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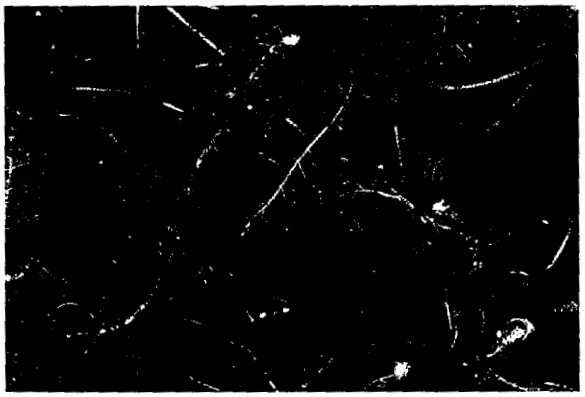
EXECUTIVE OFFICE of ENVIRONMENTAL AFFAIRS

Managing Aquatic Invasive Species in the Waters of the Commonwealth

A Report to the Legislature

February 22, 2006

Massachusetts Executive Office of Environmental Affairs
Department of Conservation and Recreation
Office of Water Resources

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Conservation and Recreation
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Managing Aquatic Invasive Species in the Waters of the Commonwealth: A Report to the Legislature

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Commonwealth of Massachusetts

Executive Office of Environmental Affairs
Department of Conservation and Recreation

Mitt Romney, Governor
Kerry Healey, Lt. Governor
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February 22, 2006

The Honorable Therese Murray, Chair
Senate Committee on Ways & Means
State House, Room 212
Boston, MA 02133

The Honorable Robert A. DeLeo, Chair
House Committee on Ways & Means
State House, Room 243
Boston, MA 02133

The Honorable Pamela P. Resor, Senate Chair
Joint Committee on Environment, Natural Resources and Agriculture
State House, Room 410
Boston, MA 02133

The Honorable Frank I. Smizik, House Chair
Joint Committee on Environment, Natural Resources and Agriculture
State House, Room 473F
Boston, MA 02133

The Honorable Stephen R. Canessa
State House, Room 443
Boston, MA 02133

Dear Chairmen Murray, DeLeo, Resor, Smizik and Representative Canessa:

Pursuant to the provisions contained in the FY 2006 General Appropriations Act (St.2005, c. 45, s. 2, line item 2310-0200), the Executive of Environmental Affairs (EOEA) respectfully submits the enclosed report relative to invasive plants in the waters of the Commonwealth. The language of the line item provides:

> *"...that the executive office shall conduct a study on the severity of invasive weeds in the commonwealth's bodies of natural water; provided further, that said study shall include, but not be limited to the costs associated with full clean-up*

and eradication, a priority list of projects, an analysis of future environmental concerns stemming from invasive weeds, and plans for communities to prevent future growth of invasive weeds; provided further, that the executive office shall also conduct a study of the advantages and disadvantages of future maintenance of invasive weeds in the state; and provided further, that the executive office shall report to the general court the results and recommendations, if any, together with drafts of legislation necessary to carry out recommendations into effect by filing the same with the clerk of the house of representatives, the house and senate committees on ways and means, and the joint committee on environment, natural resources and agriculture on or before the last Wednesday of February 2006..."

The report, prepared at the Secretariat's direction by the Department of Conservation and Recreation (DCR) Office of Water Resources, responds to the issues and concerns identified in this language. It provides an overview of the Aquatic Invasive Species (AIS) problem, including distribution, control costs, management options, and assessment of risks. It further provides a strategic plan for Aquatic Invasive Species control, as well as recommendations to provide for long-term protection of our valuable water resources. Much of the information contained in the report is based on two key documents: the *Massachusetts Aquatic Invasive Species Management Plan* and *the Generic Environmental Impact Report (GEIR): Eutrophication and Aquatic Plant Management in Massachusetts*.

I trust you will find this information to be in order. If you have any questions, please feel free to contact, Mike Gildesgame, DCR's Director of Water Resources at (617) 626-1371 or Bethann Steiner, EOEA's Director of Legislative Affairs at (617) 626-1109.

Sincerely,

Stephen R. Pritchard

Enclosure

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Executive Summary

Aquatic Invasive Species (AIS) have been recognized as a major threat to the ecological integrity of Massachusetts' lakes and ponds for over 25 years. In 1973, the MA Division of Environmental Health (now a division of the Department of Public Health) proposed to prepare an Environmental Impact Report for its program for control of Aquatic nuisance vegetation. Additional efforts were underway by the Department of Environmental Quality Engineering (now the Massachusetts Department of Environmental Protection, DEP) before the 1980s, but there were no dedicated programs to address AIS at the state level. In 1994, the Department of Environmental Management (now the Department of Conservation and Recreation, DCR) established the Lake and Pond Grant Program to assist communities with AIS problems and other lake management issues. In January 2001, EOEA published the *Massachusetts Lakes and Ponds Watershed Action Strategy* which recognized aquatic invasive species as one of six priority issues for Massachusetts lakes and ponds. The *Strategy* recommended that the state establish an Invasive Species Response Team to step up statewide efforts to prevent new infestations of AIS and to stop the spread of AIS. Other key achievements for AIS control and lake management included:

- Completion of the *Generic Environmental Impact Report: Eutrophication and Aquatic Plant Management in Massachusetts* (GEIR) and *The Practical Guide to Lake and Pond Management in Massachusetts* (2004)
- Completion of the *Massachusetts Aquatic Invasive Species Management Plan* (CZM 2002)
- Establishing a staffed AIS prevention and control program within the DCR Lakes and Ponds Program which developed the "Weed Watcher" volunteer training project and the Boat Ramp Monitoring Project, along with numerous education/outreach materials (2001-present)

The legislative direction to the Executive Office to file this report, and the anticipated actions that will result from its implementation, represent the next major step forward in the battle to protect our lakes and ponds from AIS. This report presents the current state of AIS in Massachusetts, where we hope to be in the future, and how we can get there.

Section I introduces the reader to the issues Massachusetts faces concerning the spread of AIS.

Section II presents the current state of AIS in Massachusetts. Data on AIS in Massachusetts are maintained in a DCR Lakes and Ponds database that is continuously updated as new surveys are completed. Currently, the database shows that:

- Massachusetts has over 3,530 lakes and ponds, approximately 300 of which are owned by DCR (less than 10%)
- Only 20% (approximately 700) of the Commonwealth's lakes and ponds have been surveyed for AIS – 64 of which are DCR owned
- Of the 20% surveyed, 95% had at least one AIS
- Of the 20% surveyed, 30% do not have any submerged AIS, but do have emergent AIS (either loosestrife or Phragmites)

Section III summarizes the current activities and resources available to address AIS in Massachusetts. The two key resource documents are: (1) the *GEIR*, which provides a comprehensive review of prevention and management techniques for AIS, and (2) the *Massachusetts AIS Management Plan* which provides specific management objectives and actions for state agencies. Because the problem of AIS is so widespread, state agency staff

coordinate with groups at the regional, state and local levels to share information, results of new AIS control techniques, and the results of field studies.

