AQUATIC CONTROL TECHNOLOGY, INC.
POND AND LAKE MANAGEMENT SPECIALISTS

October 15, 2009

Larry Levine, Chairman
Arlington Pond Protective Association
PO Box 308
Salem, NH 03073

Re: 2009 Aquatic Plant Survey and Evaluation of Management Alternatives for Arlington Pond (a/k/a Arlington Mill Reservoir) in Salem, New Hampshire

Dear Mr. Levine:

The Arlington Pond Protective Association (APPA) contracted Aquatic Control Technology, Inc. to survey the aquatic vegetation on Arlington Pond during the summer of 2009. The primary objective of the survey was to assess the extent of non-native and invasive aquatic plants, namely fanwort (*Cabomba caroliniana*), and to evaluate management alternatives. Findings from the 2009 survey and management recommendations are provided in the following report.

AQUATIC PLANT SURVEY - 2009

Lake Description

Arlington Pond is located in North Salem south of Route 111. It has a reported total surface area of 238 acres, and maximum and mean depths of 39 feet and 9.5 feet, respectively. The primary inlet is at the northern end of the lake. Big Island Pond is located immediately upstream. The dam and outlet structure are located in the southeast corner of the lake. The outlet stream combines with other streams to form the Spicket River. Arlington Pond has a large watershed, over 14,000 acres, and a reported flushing rate of 7.2 times per year. The majority of the lake shoreline moderate to heavy residential development.

Survey Methods

The comprehensive late season vegetation survey was performed by Marc Bellaud, Senior Biologist, and Peter Beisler, Biologist, with Aquatic Control on August 14, 2009. Larry Levine and Lynda Paul from APPA were present for the survey. Weather conditions were mostly sunny with little to no wind providing for very good visibility. The survey was conducted from Aquatic Control's boat and involved visual inspections of the aquatic plant community and the use of a throw rake. In addition, a View Scope and Aqua Vu Underwater Camera System were used to verify growth in deep water.

The entire littoral zone of Arlington Pond was slowly toured in a zig-zag fashion. A high-resolution depth finder (sonar unit) was used to determine the deep water extent of plant growth. Different plant signatures seen on depth finder were verified using the underwater camera. Locations where fanwort was observed were marked using a GPS unit (Figure 1). In addition to documenting the milfoil infestation, dominant aquatic plant species encountered during the survey was recorded along with notes on their distribution.

Fanwort Distribution

Fanwort was widely distributed, primarily at the northern end and deep in the coves along the western and southern shorelines, along Shore Drive. Most of the fanwort plants were found in cove areas. This probably suggests that this is where fragments have settled and become established. Big Island Pond located directly upstream of Arlington Pond is infested with fanwort. Most fanwort plants were found in

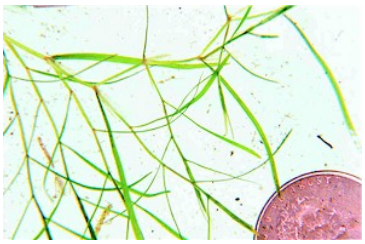
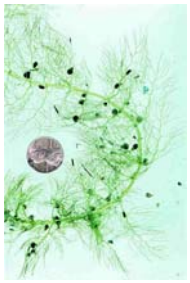
water depths less than 6-7 feet. The distribution of fanwort seen on 8/14/09 was similar to what had been previously reported by DES. The coves at the northern end of the lake supported the most established fanwort growth, where fanwort cover probably exceeded 25% over several contiguous acres. Most other locations had either smaller patches ranging in size from several hundred to a few thousand square feet, or more widely scattered growth that represented less than 10% cover. The total estimated cover of fanwort found throughout Arlington Pond was estimated to only be between 7.5 to 10 acres.

