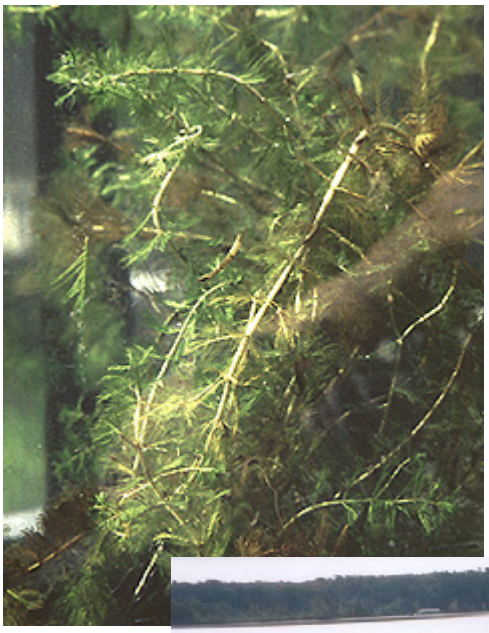
Eurasian Watermilfoil Re-growth Control Project at Onota Lake



conducted by
The City of Pittsfield
The Berkshire Regional Planning Commission (BPRC)
and
The Lake Onota Preservation Association, Incorporated (LOPA)

Funded by
The Massachusetts Department of Environmental Management (DEM)
Lakes and Ponds Grant Program

This 2002 DEM Lakes and Ponds Program Grant entitled *"Eurasian Watermilfoil Re-growth Control Project at Onota Lake"* was conducted by the City of Pittsfield, The Berkshire Regional Planning Commission (BPRC) and the Lake Onota Preservation Association, Incorporated (LOPA). It's genesis was a 1999 whole-lake SONAR treatment of Onota Lake which eliminated better than 90% of the 200 or so acres of milfoil that was choking the lake greatly impeding recreational useage. However it was recognized that the milfoil was likely to return and thus a multifaceted program was derived to employ and evaluate a combination of mechanical, biological and limited chemical in-lake techniques to combat its resurgence. Additional efforts at erosion control in Burbank Park (the City's large, public park on the lakeshore) and an outreach/public education program were included. The resulting $60,140 program ($25,000 DEM, $25,000 City match, $10,140 private contribution) contained eight tasks which will be very briefly summarized here-in and thoroughly documented in the body of this report.

Task 1: Assessment of stabilization/erosion control and storm drain treatment needs
A thorough assessment of Burbank Park was completed resulting in prioritization of remediation needs and preliminary design of an implementation concept for the highest priority concern.

Task 2: Benthic Barrier
A 4,200 square foot benthic barrier was successfully installed by divers in a prime swimming area just offshore in Burbank Park in August 2002 and has fully controlled all macrophyte growth since.

Task 3: Milfoil-eating Weevil trial
This trial was originally planned for 2002 but due to contracting delays and lack of a suitable site, was postponed for a year. In July 2003, GeoSyntec Consultants, under subcontract to BRPC, emplaced 10,000 weevils along a 30 meter tract. An initial survey in late August showed significant evidence of weevil activity. A follow-up survey will be conducted in the summer of 2004 to verify success or failure to winter-over and re-establish and/or expand effective control.

Task 4: Diver Harvesting
Under BRPC subcontract, Action Sports & Travel scuba divers cleared a one-half acre plot of dense milfoil in September 2002. They extracted approximately 1300 gallons of milfoil plant and root structure in seven one-half day diving sessions removing 80-90% of the plants. We concluded that diver harvesting in dense plant beds is manpower intensive and quite expensive (~$5,000/acre). Follow-up assessment showed the milfoil filled back in over one season (probably due to heavily-infested surrounding area) and thus is probably only cost-effective for isolated areas.

Task 5: Spot-suction Harvesting
LOPA volunteers constructed an experimental suction platform using a sump pump on a swimming raft. The trial showed the concept is viable but should be designed with a venturi type pump and either power-assist mechanical or scuba diver control of the suction head.