Sections IV and V present an overview of the management options for preventing and controlling the spread of AIS and their associated costs. Key elements of a successful prevention program include education, outreach, training, policy development, scientific assessments, and development of new technology. Management options are briefly summarized (a full discussion of each is presented in the *GEIR*), and include physical, chemical and biological techniques. The costs associated with AIS are difficult to specify, but include:

- Ecological costs (no dollar amount is available, but impacts are clear and significant)
- Economic costs (estimates for the US range from $1 to $100 billion annually)
- Prevention costs (minimal costs that result in tremendous savings long-term, but no figures have been developed)
- Control costs (extremely variable depending on type of control, target species, regulatory requirements, and size of infestation; a conservative estimate for the US is at least $100 million annually)

Section VI presents an assessment of future risks from AIS. Currently little to no information is available about which AIS are most likely to invade MA and whether they would present a high, medium or low risk to our economy and ecosystems. Therefore, the Massachusetts AIS Working Group (which implements the Massachusetts AIS Plan) is proposing the establishment of a Scientific Advisory Committee (SAC) to conduct risk assessments on future potential invaders and make recommendations on appropriate responses, depending on the level of threat. The SAC will be made up primarily of state agency staff and several experts in the field of AIS who will serve as consultants to the committee. The goal of the committee will be to develop threat rankings for new AIS and make recommendations on appropriate responses if an infestation were to occur. Two example species (Hydrilla and Zebra Mussels) are presented as examples.

Section VII presents recommendations to address the problem of managing AIS. Recommended priorities for DCR's Lakes and Ponds Program include:

1. Prevention First: Protect lakes and ponds that are currently free of AIS.
2. Manage and wherever possible restore AIS infested public lakes and ponds with high recreational use and/or lakes and ponds with particularly outstanding ecological values.
3. Control and wherever possible eradicate new AIS infestations.

For communities the report provides a checklist of nine actions they can take to ensure they are doing all they can to address AIS within their jurisdiction. The checklist is focused on prevention, education, and outreach.

I. Introduction

> The introduction and spread of **aquatic invasive species** (AIS) in the marine and freshwater environments of Massachusetts pose a serious threat to the ecology of **native** systems, and can effect [sic] the economic stability of the Commonwealth. These **nonindigenous** species have the potential to establish and spread rapidly, due to a lack of physical and biological constraints in the habitats to which they have been introduced. The range of impacts these organisms can have on aquatic systems is extensive, including the loss of habitat and community diversity, the localized or complete extinction of rare and endangered species, the spread of human **pathogens**, and the choking of waterways, water intakes, and wetland systems.
>
> *--Massachusetts Aquatic Invasive Species Management Plan, 2002 (MA AIS Plan)*

Aquatic Invasive Species (AIS) have been recognized as a major threat to the ecological integrity of Massachusetts' lakes and ponds for over 25 years. In 1973, the Division of Environmental Health proposed an Environmental Impact Report for its program to control Aquatic nuisance vegetation. In the 1970's and 1980's, the Department of Environmental Quality Engineering (now MassDEP) managed the Section 314 Clean Waters Act carrying out diagnostic and feasibility studies, but there were no programs dedicated to address AIS at the state level. In 1994, the Department of Environmental Management (now the Department of Conservation and Recreation, DCR) established the Lake and Pond Program to assist communities with AIS problems and other lake management issues. In January 2001, EOEA published the *Massachusetts Lakes and Ponds Watershed Action Strategy* which recognized aquatic invasive species as one of six priority issues for MA lakes and ponds. The *Strategy* recommended that the state establish an Invasive Species Response Team to step up statewide efforts to prevent new infestations of AIS and to stop the spread of AIS. Other key milestones followed, including:

- Completion of the *Generic Environmental Impact Report: Eutrophication and Aquatic Plant Management in Massachusetts* (GEIR) and *The Practical Guide to Lake and Pond Management in Massachusetts* (2004)
- Completion of the *Massachusetts Aquatic Invasive Species Management Plan* (CZM 2002)
- Establishing a staffed AIS prevention and control program within the DCR Lakes and Ponds Program which developed the "Weed Watcher" volunteer training project and the Boat Ramp Monitoring Project, along with numerous education/outreach materials

For the purposes of this report, aquatic invasive species (AIS) are defined as non-indigenous species that threaten the diversity or abundance of native species or the ecological stability and/or uses of infested waters (adapted from the Massachusetts AIS Plan (MA AIS Plan) and the Aquatic Nuisance Prevention and Control Act of 1990). The terms "exotics," "non-indigenous," and "non-natives" often are used synonymously with AIS, but this report will use the term AIS, to be consistent with the MA AIS Plan and federal programs. In addition, while this report focuses on invasive aquatic plants, there are references to some invasive animals, particularly in the section on future risks.

This report is an important step in an ongoing effort to clarify the extent of Aquatic Invasive Species (AIS) in the Commonwealth, to quantify both the ecological and financial impacts of AIS, and to implement practical, effective measures to control them and reduce their impacts. Significant efforts are ongoing at the federal, regional and state levels; however, much remains to

be done. While additional studies will continue to fill in the details, the overall picture is clear: **the sooner and more vigorously we can control or eradicate aquatic invasive species; the greater will be the financial savings and benefits to our environment.**

AIS are a problem for the water bodies of Massachusetts because they establish and spread rapidly and lack physical and/or biological constraints. The result is:

- Loss of native community diversity and reduction in ecosystem stability and functions
- Localized or complete extinction of rare and endangered species
- Reduced water volume/depth
- Loss of critical food and habitat for native species
- Reduced recreational, aesthetic and property values
- **Very** costly management and control.

This report provides a summary of information about aquatic invasive species in Massachusetts, specifically:

- The State of AIS in Massachusetts: Which species are we concerned about and what information do we have on their distribution?

- Current Resources and Activities: What groups are involved at the national, regional, state, and local levels, and what actions are they taking? What resources are available?

- AIS Management Options: What are the options available to prevent, control, and eradicate AIS?

- AIS Management Costs: What do we know about the costs associated with prevention, management, and eradication of AIS?