Dominant Aquatic Vegetation

Aside from the fanwort growth, Arlington Pond does support several native aquatic plant species. We understand that along some of the developed shorelines native plant growth does interfere with access and recreational activities. Dominant aquatic plants observed during the 8/14/09 survey are listed below. Other less abundant species are undoubtedly present, but were not encountered during the survey.

Dominant Aquatic Plants Observed in Arlington Pond on 8/14/09

Macrophyte Species	Common Name	Type / Notes	Photograph
Cabomba caroliniana	Fanwort (EXOTIC)	Submersed; scattered to common in cove areas	
Eleocharis sp.	Spikerush, slender	Submersed; sparse, patchy growth	
Myriophyllum humlie	Lowly watermilfoil	Submersed; sparse	

Najas flexilis	Slender naiad	Submersed; sparse and widely distributed	
Potamogeton pusillus	Thin-leaf pondweed	Submersed; common cover seen in many locations	
Utricularia spp.	Bladderwort	Submersed; several species, common cover seen in northern end	
Vallisneria americana	Wild celery	Submersed; occasional patches encountered	

Native plant cover was low to moderate in most locations. Two varying densities of native plant cover are depicted on Figure 1, scattered or 10-25% and moderate or 25-50%. Consistent with the fanwort distribution, the northern coves appear to support the majority of native plant growth. Bladderwort and thin-leaf pondweed appear to be the most widely established native plants. Wild celery and naiad are next, followed by lowly milfoil and slender spikerush. Low to moderate density aquatic plant growth was observed throughout approximately 50 acres of the lake.

Thin-leaf pondweed and bladderwort appear to be responsible for the localized concern over increasing native plant densities. Both plants were occasionally found in moderate densities within or immediately adjacent to individual swim areas. Bladderwort was more established in quiet, shallow cove areas, while thin-leaf pondweed was found along some of the more exposed and sandy shorelines in the northern end of the lake. The density of both of these plants is known to fluctuate from year to year, depending on water quality, weather conditions and other factors.

AQUATIC PLANT MANAGEMENT ALTERNATIVES

Compared with many other lakes in New Hampshire and other New England States, Arlington Pond does not appear to have a severe problem with invasive or nuisance aquatic plants. Select areas do support higher plant densities than others, but overall only approximately 20% of the lake area had low to moderate density plant cover.

Fanwort was the only non-native invasive species observed in the lake. It has reportedly been in the lake since at least the late 1990s. Its presence is not surprising considering the sizeable fanwort infestation found in Big Island Pond located upstream. What is surprising however is that fanwort has not spread more within Arlington Pond where it has been established in the lake for over a decade. Expansion of fanwort has probably been limited by the annual winter drawdown program. It is also noteworthy to mention that variable watermilfoil (*Myriophyllum heterophyllum),* another invasive plant in Big Island Pond, was not seen in Arlington Pond. We also understand that there is concern over the native plant growth found along some of the developed shorelines and high use areas in the lake.

While most of the techniques used to control invasive and native aquatic plants are the same, it may be necessary to separate the two objectives to comply with NH rules and regulations. The State has generally been supportive of managing non-native or invasive aquatic plants. DES even provides a matching fund grant program to help lake associations manage invasive species. It is more difficult to make a compelling case for native plant control.

Considering the target plants and size of the infestation, several strategies can be immediately discounted. *Dredging* or deepening to remove aquatic plants and the underlying sediment can be effective, but it is usually prohibitively expensive and extremely difficult to secure the necessary permits. Dredging projects typically cost tens of thousands of dollars per acre depending on the project scope and approach being used.

Hand-pulling, diver-assisted suction-harvesting and use of *benthic barriers* are not usually cost-effective to remove excessive weed growth from large areas of several acres or more, but they are suitable for small patches or to clear individual shorefronts. These strategies are worth considering for management of individual shorefronts or for selectively targeting fanwort removal.

There are no selective *biological controls* (e.g. herbaceous insects) that are known to fanwort or the target the native plants found in Arlington Pond; and the one non-selective bio-control that might help, sterile or triploid grass carp, are not legal to use in Massachusetts.