Task 6: Professional macrophyte surveys
Under subcontract to the City, Aquatic Control Technologies, Inc. (ACT) completed early and late season surveys in 2002, documenting the aquatic plant community status throughout the lake and revealing significant milfoil re-growth and early season Curley-leaf Pondweed re-emergence.

Task 7: Chemical Spot Treatment
Under subcontract to the City, ACT, in July 2002 treated approximately 70 acres (35 acres under $10,000 of this grant plus 35 acres privately funded thru LOPA fundraising) with the herbicide REWARD obtaining one season control of milfoil re-growth.

Task 8: Outreach
BRPC sent letters to over 400 watershed, tributary and lake-front owners encouraging membership in LOPA to help preserve Onota Lake. BRPC also generated and published two brochures (also available on the internet): "Non-point Source Pollution Education for Homeowners" and "Onota Lake Exotic Invasive Aquatic Species". Under subcontract to BRPC, 4Winns Productions produced a documentary video-tape covering the above tasks of this grant. This video has been included as part of this final report.

Overall, this grant has been fully and successfully completed and has accomplished its goal of stemming the tide of milfoil re-growth while evaluating and documenting the cost-effectiveness of various mechanical, biological and chemical control techniques. However, its conduct has also pointedly revealed how difficult the task of controlling milfoil re-growth really is, particularly if the control efforts are not started immediately after a successful SONAR treatment as was the case here. LOPA's conclusion is that mechanical means have the potential to accomplish re-growth control, but only if applied immediately and massively to the earliest sign of re-growth. Unfortunately, it is "too little – too late" for Onota Lake.

Onota Lake is a 617-acre lake located 3 miles northwest of the City limits of Pittsfield. Onota Lake has been classified as mesotrophic and is listed on the federal 303d list of impaired waters as impaired by noxious aquatic weeds. 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. Stormwater runoff from existing development and future development is likely to result in reduced water quality and further impairment to the lake if left unchecked. Impacts of stormwater runoff vary, but may include reduced water clarity, the destruction of aquatic habitat, and the growth of algal blooms. As a consequence of these impacts, the value of the Lake as an ecological, community and economic resource is threatened.

A significant amount of research and monitoring has been undertaken in Onota Lake. To avoid duplication and maintain consistency with other relevant studies and policies the partners in this project have taken 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. Steve Souza
- *Environmental Impact Review and Managerial Implications for a Proposed Drawdown of Onota Lake, Pittsfield, MA*
  Fugro East, Inc., July 1996, Principal Investigator – Dr. Ken 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)

A significant number of recommendations have been addressed at Onota Lake. A brief list of recommendations with their current status is as follows:

Watershed management techniques identified to control causes of eutrophication by reducing external nutrient and sediment loading.

1. Stormwater retention/detention
2. Erosion control (conducted at Burbank Park)
3. Land use ordinances
4. Stormwater management ordinance for new development
5. Product modification
6. Sewering/infrastructure improvements (nearing completion)

In-lake techniques identified to reduce impact of existing eutrophication

1. Construction of Thomas Island culvert accompanied by dredging (currently being implemented under s319 Grant)
2. Weed Harvesting (not done since 1998 – no plans to resume)
3. Spot dredging (not being planned)

4. Aeration (assessment planned)
5. Sediment inactivation with sodium aluminate of aluminum sulfate (not being considered)
6. Macrophyte barriers to create fishing lanes
7. Drawdown overwinter to 3-4 ft (currently 3ft)
8. Power boat limitations
9. Herbicide treatment (1999/2000 Whole lake SONAR treatment – 2001& 2002 spot treatment)
10. Biological
11. Monitoring program (current bi-weekly in-lake program – newly established tributary monitoring)

This project is a critical component of a larger watershed approach, the Onota Lake Preservation Strategy for 2002/2003. The Strategy recommends various watershed and in-lake techniques to address the long-term preservation of the recreational and cultural value of Onota Lake. The goal of the project is to control the re-growth of non-native, invasive Eurasian watermilfoil after years of watershed and in-lake management implementation conducted in partnership by the City of Pittsfield, the Lake Onota Preservation Association Inc. (LOPA), and the Berkshire Regional Planning Commission (BRPC) without becoming dependent on the continued use of herbicides. This project addresses the degradation of recreational uses of the lake due to the re-growth of Eurasian watermilfoil after a successful whole-lake SONAR treatment. This project addresses the primary recreational impairment to the current uses of Onota Lake through a cost-effective, holistic approach to control the re-growth of Eurasian watermilfoil throughout the lake by utilizing a variety of watershed and in-lake management techniques.