- Assessment of Future Risks from AIS: If we choose to take no action or limited action, what are the risks? How can we evaluate risk of future introductions?

- Recommendations: Given the current state of AIS and the available resources, what should state agencies and communities do to protect themselves from AIS? What should be the priorities?

II. The State of Aquatic Invasive Species in Massachusetts

During the last four years, Department of Conservation and Recreation (DCR) Lakes and Ponds Program staff have compiled information regarding the number of surveyed lakes and ponds that contain AIS and have developed a database in cooperation with other state agencies and groups. This database includes 3,530 public lakes and ponds in Massachusetts, although currently only about 20% of these waterbodies have been surveyed for the presence of AIS. The list of AIS that DCR considers a threat are published in *A Guide to Selected Invasive Non-native Aquatic Species in Massachusetts"* (January 2004) and included in Appendix A.

The list of ponds in the database was generated from *The Attorney General's Guide to Public Water Bodies* and the Department of Environmental Protection's (MassDEP) Pond and Lake Index System (PALIS). The data on presence of AIS were generated from the following sources:

- MassDEP AIS report (1999)
- DCR AIS surveys (2001-2005)
- DEP herbicide files (1992-2005)
- DFG Natural Heritage and Endangered Species Program data

This database is a draft document that is continually being updated as new invasive species information is collected.

Of the 3,530 water bodies in the database, only 689 (or about 20%) have been surveyed for the presence or absence of AIS (see Appendix B). Of the waterbodies that have been surveyed, only 32 (or less than 5%) were found to be free of AIS at the time of the survey. This means that over 95% of the lakes surveyed have at least one invasive species of plant. Many of the water bodies surveyed were infested with more than one non-native species. Following is a summary of occurrences for the thirteen AIS that are established or considered a threat in Massachusetts.

PLANT SPECIES	OCCURRENCES
Purple Loosestrife (*Lythrum salicaria*)	376
Variable Milfoil (*Myriophyllum heterophyllum*)	173
Fanwort (*Cabomba caroliniana*)	152
Eurasian Milfoil (*Myriophyllum spicatum*)	97
Common Reed (*Phragmites*)	88
Curly-leaved Pondweed (*Potamogeton crispus*)	53
Water Chestnut (*Trapa natans*)	22
European Naiad (*Najas minor*)	12
Yellow Floating Heart (*Nymphoides peltata*)	7
South American Waterweed (*Egeria densa*)	2
Swollen Bladderwort (*Utricularia inflata)*	2
Hydrilla (*Hydrilla verticillata*)	1*
Parrot Feather (*Myriophyllum aquaticum*)	1*

*Note that these are new AIS infestations in the state during the last 2-3 years

III. Current Resources and Activities

Current efforts to address AIS in Massachusetts are guided largely by the MA AIS Plan. This section introduces and summarizes the MA AIS Plan, discusses each of the key regional, state and local groups involved in AIS efforts, and briefly describes other important resources in addition to the MA AIS plan, including the *Generic Environmental Impact Report on Eutrophication and Aquatic Plant Management in Massachusetts* (the GEIR) and *The Practical Guide to Lake Management in Massachusetts.*

A. Resources

The *Massachusetts Aquatic Invasive Species Management Plan*

The Aquatic Nuisance Prevention and Control Act of 1990 (amended as the National Invasive Species Act of 1996) specifically calls for states to develop comprehensive non-indigenous aquatic nuisance species management plans. This Act authorizes a 75:25 federal to state match of funds for objectives and actions outlined in plans that are approved by the Federal Aquatic Nuisance Species Task Force (the ANS Task Force, also established by the 1990 Act). The MA AIS Plan was approved by the federal Task Force and issued in December 2002 by the Massachusetts Aquatic Invasive Species Working Group (MA AIS Group). Massachusetts is one of only two New England states, and one of only 18 states nationwide, to have a Federally-approved plan.

The MA AIS Plan outlines an ambitious five-year plan for AIS management with the goal of "implementing a coordinated approach to minimizing the ecological and socioeconomic impacts of AIS in the marine and freshwater environments of Massachusetts." The Plan is implemented by the MA AIS Working Group (composed primarily of state environmental agency staff) describes four main goals:

1. Educate the public about threats from aquatic invaders and measures that can be taken to prevent their further introduction and spread
2. Reduce the potential for the introduction of AIS into Massachusetts waters through preventative measures
3. Control the spread of established AIS to uncolonized waters of Massachusetts
4. Minimize harmful ecological, socioeconomic, and public health/safety impacts from aquatic invaders that have been introduced into Massachusetts waters.

Since 2002, Massachusetts has received about $200,000 in federal funds for control of AIS in freshwater and marine environments in accordance with this Plan. The Plan can be found at http://www.mass.gov/czm/invasivemanagementplan.htm

The Generic Environmental Impact Report: Eutrophication and Aquatic Plant Management in Massachusetts (GEIR) and ***The Practical Guide to Lake Management in Massachusetts (Practical Guide)***

The *GEIR* and *Practical Guide* were approved by the Secretary of the Executive Office of Environmental Affairs (EOEA) in March 2004. These two documents provide a complete description of the issues of lake management, prevention of unwanted plant growth and nutrients, and a thorough assessment of all the techniques available for lake management in the

Commonwealth. "The Practical Guide" provides the non-technical reader with the key information in the GEIR, along with information that will help citizens and municipal Conservation Commissions more clearly understand options for lake management, including control techniques for both native and non-indigenous aquatic plants. These publications are available at the DCR website: **www.mass.gov/lakesandponds**.

B. Regional Activities

Northeast Aquatic Nuisance Species Panel (NEANS)
NEANS consists of representatives from the seven New England states, New York, and two Canadian provinces, as well as representatives from private industry and nongovernmental organizations (NGOs), such as The Nature Conservancy. The Panel exists to facilitate cooperation within the New England states and with Canada and other countries. AIS information, materials, research ideas, and management/study results are exchanged. The panel is part of the Federal Task Force on Invasive Species and receives all of its funding from the U. S. Fish and Wildlife Service. To date, NEANS has received over $150,000 from the federal government to assist in cooperative projects within the region. Massachusetts currently has three official representatives on the Panel: a Panel co-chair and co-chairs of the Science and Technology Committee and the Legislation and Policy Committee. The NEANS website can be found at: ***http://www.northeastans.org/index.htm***

The New England Invasive Plant Group (NIPGro)
NIPGro is a networking link among the organizations and agencies involved with terrestrial and freshwater aquatic invasive plant issues in the region. Priorities of the group include:

1. Minimizing new introductions to the region by instituting an early warning and response system
2. Using the NIPGro network to exchange information, share educational materials, identify research needs, and establish links with researchers
3. Developing standardized criteria for creating priority species lists
4. Coordinating control efforts.