Mechanical harvesting (cutting and collecting) or *hydro-raking* might be suitable for native plant control, but they are not recommended for fanwort control. Fanwort primarily reproduces through vegetative fragmentation and mechanical controls can stimulate new growth and spread the infestation. These techniques could be considered for native plant control, but it would be difficult to avoid fanwort and risk of spread may be too great.

This leaves winter drawdown and the use of aquatic herbicides as the most applicable large-scale management approaches. Hand-pulling, bottom barriers or suction-harvesting may be suitable for smaller-scale control.

Herbicides

Treatment with USEPA/State registered aquatic herbicides is usually the most cost-effective way to control invasive plants like fanwort or milfoil.

Sonar (fluridone) herbicide – The challenge with fanwort is that it is only susceptible to Sonar (fluridone) herbicide. This is a slow-acting product that requires 60-90 days of contact time to provide effective control. This will be very difficult to achieve in Arlington Pond due to large watershed and its fairly rapid flushing rate. There are time-release pellet formulations that can be used to help extend the contact-time, but when performing partial-lake or spot-treatment, high concentrations, expanded treatment areas and multiple applications are needed to overcome the effects of dilution. Treatment of a minimum of 25-30 acres would be needed to target the 8-10 acres of nuisance fanwort growth currently found in Arlington Pond. Treatment costs would probably exceed $1000 per acre treated once the required abutter and newspaper notifications and herbicide residue testing are completed.

Reward (diquat) herbicide – Diquat is probably the most widely used herbicide in New England and could be used for control of the native pondweeds and bladderwort found in Arlington Pond. Estimated costs are likely to run around $350-$400 per acre treated, assuming that a minimum number of acres were being targeted. Diquat does not control fanwort and as a result it may be difficult to secure permit approval for its use in Arlington Pond.

Other currently registered herbicides that could be considered for partial-lake treatments include 2,4-D granular (trade name Navigate), Triclopyr (trade name Renovate) or Endothall (trade name Aquathol). 2,4-D and Triclopyr are effective for milfoil control, but would not control pondweeds or bladderwort. Endothall is most effective on pondweeds and offers limited control over other submersed weed species. None of these products are particularly well suited for the current plant composition found in Arlington Pond.

There is a new aquatic herbicide that is due to receive its full registration from the EPA for aquatic use in early 2010. The active ingredient is flumioxazin and it is reported to be effective on both fanwort and milfoil. It has been used under EUP (experimental use permits) in a number of states for several years. It is fast-acting, contact herbicide that does not require the extended contact time needed with Sonar. This may be a good alternative for area selective control of fanwort in the near future. We do not know what the associated water use restrictions or unit costs will be for this product, but hope to know more about it in early 2010.

Drawdown

Water level lowering or drawdown during the winter months to expose aquatic plants to freezing and drying conditions can help to control aquatic vegetation. Drawdown is usually effective on plants that reproduce through vegetative means (e.g. fragmentation, rhizomes). Fanwort is usually particularly susceptible to drawdown. This probably explains why the fanwort growth has not expanded into more areas of Arlington Pond. On the other hand, seed producing plants like the native pondweeds may be selected for during drawdown conditions.

Drawdown is probably the most cost-effective aquatic plant management tool available at Arlington Pond. The lake has the necessary outlet structure to facilitate winter drawdown and they have been done historically at the lake. In order for drawdown to be effective, the lake bottom must be exposed to freezing and drying conditions for 6-8 consecutive weeks. Usually lakes are lowered by December 1st and are then refilled by the end of April. Conditions that might limit the effectiveness of drawdown include warm or wet conditions or an early snow cover that insulates the lake bottom and prevent freezing from occurring.