The goal of this project is to successfully combine biological, mechanical, and limited chemical methods to reduce the dependency on herbicides while preventing the re-growth of non-native, invasive Eurasian watermilfoil to dominant, problematic levels. This project addresses the primary impairment to the current uses of Onota Lake, addresses the need to maintain appropriate water quality and reduce the symptoms of cultural eutrophication while maintaining a diversity of native macrophytes. This project addresses the current recreational use impairment of Onota Lake in a manner that is cost-effective, reduces the dependency on herbicides, and is applicable to many other lakes and ponds throughout the Commonwealth. Following the completion of the project the City and LOPA will continue to conduct follow-up monitoring to evaluate the effectiveness of each of the techniques utilized in this project.

Task 1 - Assessment of Stabilization/Erosion Control and Storm Drain Treatment Needs

BRPC completed a comprehensive assessment of bank stabilization/erosion control and storm drain treatment needs for Burbank Park. The complete assessment, *Storm Drain & Erosion Assessment at Burbank Park*, can be found in Attachment A. Foresight Land Services Division of Brown Associates, Inc. was contracted by BRPC to perform engineering and design services to address phosphorus and sediments in Onota Lake. Foresight Land Services entered into an agreement with BRPC to develop preliminary designs for several techniques to address phosphorus and sediments in Onota Lake. The preliminary designs have been designed to address the findings and recommendations of the *Storm Drain & Erosion Assessment at Burbank Park* and are of sufficient caliber to supply reliable cost estimates and to be submitted with a Massachusetts Department of Environmental Protection s.319 grant application. In addition, these techniques have been assessed for the feasibility of implementation, cost, operation and maintenance, and anticipated short and long term impacts.

A final report has been developed documenting the design and performance specifications of recommended stormwater management techniques, their construction and maintenance costs, and the feasibility of their installation including such considerations as available land, property ownership and permit requirements. Preliminary designs of stormwater management techniques to provide nutrient and sediment reduction at Burbank Park have also been completed and the final report and can be found in Attachment A.

Task 2 - Benthic Barrier

Benthic barriers or bottom weed barriers are commercially manufactured fabric mats that are placed on the lake bottom to control weeds through compression and blockage of sunlight. They are most effective when used in areas with small dense patches of weed growth, particularly around beaches, docks and other high use areas. For this demonstration project, Aquatic Control Technology, Inc. (ACT) was contracted by the City of Pittsfield to provide the barrier material and supervise its installation. Aquatic Weed Net (also known as Aquascreen) was the chosen material and is described in the product description sheet, which can be found in Attachment B. It is a PVC coated fiberglass mesh screening that has an aperture size small enough to block sunlight needed for growth while still large enough to allow gas transpiration to prevent "billowing" of the barrier from decaying organic matter beneath the barrier. When properly maintained, this barrier material has demonstrated a useful lifespan of over 10 years.

On August 19, 2002, ACT supervised the installation of three 1,400 square foot panels approximately 100 feet offshore in Burbank Park and approximately 1,000 feet south of the City's public swimming beach area. The original 14 foot by 100 foot panels were cut into 50 foot sections for ease of installation. To hold the panels in place on the bottom, a set of weights were made comprised of 10 foot long sections of ½ inch diameter steel reinforcing bar encased in capped PVC pipes which provided long, evenly distributed weights. In preparation for installation, LOPA volunteers marked the corners of the emplacement area with buoys and anchors roped together with white nylon line. The 14 by 50 barriers were rolled out on land, had the re-bar weights put in place distributed along their length, and then re-rolled and secured with duct tape. These bundles were then placed on the bow of the LOPA provided pontoon boat for transport to the installation location. There two Scuba- divers hired by the City of Pittsfield from Marine Study Program of Lakeville, CT took each bundle from the boat and unrolled it on the bottom.

