue and expand volunteer water quality monitoring of in-lake and tributary/storm drain systems	LOPA	1-5	Volunteer
Planning	Review land use regulations and ordinances applicable to the Onota Lake watershed	City of Pittsfield/ BRPC/ LOPA	2-3	TBD
Planning	Research and support appropriate revisions to existing and/or additional land use regulations and City and Town ordinances to prevent lake deterioration	City of Pittsfield/ BRPC	2-3	TBD
Planning	Preserve and protect open space within the watershed	Berkshire Natural resources Council (BNRC)	1-5	TBD
Monitor	Monitor erosion sites and remediate as necessary	LOPA	1-5	Volunteer
Planning	Prioritize and implement recommended actions of the *Watershed Survey Final Report & Action Plan* Prepared by Riverways, Spring 2003 as appropriate	City of Pittsfield/ BRPC/ LOPA	3-5	TBD

C. Watershed Management

Goal #3 - Manage the internal recycling of phosphorus within the lake.

Strategy	Objective/Action	Lead Committee or Agency	Year	Funding/Cost (estimated)
Structural	Consider deep hole aeration	City of Pittsfield	2,3	$330,000+
Physical	Consider dredging of nutrient rich sediments	City of Pittsfield/ LOPA	4,5	TBD

D. Education & Outreach

Goal - Increase public awareness and knowledge through enhanced education and outreach efforts.

Strategy	Objective/Action	Lead Committee or Agency	Year	Funding/Cost
Education	Strengthen efforts of LOPA's Citizen Education and Public Relations Committee.	LOPA	1-5	Volunteer
Education	Promote product modification and behavior modification within the watershed.	LOPA	1-5	Volunteer
Education	Work with appropriate groups to disseminate educational and outreach materials throughout the watershed.	LOPA	1-5	Volunteer
Education	Increase use of media for the dissemination of information and solicitation of new members.	LOPA	1-5	Volunteer
Outreach	Continue to strengthen LOPA with new members from all user groups and stakeholders.	LOPA	3-5	Volunteer
Outreach	Increase outreach to property owners within the watershed, including camps, farms, gravel operations, and Hillcrest Hospital.	LOPA	3-5	Volunteer
Outreach	Increase outreach to individual neighborhood associations within the watershed.	LOPA	4-5	Volunteer

E. Recreation & Regulations

Goal #1 - Increase the City's commitment to both lake management and enforcement of City regulations within the watershed.

Strategy	Objective/Action	Lead Committee or Agency	Year	Funding/Cost
Regulatory	Work with Pittsfield Parks Department and Environmental Police to post regulations, distribute educational materials, and report violations.	LOPA/ City of Pittsfield	1-5	Volunteer

E. Recreation & Regulations

Goal #2 - Work with the proper local and state authorities to increase the enforcement of existing safety and environmental protection regulations to a) reduce user conflicts; b)minimize nonpoint source pollution resulting from use activities, such as ORV's, trash, and pet waste; and c) assure that boating activities are safe, courteous and do not add to shoreline erosion.

Strategy	Objective/Action	Lead Committee or Agency	Year	Funding/Cost
Regulatory	Enforce surface regulations to promote safe and courteous boating.	City of Pittsfield/ Massachusetts Environmental Police	1-5	Volunteer
Regulatory	Lobby at the state and local level for improved water safety law enforcement	LOPA/ City of Pittsfield	3-5	Volunteer
Regulatory	Consider City ordinance provisions In addition to applicable state-wide boating regulations, that may include: · Speed Limits · Water-Skiing or Surfboarding Restrictions · No Wake Zones	LOPA/City of Pittsfield	3-5	TBD