We understand that presently Arlington Pond is being lowered approximately 3.5 feet (from elevation 161.2 to 157.5) during the winter months. It would be worthwhile to explore with the City if the depth of drawdown could be increased. This would potentially expose more of the bottom and provide better

control of fanwort, which was found growing to a depth of at least 6 feet. Drawdown should also allow for individual shorefront property owners to clean up their individual shorefront access areas, which may help control some of the native weed growth.

It would be prudent to increase the depth of drawdown incrementally, perhaps by one foot during the first year. If there were no adverse impacts (i.e. loss of water to shallow wells or difficulty refilling the lake), then the drawdown depth could possibly be increased by another foot or so in 2010/2011, which would effectively target the majority of the fanwort growth. We checked with DES and learned that the Arlington Pond dam is controlled by the City of Salem. The contact person that we were provided is Mr. Jonathon Sistare, 603-890-2120.

PERMITTING CONSIDERATIONS

Most aquatic plant management activities require permit approval at the state or local level. Herbicide treatments are permitted through the Department of Agriculture's Division of Pesticide Control. Permit applications are filed with DPC and are then sent out to other State Departments for review and comment. For herbicide treatments on public lakes, development of a Long-Term Management Program is typically required. This is especially important if APPA decides to pursue herbicide treatment for native plant control. Permit applications must be filed at least 90 days in advance of the proposed treatment date to allow sufficient time for public comment and state review. We would recommend planning for a minimum of 120 days.

Increasing the depth of drawdown at Arlington Pond will likely require approval from the City of Salem. The City should be consulted to see if any other regulatory review will be required.

Smaller scale control such as hand-pulling or suction harvesting may be permitted for control of invasive species like fanwort, provided that state trained divers/companies are used. Amy Smagula in DES should be contacted to learn specifically what activities are permissible. Using these techniques or bottom weed barriers to control native plants will likely require permit approval through DES Wetlands.

SUMMARY AND RECOMMENDED MANAGEMENT ACTIVITIES

The first step towards implementing an aquatic plant management program is to formulate a set of specific management goals or objectives. Based on the conditions that we observed during our 8/14/09 survey, we believe that the greatest aquatic plant threat to Arlington Pond is the presence of non-native fanwort growth. This plant is capable of explosive growth, but fortunately its distribution continues to be fairly limited, which may be a result of the limited winter drawdown that has been performed at the lake in past years.

Seeking approval for a deeper winter drawdown would undoubtedly be the most cost effective way to attempt larger-scale control of fanwort in Arlington Pond. An increased drawdown may also provide additional suppression of native plants that are problematic in localized portions of the lake. At the very least, a deeper drawdown will allow shorefront property owners more access to clean out their shorefront areas. We would recommend contacting the City of Salem to determine if the annual drawdown could be increased by perhaps one-foot in 2009/2010. If this proves to be effective and there are no adverse impacts, then an even deeper drawdown could be pursued in future years.

Aside from a deeper drawdown, APPA may want to consider the possibility of exploring herbicide treatment options for the lake. Based on the current distribution of fanwort, we do feel that a whole-lake or large scale Sonar (fluridone) herbicide treatment is warranted. Some smaller-scale pilot or

demonstration treatments with Sonar may be worth considering, but they will carry high per acre treatment costs due to the slow mode of action of the herbicide. Instead we would recommend waiting to see if the new flumioxazin herbicide received its federal and state registrations in early 2010. If this product becomes registered, we would encourage APPA to consider a demonstration treatment to see how effectively it controls fanwort and if it provides any suppression of native plants.

Finally, we would strongly encourage APPA to attempt to educate its membership and shoreline residents about proper shoreline Best Management Practices (BMPs). DES has several publications on these topics and we can also provide material prepared by other states. Educating people about proper lawn care practices, maintaining vegetated buffer strips along their shoreline and other fairly simple protective measures can help to reduce the transport of sediment and nutrients into the lake that helps to fuel nuisance weed and algae growth.

Sincerely,

AQUATIC CONTROL TECHNOLOGY, INC.

Marc Bellaud
Senior Biologist