Figure 1

Figure 2

This installation can be seen in process in Figures 1 and 2. The barriers will be moved regularly every 1 – 3 years to prevent plants from starting to grow in the sediment which will accumulate on top of the barrier.

The barrier emplacement process was documented on video by 4Winns Productions of Pittsfield, MA and is included in the video tape furnished as part of this final report. The preliminary script for the video can be found in Attachment B for those who can not watch the video.

Task 3 - Milfoil-eating Weevil Trial

In 1995, the Massachusetts Department of Environmental Management (DEM) conducted the first intensive field trials of the native aquatic weevil (*Euhrychiopsis lecontei*) as a biological control for Eurasian milfoil in Lake Mansfield (Great Barrington, MA) and Upper Goose Pond (Lee/Tyringham, MA). Since this time, aquatic weevils have become an accepted and commercially available milfoil control technique that has been used in 10 states, including Massachusetts, Connecticut, New York, New Jersey, Ohio, Indiana, Wisconsin, Minnesota, and Michigan.

The aquatic weevil potentially provides a sustainable and environmentally safe alternative to traditional milfoil control techniques such as harvesting and herbicides. In contrast to traditional milfoil control techniques, weevils provide a sustainable and extremely species-specific control of Eurasian milfoil. Adult weevils and larvae feed on milfoil leaves, while the larvae also damage the plant and slow its growth by burrowing through the plant stems. Weevils will not eradicate milfoil, but can reduce and slow its growth to non-nuisance levels.

As with any biological control technique, there are a number of site-specific factors that influence the degree of milfoil control and the speed with which the desired level of control is attained. These factors include the extent and density of milfoil growth, the number of weevils stocked per site, human disturbance of stocking sites, and fish populations that predate weevils. As long as milfoil is available as a food source, the weevils can be expected to gradually increase in population and distribution throughout a waterbody until milfoil is controlled below nuisance levels.

Under this project, GeoSyntec Consultants were contracted to survey the aquatic vegetation within Onota Lake in July/August 2003 to (1) visually assess the condition and extent of Eurasian milfoil growth, and (2) confirm the most appropriate locations for stocking weevils. Weevil stocking sites were mapped and surveyed, using a GPS, so that future changes may be documented. A "control site" that was not stocked with weevils was selected and surveyed. Qualitative and quantitative data was gathered on the condition and distribution of aquatic plant species at the stocking sites and control sites. After collecting the baseline data, weevil stocking was conducted.

Two follow-up monitoring surveys will be conducted as part of the weevil introduction process. The first survey was conducted under the *"Eurasian Watermilfoil Re-growth Control Project at Onota Lake"* and took place at the end of the first growing season (September 2003). The second survey will take place during the summer of 2004.

At the stocking location and control site, the abundance and condition of all aquatic plant species was recorded, along with other qualitative information (i.e. unusual sediment conditions, etc.). Next, quantitative data was gathered to determine milfoil stem density and weevil population density. At each site, three transect lines parallel to each other and perpendicular to the shore were used to collect milfoil samples for analysis of weevil density, stem density, and weevil-related damage to plants.

After the 2003 monitoring was completed, GeoSyntec prepared a report summarizing the weevil stocking activities, monitoring results and analysis. The first monitoring report, which documents monitoring conducted in September 2003, can be found in Attachment C. This report documents the methodology used and the number of weevils stocked. A map of Onota Lake is included, which identifies the locations of the weevil stocking site and control plot. After monitoring is completed in 2004, GeoSyntec will prepare a report summarizing all project activities, sampling results and analysis.

Task 4 - Diver Harvesting Trial

Action Sports and Travel of Pittsfield, Massachusetts was contracted by BRPC to provide the services of up to four divers at a time for periods of two to four hours at a time to hand pull Eurasian watermilfoil plants, including the root ball, from specific areas of Onota Lake. As a component of this task Action Sports and Travel was directed to collect the milfoil plants in 5 gallon buckets in order to allow for the documentation of the amount of milfoil removed.