The NIPGro website is found at: ***http://invasives.uconn.edu/ipane/relatedinfo/NIPGro.htm***

Invasive Plant Atlas of New England
The Invasive Plant Atlas of New England (IPANE), housed at the University of Connecticut, has as its mission to create a comprehensive web-accessible database of invasive and potentially invasive plants in New England that will be continually updated by a network of professionals and trained volunteers. The database facilitates education and research that leads to a greater understanding of invasive plant ecology and supports informed conservation management. An important focus of the project is the early detection of, and rapid response to, new invasions. IPANE's website is found at: ***http://invasives.uconn.edu/ipane/index.htm***

The Silvio O. Conte National Fish and Wildlife Refuge Invasive Plant Control Initiative
The Silvio O. Conte National Fish and Wildlife Refuge, located in Turner's Falls, Massachusetts, developed an Invasive Plant Control Initiative in response to the threat to natural diversity posed by invasive plant species in the Connecticut River Watershed and Long Island Sound. The Plan,

completed and distributed in March 1999, identifies problem plants in the watershed, gives a detailed description of the efforts of agencies and organizations working to mitigate the problem, and makes recommendations for additional management activities. The refuge's website is found at: ***http://www.fws.gov/r5soc/***

C. State Activities

Department of Conservation and Recreation (DCR) Lakes and Ponds Program
The DCR Lakes and Ponds Program provides technical assistance, training, outreach, and education and project management for AIS control projects statewide. Staff focus their efforts on DCR lakes and ponds, but also work closely with communities and citizens groups and coordinate with all the organizations mentioned above. Following are DCR's efforts related to AIS:

- Weed Watcher Training

The key to success is early detection and rapid response. This program trains citizens to take a proactive role in protecting their water body by learning to identify aquatic plants and carrying out lake surveys. By engaging local citizens in routine AIS monitoring, the program aims to detect new infestations in a pioneer stage, increasing the chance of a successful eradication or control. *To date, over 480 volunteers associated with 60 water bodies have participated.*

- Boat Ramp Monitors

This program hires seasonal staff to inspect boats for AIS and educate boaters as they enter and leave boat ramps. The goals of the program are to prevent pristine water bodies from becoming infested, to reduce further spread of AIS from infested areas, and to educate boaters about non-native species and the steps they can take to protect our lakes and ponds. *Since 2004, over 2,820 surveys have been collected, and 183 boats were found transporting non-native plants, which were removed, resulting in a "save."*

- AIS Surveys and Database

In order to document the locations and severity of AIS in Massachusetts water bodies, DCR staff conduct AIS surveys throughout the field season and maintain the database (described in Section II and in Appendix A). In a typical field season, roughly 50 lakes and ponds are surveyed by DCR staff. The database is continuously being updated and ultimately will be available on the web in the form of an interactive GIS map. This map eventually will be linked with the IPANE effort noted above.

- Education

Public education provides the basis for raising public awareness of issues surrounding invasive species, including how they are spread and how individual actions can prevent further distribution of AIS. The DCR Lakes and Ponds Program has developed numerous education and outreach materials for the public, including brochures, guides to common invaders, posters, floating AIS boat key rings, an interactive website, and an AIS exhibit. DCR staff also write articles on invasive species for magazines and newspapers. Additionally, Lakes and Ponds staff have partnered with the Massachusetts Environmental Police to include an AIS brochure with the mailing of 80,000 state boat registration renewals this year.

- Management

The DCR Lakes and Ponds Program spends about 60% of its time combating existing AIS within our state forests and parks. This includes controlling invaders such as Phragmites and purple loosestrife infestations, which are taking over our vital wetland habitats and pushing out many native species, as well as many in-lake species, which are threatening the ecology, recreational, and aesthetic value of our freshwater lakes. The DCR Lakes and Ponds Program has developed Rapid Response Protocols and initiated an AIS Control Project to deal quickly with these new invasives in our parks and forests once they are identified.

Department of Environmental Protection (MassDEP) Division of Watershed Management

MassDEP is responsible for monitoring the waters of the Commonwealth, identifying waters that are impaired, and developing a plan to bring them back into compliance with the Massachusetts Surface Water Quality Standards. Impairment can include "exotic" species or AIS. Following are MassDEP's efforts related to AIS:

- The Division produces the Massachusetts Integrated List of Waters, which identifies impaired river, lake and coastal waters and the reasons for impairment. (http://www.mass.gov/dep/brp/wm/tmdls.htm)
- The Division also awards funding for lake projects through the section 319 Nonpoint Source Pollution grant program (http://www.mass.gov/dep/brp/wm/nonpoint.htm).

Department of Agricultural Resources (DAR)

The mission of the Massachusetts Department of Agricultural Resources (DAR) is to support, promote, and enhance the long-term viability of Massachusetts agriculture, with the aim of helping the state's agricultural businesses become as economically and environmentally sound as possible. DAR's efforts related to AIS include a ban on the importation, sale, and distribution of over 140 plants that are considered noxious or invasive in Massachusetts, including the 14 aquatic species identified by the DCR Lakes and Ponds Program (Appendix C). For more information on this ban refer to Appendix C or visit The DAR website which is located at: www.mass.gov/agr/farmproducts/Prohibited_Plant_Index2.htm.

The Massachusetts Invasive Plant Advisory Group (MIPAG)

This collaboration of government, industry, and environmental organizations was formed in 1999 under the leadership of the Silvio O. Conte Refuge. It is a broad-based coalition of state and federal governmental agencies which seeks to:

1. Share invasive plant information among members
2. Educate the public and other interest groups about invasive plants and their control
3. Promote native alternatives to those non-indigenous species still being used for various purposes in Massachusetts
4. Promote research in the field of invasive plant management.

MIPAG serves as an important advisory committee for state agencies working to develop control strategies and identify invasive plant priorities. They have published a definitive invasive plant list, published in *The Evaluation of Non-native Plant Species for Invasiveness in Massachusetts*, which includes upland as well as aquatic species. Their list is consistent with DCR's list of problem AIS (Appendix A) and the AIS included in the DAR list of prohibited plants (Appendix

C). The MIPAG website is under construction and should be available shortly at http://massnrc.org/mipag; other relevant information can be found at www.mnla.org and www.newfs.org.