Action Sports and Travel, represented by Jerry Smith, conducted this task under the direction of Bob Race and Tom Armstrong, volunteers from LOPA, representing BRPC. The areas to be harvested were marked by subsurface and surface buoys. A video record of the before and after conditions was produced by 4Winns Productions and has been furnished as part of this final report.

The site selected for the diver harvesting trial was an area with dense (75% - 100%) coverage of milfoil. A one-half acre area was marked off utilizing white quarter-inch nylon line strung between five-gallon pail cement anchors at the corners of an approximately 100 by 210 foot rectangle. This half-acre is located south of the western portion of the old roadway separating the north and south basins of the lake. Water depths range from less than 4 feet near the roadway to approximately 8 feet along the southern border. The majority of the milfoil had grown to a height of 6 to 12 inches below the lake surface.

The task included the collection of full milfoil plants in 5-gallon buckets. After monitoring the first dive, it was agreed to collect the plants in 32-gallon buckets for the remainder of the program. It was originally expected that 4 to 6 divers diving 2 to 3 times would clear the area. However, to complete this task a total of 7 nominal half-day dives utilizing 2 or 3 divers in the water on 5 different days was require to clear 90% of the area.

The first dive was conducted, as scheduled, on September 11, 2002. LOPA volunteers met the divers at the Burbank Park launching ramp to review the plan. The divers proceeded to the site and commenced diving. They returned to the launching ramp after four (4) hours with twenty-one (21) 5-gallon buckets and two (2) 30-gallon buckets of plant material, which were analyzed and transported for disposal via composting. The results of the analysis are shown in Table 1. To summarize: of the 165 gallons of weeds collected, 119.5 gallons (approximately 72%) were Eurasian watermilfoil of which 95% were whole plants, including the root structure.

Table 1 – Dive One

Bucket		%	E. watermilfoil	E. watermilfoil	Root	Comment
Number	Gallons	E. watermilfoil	w/ root structure	w/out root structure	structure included	
1	5	10%	0.50		Y	
2	5	50%	2.50		Y	
3	5	20%		1.00	N	
4	5	50%	2.50		Y	
5	5	100%	5.00		Y	
6	5	100%	5.00		Y	
7	5	10%	0.50		Y	
8	5	90%	4.50		Y	Mud
9	5	25%	1.25		Y	
10	5	100%	5.00		Y	
11	5	50%	2.50		Y	
12	5	100%	5.00		Y	
13	5	50%		2.50	N	(1) Root
14	5	75%	3.75		Y	
15	5	100%	2.50	2.50	Y	Half roots
16	5	10%		0.50	N	
17	5	10%	0.50		Y	
18	5	100%	5.00		Y	
19	5	90%	4.50		Y	
20	5	100%	5.00		Y	
21	5	100%	5.00		Y	
22	30	75%	22.50		Y	
23	30	100%	30.00		Y	

Total gallons of E. watermilfoil removed with root structure	113.00 gal
Total gallons of E. watermilfoil removed without root structure	6.50 gal
Percent of E. watermilfoil removed with root structure	95%
Percent of E. watermilfoil removed without roots	5%

The second dive, on September 30, 2002, resulted in the collection of six (6) 32-gallon buckets of plant material for composting disposal. We were pleased to find almost 100% of the plant material were whole Eurasian watermilfoil plants, including root structures. Ultimately, 192 gallons of milfoil was removed from the site as a result of the second dive. However, an inspection of the site the following morning revealed that the area still experienced significant milfoil coverage, nearly 50% coverage. Additional dives would be necessary to reduce milfoil coverage to a level of sufficient significance to impact milfoil re-growth in the next growing season. Jerry Smith of Action Sports accepted the responsibility of monitoring the quantity of plant material removed and for properly disposing of the material. His final report Attachment

D documents the removal of an additional 980 gallons of plant material, including root structure at a total cost of $3,300.

LOPA volunteers plan to monitor the plant growth at this site in the spring and summer of 2003. This effort indicates that the cost of diver harvesting for the removal of milfoil in an area densely covered will be 4 to 5 thousand dollars per acre. Through this trial effort diver hand pulling of Eurasian watermilfoil appears to have merit as an effective management technique for controlling milfoil. Volunteer monitoring conducted during the first growing season following the trial will yield more information regarding the impacts of this approach. At this time, it is clear that this technique requires an intensive amount of labor and is not an inexpensive management technique for controlling milfoil.

LOPA volunteers re-visited the half acre dive site at the height of the 2003 growing season and found that the milfoil had returned to its original 75% - 100% coverage density. It seems doubtful that this degree of re-growth can be attributed to the 10% or less plant density remaining after the 2002 diver pulling. It seems likely that the re-growth is more a result of self-fragmentation of the milfoil beds surrounding the dive area. This suggests that diver pulling may be most effective when the milfoil area can be totally cleared and is of questionable cost-effectiveness if dense milfoil beds will be left in close proximity to the cleared area.

Task 5 - Spot Suctioning Trial

During the summer of 2001, LOPA volunteers Bob Race, Tom Armstrong, Andy Kelly and Rick Petricca collaborated on constructing an experimental milfoil spot suction harvesting rig utilizing a mud-sucker pump borrowed from Rick's construction company and mounted on his old 8 by 8 foot pontoon swimming raft. Although one or two plants, complete with root structure, were successfully suctioned, the heavy suction hose full of water proved unmanageable. As a result of this experiment the apparatus was reconfigured for a second trial during the summer of 2002. During the second trial a raft and an old refurbished mud-sucker pump were used. For this trial, a floating lightweight corrugated inlet hose with an aluminum pipe attached to a funnel shaped head, discharging into a newly built wood framed, 3/8 inch hardware cloth-bottomed weed-catcher was hinged to the raft and floated on an old sailboard. (Figure 1)

Figure 1

Through this approach, we were able to conduct an operational trial of limited extent and gained useful information upon which to base a conceptual design for a future custom-designed, pontoon boat based milfoil spot suction system. The following summarizes the results of this trial:

1) The suction harvester was operated for approximately 45 minutes at which time the inlet suction hose plugged up. Investigations revealed that debris had collected where the hose was connected to the pump. It was determined that the 4 inch to 3 inch connection created an obstruction point. The obstruction point created by this particular connection can be resolved without difficulty through a modification to the design of the system.
2) The 3/8-inch hardware cloth catcher plugged up with sediment. The cloth catcher became clogged to a degree that required raking to prevent sinking the catcher. It is expected that a ½ inch cloth would relieve this problem and still contain the plant material and root structure.

3) The process of lowering the intake funnel over each plant, sucking up the plant material and root structure, and then lifting the nozzle to clear the bottom to re-position over the next plant became physically tiring even with the floating, flexible corrugated intake hose.
4) Based on the analysis conducted after the trial;
    a) 20 gallons of Eurasian watermilfoil including the root structure and some associated bottom material were collected, (Figure 2)
    b) the diaphragm pump chopped up much of the material that was suctioned and even after washing and separating the collected material it was very difficult to ascertain how much Eurasian watermilfoil and root structures were collected
    c) it was clear that there was significant milfoil root structure and plant stem in the collected material, which was estimated to be 25% of the total or 5 gallons of Eurasian watermilfoil.

After conducting this operational trial, it has been concluded that a self-contained, surface operated milfoil spot suction system can be designed and can be an attractive candidate for non-chemical control of Eurasian watermilfoil re-growth. To be both cost and manpower effective, we believe the system must be installed on a re-built 20 or 24-foot pontoon boat with a foot-controlled electric motor for directional control, as utilized by modern bass fisherman. Most probably a hand-controlled, hydraulically powered, mechanical arm, much like a miniature backhoe, should be attached to the intake nozzle. A single operator, seated appropriately at the front of the boat for visibility, would operate both the foot-controlled and hand-controlled devices. The suction discharge would be directed aft to a structure designed to catch the suctioned material. This structure would be located either at the back of the boat or separately connected to the stern of the boat. Through the course of the work conducted under this trial, an existing commercial diver operated suction system called "Pondcleaner" was discovered. Volunteers from LOPA have contacted the originator of the device, Mike Yeaw of Hornell, NY. The "Pondcleaner" device uses a venturi type pump, which eliminates the chopping of suctioned material that was experienced during this trial. Mike Yeaw has agreed, in principle, to collaborate with LOPA to incorporate his system into the concept applied through this trial. LOPA volunteers planned to meet with Mike Yeaw in early 2003 to develop a conceptual design. Unfortunately, Mr. Yeaw became seriously ill and no further collaboration has been possible.