IV. AIS Management Options

A. Prevention Techniques

Preventing a new AIS invasion is by far the most cost-effective and environmentally sound approach to managing AIS. The DCR Lakes and Ponds Program promotes and practices prevention wherever possible. Key elements of a successful prevention program include:

- Education, Outreach and Training
  - Train citizens to identify AIS
  - Monitor boat ramps
  - Provide educational signage
  - Develop and distribute educational publications.

- Policy and Legislation
  - Establish regulations to ban the import and transport of AIS
  - Establish rapid response procedures
  - Appoint a Scientific Advisory Committee to evaluate statewide AIS threats and recommend responses (see section VI).

- Science and Technology
  - Evaluate the current status of invasives and the threat of new invasions
  - Evaluate new control techniques.

B. Control Techniques

While native plants and algae are essential components of a healthy lake ecosystem, the introduction of non-native invasive plants poses particular challenges. If these invaders are not stopped in their pioneer stages, their rapid spread usually results in a protracted and expensive campaign to control them. Once past the pioneer stage of infestation, aggressive and often expensive AIS controls may be needed, and complete eradication is rare.

There are many techniques to control aquatic plants and algae in our lakes and ponds, and the decision of which technique to use will depend on many individual factors. The *GEIR* and *Practical Guide* review the full range of control methods applicable in Massachusetts, but the major techniques are:

- Physical Techniques, including:
  - Mechanical Harvesting - Machines that cut and collect vegetation
  - Hand Pulling/Snorkelers - Following a survey, selectively pull unwanted plants
  - Diver-Assisted Suction Harvesting (DASH) – Divers survey an area and hand pull plants which are then "vacuumed up," using a suction device
  - Dredging - Mechanical removal of sediment and vegetation
  - Benthic Barriers - Placement of bottom cover over plants to inhibit sun light needed for their growth

- Drawdown - Lowering the water level in a water body to expose plants to winter freezing.

- Chemical Techniques, including the use of:
  - Herbicides - Chemicals with active ingredients that are toxic to target plants
  - Algaecides - Chemicals with active ingredients that are toxic to target algae
  - Dyes - Limit sun light penetration needed for plants to grow.

- Biological Techniques, including the use of:
  - Herbivorous insects – Insects, such as the milfoil weevil, that typically feed on a specific host (the target plant)
  - Herbivorous fish (illegal in MA) – Fish that feed on submerged aquatic vegetation.

V. AIS Management Costs

Once aquatic invasive species have a foothold beyond the pioneer infestation stage, eradication usually is not possible with current knowledge and techniques. Costs related to AIS include both the direct costs of prevention and control programs, and the ecological and economic costs associated with proliferation of AIS in aquatic ecosystems. This section provides a brief discussion of ecological, economic, and prevention costs, and a more detailed discussion of control costs.

A. Ecological Costs

The damage to lake ecosystems from invasive aquatic plants may be very difficult to measure, but probably is the most significant issue we face. The "costs" to the lake environment include, but are not limited to:

- Loss of native biological diversity and reduction in ecosystem stability
- Loss of ecosystem functions
- Loss of critical food and habitat for native species.

Due to the difficulty of assigning monetary values to ecosystem functions, few studies have reported actual monetary estimates for the above losses. Often the ecological losses are tied to economic losses that are more easily measured, such as lakefront property value declining as a result of accelerated eutrophication. Following are some specific examples of AIS impacts on ecosystems:

- The displacement of native plants that provide wildlife with good habitat and higher food value than non-native plants, such as the common reed, purple loosestrife, and Eurasian milfoil
- The threat to native crab, clam, and oyster fisheries by non-native green crabs, which compete with native fish and birds for food and preys on native bivalve populations

B. Economic Costs

The economic costs of AIS appear to be very large, although precise information is not easily available. The federal Environmental Protection Agency (EPA) has estimated the economic losses in the U. S. from invasive species at over $100 billion annually *(http://www.swfwc.org/ANS/Impacts.htm),* while Rockwell reports national costs of $1 to $10 billion dollars annually. (Rockwell, 2003). Economic costs that have been measured and studied include:

- Loss of recreational value
- Loss of property value
- Loss of commercial value
- Loss of flood protection, due to loss of flood storage capacity.

While some estimates are available, the science of valuing economic costs of AIS is still developing, and only a small number of studies have been conducted in the northeastern U S. A review of economic sources on AIS shows the literature is still in its infancy. (Lovell, S. J.,

Stone, S. F., 2005). Following are some specific cost estimates:

- Annual zebra mussel control/adaptation costs incurred by major raw water users in the Great Lakes are estimated at $30 Million per year (U. S. Department of Fisheries and Wildlife).
- Invasive weeds in Nevada public lands are estimated to cost $6 to $12 Million per year in reduced recreation. (University of Nevada, Special Publication SP-05-06)
- Research in Vermont shows that invasive plants can cost shoreline owners over $12,000 in lost property values on infested lakes.
- A University of New Hampshire study showed that infestations can adversely affect recreational and aesthetic values of the state's surface waters, decreasing shore-front property values by as much as 16 percent.

C. Direct Costs of Prevention

In addition to indirect economic costs of AIS, such as the loss of property value, huge direct costs of AIS are associated with management and control programs, and to a lesser degree with prevention programs. The DCR Lakes and Ponds Program dedicates significant levels of staff time and resources to AIS.

D. Direct Costs of Control

Nearly every management method requires approval under the Massachusetts Wetlands Protection Act by a local Conservation Commission, frequently requiring a consultant or other expert to be involved. Aggressive techniques, such as dredging, require substantial planning, permitting, monitoring, and reporting, which adds to the expense of the project. If a Conservation Commission decision is appealed, additional time and expense are involved. The conservation commission or DEP may impose special conditions requiring special monitoring or other activities.

Once the permitting is achieved, the costs of implementing the AIS control project can vary tremendously. The following data are provided as part of a national and regional perspective on control costs:

- As a conservative estimate, at least $100 million is spent annually in the direct control of aquatic weeds. (*The estimated benefits of control are generally reported to be much higher--ten times or more--than these costs. (Rockwell, 2003).*
- The *GEIR* provides a range of costs (per acre) for each management technique. To summarize, costs range from $100 to $500 per acre for hand-pulling, to a high of $5,000 to $15,000 per acre for suction-harvesting and $6,000 to $10,000 per acre for hydroraking. See *The Practical Guide* for a complete summary of costs per acre for each technique.

E. Estimated Costs

The management cost per lake depends on the size of the infestation and the cost per acre for the recommended management technique(s) selected. The recommended management technique depends on numerous factors including (1) the type of species, (2) the size of infestation, (3) political constraints, (4) cost considerations, and (5) environmental constraints. For example,

mechanical harvesting is not recommended for species that spread by fragmentation. Benthic matting generally works for any species, but is only recommended for smaller infestations due to cost.