Through the preliminary results of this trial it is believed that the concept of a self-contained, one to two man system that selectively suctions plants and root structures is worthy of further consideration. It is hoped that LOPA will have the ability to continue to pursue this technique as a potential tool for the management of the re-growth of Eurasian watermilfoil.

Although not a formal part of the *Eurasian watermilfoil Re-growth Control Project at Onota Lake Project,* LOPA added value to the task of spot-suctioning by conducting an evaluation of what has been termed the "Armstrong Rake". (Figure 2) The Armstrong Rake is a plant grab rake developed during the year2001 by LOPA volunteer Tom Armstrong. LOPA conducted an evaluation of this rake in parallel with the trial of the spot suction harvesting system discussed above. The experimental "proof-of-concept" rake is a fairly effective approach to plant material

and root structure extraction. (Figure 3) The rake was operated for approximately 15 minutes during which approximately 10 gallons of plant material was collected. Of the plant material collected through this technique approximately 50% was Eurasian watermilfoil root structure and stem. It appears that a modest redesign with slightly stiffer tongs would be a very efficient and effective personal tool for eliminating milfoil. Such a redesign is being undertaken by LOPA volunteers and it is expected that a prototype will be available for evaluation in 2004.

Figure 2

Figure 3

Task 6 - Professional macrophyte surveys

As summarized earlier, the City of Pittsfield contracted with ACT. A component of this contract was to conduct early and late season macrophyte surveys in 2002 to document the aquatic plant community status throughout Onota Lake. These surveys revealed the early season re-emergence of Curley-leaf Pondweed as well as significant, fairly wide-spread re-growth of Eurasian watermilfoil. The full description of this treatment is contained in ACT's Report, *2002 Aquatic Plant Surveys and Chemical Treatment Program Summary January 10, 2003* and can be found in Attachment E. The final report details the herbicide application conducted under Task 7, pre-treatment and post-treatment plant mapping, and recommendations for long-term alternative management options for aquatic nuisance species.

Task 7 - Chemical Spot Treatment

As originally written, Task 7 of this project included $10,000 for chemical spot treatment of selected "hot spots" of milfoil re-growth during the 2002 season. During the planning for this treatment, it became obvious that additional areas needed to be dealt with. LOPA decided to coordinate donations from private citizens to increase the areas to be treated. In the process, an additional $10,140 was collected and donated to the City to add to the subcontract with ACT for herbicide treatment. This allowed ACT to double the treatment area to approximately 70 acres which were treated with the contact herbicide Reward on July 17, 2002, obtaining seasonal control of the areas treated. The full description of this treatment is contained in ACT's Report, *2002 Aquatic Plant Surveys and Chemical Treatment Program Summary January 10, 2003* and can be found in Attachment E. The final report details the herbicide application, recommendations for long-term alternative management options for aquatic nuisance species, and pre-treatment and post-treatment plant mapping conducted under Task 6.

Task 8 - Outreach

An extensive outreach campaign was conducted under this project. LOPA has established a new committee, the Citizen Education and Public Relations Committee. This committee will head outreach efforts, citizen education, public relations, and membership. Already in its early stages, the committee has begun 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 lake-front and watershed landowners encouraging membership in LOPA to help preserve Onota Lake.

LOPA created and staffed a display at the Western Massachusetts Water Resources Symposium hosted by LAPA-West. Two display maps were created and exhibited at the Symposium and a variety of other events and open public meetings over the course of this project.