Based on the best information available and presented in the GEIR, several cost estimates have been developed to provide a statewide perspective on potential costs of AIS removal, using Eurasian Watermilfoil as an example. Note that the following are rough estimates, based on average costs per acre presented in the *GEIR*.

EXAMPLE: ***Estimated Cost of Managing Eurasian Watermilfoil in Massachusetts***
One of the most commonly occurring AIS in Massachusetts is Eurasian Water Milfoil (EWM). Of the almost 700 lakes and ponds in Massachusetts that have been surveyed for invasives (64 of which being DCR properties) EWM was present in 97 water bodies, or roughly 14 percent of water bodies surveyed. The total acreage of all the 97 lakes in which EWM is reported is approximately 19,000 acres. These 97 lakes range in size from 4 acres to 1,200 acres, with an average size of 150 acres. For the majority of surveyed lakes, the actual size of the infestation is not known, so cost estimates must be based on a range of assumptions, and for the purposes of the estimate below a range of 25% cover to 75% cover and an average lake size of 150 acres is assumed. The following scenarios provide a range of cost estimates for initial treatments to manage all the state's lakes with EWM, using the following three different treatment options:

- Chemical control using herbicides: Average cost of $550-$750 per acre (*GEIR*). Additional treatments may be needed several years after the first treatment.
- Biological control using weevils: Average cost of $3,000 per acre (*GEIR*), with a likelihood of additional introductions needed.
- Mechanical control using diver-assisted, suction-harvesting (DASH): Average cost of $10,000 per acre (*GEIR*). This technique is feasible on smaller areas.

The estimated costs for management of EWM at the average lake (150 acres) and for all 97 lakes (19,000 acres), based on treatment type and percent cover of AIS are:

Cost per lake and cost for all lakes based on 25% and 75% cover	Herbicide	Weevils	DASH
Avg. cost per lake (assume 150 acres @ 25% coverage with AIS)	$19,407	$105,858	$352,861
Avg. cost per lake (assume 150 acres @ 75% coverage with AIS)	$79,394	$317,575	$1,058,582
Cost to treat all 97 lakes (assume 25% coverage)	$1,882,513	$10,268,250	$34,227,500
Cost to treat all 97 lakes (assume 75% coverage)	$7,701,188	$30,804,750	$102,682,500

It should be noted that in an actual application, there are many factors that would influence the decision to use one or more of these techniques, and they are presented here not as recommendations, but to provide some understanding of the range of possible costs. In addition, this scenario does not include long-term management costs, which would continue following the initial treatment costs.

In addition to the cost estimate above, information from the MassDEP herbicide licensing program provides a reference for the extent of AIS control efforts by herbicides. A sample of the available licensing information showed that in 1993, herbicide/algaecide licenses were requested to treat 90 lakes, of which at least 39 were for AIS; in 2005 there were requests to treat 239

lakes, of which at least 139 were for AIS. The proportion of licenses to AIS infestations has not been researched for the remaining years. The history of licensing herbicide treatments between 1992 and 2005, however, shows a clear rise, with increased numbers of licenses being issued each successive year, from a low of 23 in 1992, to a high of 239 in 2005. It is not clear whether the increase in licensing reflects the growing awareness and concern for AIS infestations or other factors. It also is not known how many of the licenses actually resulted in herbicide treatments.

VI. Assessment of Future Risks

Invasive species have great advantages over native plants in being able to survive, propagate, and overtake ecological niches in our lakes and ponds faster and often more completely, than native species. Even so, there have been apparently spontaneous "crashes" of milfoil populations in some lakes, and all species will vary in density from season to season and certainly over longer periods. As we learn more and begin clarifying how and why these cycles occur, we will better understand the best control mechanisms and techniques. In the meantime, it is clear that *not* aggressively controlling these species will leave our water bodies open to the problems discussed in this report and elsewhere. This section discusses measures Massachusetts is taking to evaluate the risk of future AIS invasions and to determine the appropriate response.

A. Species of Concern

Over the past three years, the Massachusetts Invasive Plant Advisory Group (MIPAG) has been evaluating aquatic and terrestrial non-native plant species to determine the level of threat they pose to Massachusetts. Once the plants are evaluated, they are placed into one of three categories; *Invasive*, *Likely Invasive*, *Potentially Invasive*. The list of *Invasive* plants was used by the Department of Agricultural Resources for the development of the 2006 Plant Ban (Appendix C). The other species are still undergoing evaluation to determine if they pose a significant threat and warrant a promotion to the *Invasive* category. These species are listed in Appendix D.

B. Massachusetts Scientific Advisory Committee on AIS

Other than the list of potential invaders, compiled by MIPAG and other leading scientists (Appendix D), and the list of plants included in the 2006 Plant Ban (Appendix C), there is little or no information on how to determine if a new infestation requires a rapid response, or how to prioritize responses to multiple infestations. There are many factors that need to be considered including (but not limited to): invasiveness of the species; risks it poses to human health; available control methods/lack of any control methods; and financial constraints. Therefore, the Massachusetts AIS Working Group (which implements the MA AIS Plan and is composed predominantly of state agency staff) is proposing the establishment of a Scientific Advisory Committee (SAC) to conduct the risk assessments on potential invaders and make recommendations on appropriate responses, depending on the level of threat. One of the goals of the SAC is to run the likely invasive species, or any new invading species through a risk assessment. The SAC will be composed of Working Group members and several experts who will serve as consultants to the committee. Two of SAC's primary responsibilities will be to:

- Review risk assessments completed by state technical staff for new invaders, and
- Make recommendations to the Secretary of Environmental Affairs and appropriate Commissioners regarding rapid response actions.

Two species of concern, Zebra Mussels and Hydrilla, will be reviewed by the SAC. Hydrilla has been found and contained in one pond in MA, and Zebra Mussels are at our borders. Additionally, Hydrilla has been chosen as the target species for eradication in the northeast, by the NEANS panel. During the next year, panel members from all the New England states, New

York and several Canadian providences will be developing a strategy with the ultimate goal of eradicating Hydrilla from the northeast.

C. Impacts to Surface Drinking Water Supplies

Based on recent data from MassDEP, there are 185 active public water supply reservoirs in the Commonwealth. These water supply reservoirs range from a few acres in size, to almost 25,000 acres and range in depth from a few feet deep, to over hundred feet deep.

The introduction of some non-native aquatic plants can, within a few years, alter a reservoir's morphology and cause environmental and economic problems. In small and shallow reservoirs, a small patch of the new species can proliferate in a few years to cover and fill most of the reservoir's water column. The reservoir's ability to supply a sufficient volume of water can be impaired due to the abundance of plants. Volume can be depleted with the seasonal dying-back of plants that over time increases the thickness of bottom sediments and causes the reservoir to lose overall depth. The water quality of a reservoir can also be threatened with the introduction of some non-native aquatic species. Algae blooms can result when large volumes of plants die back in the fall and release nutrients. Some algae can cause taste and odor problems, and others can pose health risks due to toxins.

VII. Recommendations

This section provides recommendations for state agencies, communities, and legislators on future efforts to stop the spread of AIS.

A. Recommendations for the State

For the state the recommended priorities for research, prevention and control are:

1. Prevention First: Protect lakes and ponds that are currently free of AIS.
2. Manage and wherever possible restore AIS infested public lakes and ponds with high recreational use and/or lakes and ponds with particularly outstanding ecological values.
3. Control and wherever possible eradicate new AIS infestations.

Essential to these goals is a continuation of the inventory project to identify those lakes and ponds which may be AIS-free and to identify the species-infesting lakes with AIS populations. This requires an ongoing, long-term monitoring effort and should involve a combination of trained volunteers, state program staff, and partnerships with educational institutions, environmental non-profit groups, corporate sponsors, and others. The maintenance of the inventory will provide the basic knowledge upon which the Commonwealth can develop an effective control program.

1. Prevention First: Protect lakes and ponds free of AIS

This category includes the 40+ lakes in the DCR database that do not have any AIS, along with any others that are identified in future surveys. The spread of AIS can be prevented through education, training, policy, and science; and DCR will continue to pursue all of these avenues. The DCR Weed Watcher Program has trained over 480 citizens from over 60 water bodies since 1999, and plans are in place to continue these efforts. The Boat Ramp Monitor Program has proven effective in both finding AIS fragments, and educating the public on invasive species and steps that can be taken to prevent their spread. In the past two years, the latter program has produced 183 documented "saves," where non-native plants fragments have been spotted and removed from a boat entering or leaving a water body. Plans are in place to continue and expand these efforts by continuing the DCR program and training local groups to conduct boat ramp monitoring.

Because education of lake users is fundamental, efforts in this area should be focused on the public. A selection of the many brochures and other material available for distribution is available on the DCR Lakes and Ponds website at: www.mass.gov/lakesandponds

2. Manage and wherever possible restore AIS infested state owned lakes and ponds with high recreational use and/or lakes and ponds with particularly outstanding ecological values.

This category includes lakes such as Otis Reservoir in Otis and Pequot Pond in Westfield, two DCR facilities which have high recreational value, and diverse native plant communities, but also have AIS infestations. For lakes in this category, the goal should be to prevent additional spread and ideally to restore the native plant communities

3. Control and wherever possible eradicate new AIS infestations.

DCR has developed an Early Detection-Rapid Response program to control new infestations in the lakes and ponds of DCR state and urban parks. The AIS Control Project initially focused on the non-native plant Common Reed (*Phragmites australis),* and six lake sites were chosen across the state for eradication of new infestations. In 2006, this project will expand to include other lakes and ocean beaches on DCR property that have new infestations of Common Reed, in order to eradicate the plant before it becomes established at the sites.

At the local level, more local community groups and recreational organizations need to be trained to identify and remove pioneer infestations of AIS that are likely to spread to AIS-free lakes. To this end, DCR also developed standard operating procedures to provide guidance to communities and lake associations on how to respond to a pioneer AIS infestation

B. AIS Recommendations for Communities

The DCR Lakes and Ponds program has developed a checklist for communities to ensure they are doing all they can to address AIS within their jurisdiction. The list is focused on prevention, education, and outreach and is intended for use by interested individuals, lake groups within a community, and elected officials with responsibility for community natural resources. The items for check-off include:

1. Attend Weed Watcher Trainings
2. Post Boat Ramp Signs
3. Establish Boat Ramp Monitors
4. Establish a Lake and Pond Committee, and/or Lake Associations
5. Join and Attend meetings of the Congress of Lakes and Ponds (COLAP) and the Lakes and Ponds Association of Western MA (LAPA-West)
6. Conduct Regular Assessment/Monitoring for AIS
7. Conduct Management Planning for AIS
8. Conduct Ongoing Public Education and Outreach on AIS
9. Request Technical Assistance and Guidance from Appropriate Programs.

1. Attend Weed Watcher Training

The DCR Weed Watcher Program trains local lake groups on how to identify AIS, monitor their ponds for AIS, and develop a removal plan if an infestation is found. Each summer, DCR Lakes and Ponds staff conduct trainings across the state for interested lake groups or associations. The two-hour class includes an introduction to the AIS issue, a description of basic terminology, guidance on hands-on plant identification and practice on using the plant key, instruction on performing plant surveys, and information on how to report a new infestation. All participants receive training materials, and the local host receives a Weed Watcher manual. Communities should check with DCR to see which if any of their lakes have completed Weed Watcher trainings and to schedule additional trainings, if appropriate.

2. Post Boat Ramp Signs

Boat ramp signs are available at no cost from DCR. The signs were developed in conjunction with the nationwide safe waters initiative and use nationally accepted symbols and wording to support consistency of message across the country; all the New England states have agreed to use the same graphics and wording (see Appendix E). The signs remind visitors to remove all

plants and animals from the boats, trailers, and gear, and to dispose of all bait buckets and live-well water far from shore. Signs should be posted at key access points where AIS are most likely to be introduced via boat. Communities should ensure that all ramps are posted and, as needed, request additional signs from DCR.

3. Establish Boat Ramp Monitors

A cost-effective approach to prevention is to hire seasonal boat ramp monitors to check incoming and outgoing boats for AIS and to provide educational material to boaters and show them how to check their boat for plants. Since 2003, DCR has hired seasonal ramp monitors for public facilities. The ramp monitors perform voluntary boat inspections, survey visitors to assess their awareness of AIS, and hand out informative brochures and key rings. Boat ramp monitors can serve in the following three key roles: In the case where the lake is currently free of invasives, the boat ramp monitor can work to protect the lake from introductions of AIS. For lakes that may have one bad invasive but not others, the boat ramp monitor can protect the lake from additional infestations. For lakes infected with one or more AIS, the boat ramp monitor can prevent the spread of AIS out of the infected water body. In all cases, the monitor can serve as an important educational resource. DCR is in the progress of developing a volunteer boat ramp monitoring program to encourage and train citizens to monitor their own boat ramps. Communities interested in establishing a boat ramp monitoring program should contact DCR for more information and technical assistance.