4Winns Productions produced a documentary video-tape of all of the tasks conducted under this project. Two videos have been made public via several venues including Cable Access Television. One video was also incorporated into the display at the Western Massachusetts Water Resources Symposium and has been aired by the Massachusetts Congress of Lakes and Ponds.

BRPC also created and published two brochures "Non-point Source Pollution Education for Homeowners" and "Onota Lake Exotic Invasive Aquatic Species". The brochures were distributed through the BRPC web site, the Lakes and Ponds of Western Massachusetts web site and list serve, and the Massachusetts Water Watch Partnership list serve. Materials that were included in the mailing campaign, display maps, copies of the brochures and the video can be found in Attachment F.

Overall, this grant has been successful in accomplishing its goal of stemming the tide of milfoil re-growth while evaluating and documenting the cost-effectiveness of various mechanical, biological and chemical control techniques. The results of this project have led the project partners to conclude that each of the techniques explored have merit. However, it is important to recognize the limitations of each technique.

This project included the use of chemical treatment in addition to biological and mechanical treatments. However, it is the goal of this project to address milfoil re-growth without becoming dependent on herbicides. Herbicides are an effective means of treating nuisance Eurasian watermilfoil. Despite their efficacy, herbicides are not without drawbacks. Herbicide use has been questioned due to the potential to eradicate all macrophyte growth, potential effects to groundwater, potential effects to fisheries, and potential effects on the lake ecosystem as a whole. In addition, whole lake herbicide treatment is an expensive undertaking. Lastly, herbicide applications conducted at the doses most commonly permitted by local and state permitting authorities result in re-growth of Eurasian watermilfoil. Experts in the field of lake management have advised the partners in this project that long-term effective herbicide applications require higher doses than those that have been applied at Onota Lake.

The mechanical techniques evaluated under this project proved to have merit for the ability to isolate Eurasian watermilfoil from native macrophytes and to remove plant material with the root ball attached. However, the partners in this project have concluded that mechanical techniques would be more effective in isolated beds of milfoil or when the presence of milfoil is first identified. Unfortunately, these techniques are manpower intensive and costly and are not preferred or practical whole lake management techniques. In addition, through this project these techniques were not successful in creating long-term areas clear of milfoil for designated uses due to the ability of surrounding areas to repopulate cleared areas.

Biological techniques appear to have merit for Onota Lake; however it is important to understand their limitations. The benthic barrier installed at the public swimming beach proved to be highly effective in creating an area clear of milfoil. However, benthic barriers are not whole-lake management approaches. Benthic barriers should be used in specific areas to create plant free zones, such as swimming lanes and swimming beaches. In addition, benthic barriers will require maintenance and/or replacement. The efficacy of a benthic barrier will be reduced once sediment has collected on top of the barrier providing a habitat appropriate for plant growth. Additionally, the efficacy of a benthic barrier will be reduced as the material deteriorates allowing light to penetrate through the barrier. Milfoil-eating weevils have proven to be successful in previous trials and have demonstrated success in the first season since their introduction to Onota Lake. Once again, it is important to understand the limitations of this management technique. The theory behind the use of milfoil-eating weevils as a management technique is that the weevils will predate the milfoil. Since the weevils rely on the milfoil as a food supply they will not eradicate the milfoil. However, it has been demonstrated in previous trials that weevils have the potential to reduce milfoil to non-nuisance levels. It remains to be

seen whether Onota Lake will support a large enough colony of weevils to reduce milfoil to non-nuisance levels. The potential of predation by sunfish to weevils is of concern. The results of the second season monitoring are expected to reveal more information on whether weevils have the potential to reduce milfoil to non-nuisance levels at Onota Lake.

During the course of this project it was discovered that there are two species of macrophytes present within the Onota Lake watershed that are protected under the Endangered Species Act. It is unclear at this time how the presence of these species will effect lake management. However, there is a possibility that Onota Lake may now have limited options available for the control of Eurasian watermilfoil. It is imperative that Onota Lake continue efforts to control Eurasian watermilfoil due to the threat of competition that Eurasian watermilfoil poses to the endangered species. The evaluation that has been conducted under this project has proven to be quite timely and necessary and is expected to continue into the future.