4. Establish a Lake and Pond Committee, and/or Lake Association

Starting a lake group is a good first step towards protecting your lake's future and addressing problems that may be threatening your water body's health. Although one person alone can make a difference, a group of people with similar concerns and interests have a greater impact. Lake groups can attend town meetings as a voice for the lake, monitor for AIS, apply for grants, hold trainings for lake citizens, monitor water quality, work with town planning boards to reduce the impact of development, improve storm drain cleaning, etc. The Massachusetts Congress of Lakes and Ponds (COLAP) can assist groups in developing an association, and they provide opportunities for training, networking, and support.

DCR encourages the establishment of Lake and Pond Committees to coordinate community-wide oversight of all lake and pond efforts. Cities and towns should encourage lake groups to form associations and promote the formation of official lake and pond committees to oversee their activities.

5. Attend COLAP/LAPA-West

The MA Congress of Lakes and Ponds (COLAP) serves as an umbrella group for lake and pond associations throughout the state. COLAP provides annual training, education, and networking opportunities at their January Conference and via their board of directors and newsletter. The Lake and Pond Association of Western MA (LAPA-West) serves the same role as COLAP, but specifically for the western region of Massachusetts, and holds an annual conference in September. Communities are encouraged to send representatives to these two conferences to get the most up-to-date information on management of AIS.

6. Conduct Regular Assessment and Monitoring for AIS

Communities that have attended Weed Watcher trainings will be prepared to conduct their own monitoring for AIS, assuming they have enough volunteers. In addition to volunteers, some communities may choose to hire a consultant to conduct a preliminary assessment of AIS, which can then be used to develop a long-term monitoring and management plan. Communities wishing to hire a consultant to conduct AIS assessment should consider attending COLAP to network with the many other lake associations and communities that have taken this approach.

7. Conduct Management Planning for AIS

The next step to be undertaken after completing an AIS assessment is the development of a lake and watershed management plan. Whether management planning will be done primarily by volunteers, or by a consultant, the *GEIR on Eutrophication and Aquatic Plant Management* provides a tremendous resource. Communities are encouraged to reference the *GEIR* and *Practical Guide* for an overview and detailed description of all the major techniques available for preventing and controlling the spread of AIS.

8. Conduct Ongoing Public Education and Awareness Efforts on AIS

Raising public awareness is critical when striving to prevent the spread or introduction on invasive species. Boaters need to understand the importance of cleaning vessels before entering or leaving a water body, fishermen need to learn to empty bait buckets and live well-water on land away from shore, and homeowners need to learn not release their unwanted pets or plants into the wild. The DCR Lakes and Ponds Program offers a variety of educational materials (at no cost) including brochures, posters for kiosks, guidance for Conservation Commissions (*GEIR*), and other outreach materials. Communities can increase public awareness by requesting and distributing the AIS materials available from DCR, addressing AIS on the local cable channel, and involving schools in AIS projects.

9. Request Technical Assistance and Guidance from Appropriate Programs

A community may require technical assistance and guidance on AIS prevention, assessment, or management. Communities should contact the DCR Lakes and Ponds Program at any point in their process for additional guidance and technical assistance. If DCR is not the appropriate resource, program staff will be able to guide the community to the proper contact.

C. Overall Recommendations

This report outlines the need for the following statewide goals:

- Prevent additional infestations of our waters by AIS
- Control those species that currently threaten the ecology and recreational uses of our lakes and ponds
- Help our communities educate their citizens and take action locally
- Make policy decisions on how to best determine how to protect and restore our state owned lakes and ponds over the long term, and provide guidance to municipalities for their facilities.

Legislation that has been filed on several occasions over the last decade indicates a growing awareness of the AIS problem by legislators and their constituents, and a desire to take steps to begin addressing these issues within the state's legal framework. It should be noted that our neighboring states of Vermont, New Hampshire and Maine are also taking steps towards greater

AIS control, and the Commonwealth should be moving to participate in a concerted, regional approach. To this end, the Massachusetts Legislature has given the general care and oversight of the lands, waters, and flowed tidelands held in trust by the Commonwealth to DCR (ch. 91), and has authorized DCR to undertake certain activities and programs in the Great Ponds as set forth in G.L. c. 21, §§37A-37D.

This report has provided the key principles and actions that should be included in any future legislative package, and the Commonwealth's environmental agencies would look forward to working with all interested parties in this endeavor. It is noted, however, that the environmental agencies must defer to the Executive Office of Administration and Finance on all matters regarding funding.

A comprehensive lake protection and restoration effort should look to include the following components:

- prevention of new infestations of non-native invasive aquatic species
- protection and restoration of the lakes, ponds and other waterways of the Commonwealth from the impacts of existing non-native aquatic invasive species
- public education and training to increase general awareness of the issues.

Because the Commonwealth's lakes and ponds are owned by various groups, including private individuals, non-profits, municipalities, and state and federal agencies, it is difficult to propose viable recommendations to address AIS control without first having access to a forum for each of these ownership interests to be able to express their concerns.

The environmental agencies look forward to participating in this type of collaborative effort. A well functioning AIS control program is an investment in the Commonwealth's environmental future.

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APPENDIX A- MA DCR Lakes and Ponds Program Aquatic Invasive Plant Species of Concern

Common Reed
Phragmites australis
The Common Reed is aggressive wetland species that is able to invade freshwater, brackish water and saline marshes, and is often seen in wetlands and roadside ditches. *Phragmites* can form very dense impenetrable stands that may exclude native vegetation and not provide ideal shelter or food for wildlife. As *Phragmites* spreads rapidly and fills in wetlands, water flow and flood retention may be decreased.

Curly-leaved Pondweed
Potamogeton crispus
Pondweeds are a very common and diverse group of aquatic plants. *Potamogeton crispus* is the only non-native pondweed and is easily identifiable. Curly-leaved Pondweed does not reproduce from fragments, instead, seeds are produced in late spring early/summer and by July, *P. crispus* has died back. The seeds germinate in the fall, grow to a few centimeters tall, and over-winter in a dormant stage. In spring the small plants have a head start over other native plants and can quickly form dense stands.

Eurasian Milfoil
Myriophyllum spicatum
Eurasian Milfoil is an aggressive exotic plant, native to Eurasia, which is abundant in the alkaline waters of western Massachusetts and has spread to many ponds in central and eastern waterbodies. Eurasian Milfoil spreads rapidly via fragmentation and forms dense monocultures in the waterbody. Eurasian Milfoil often displaces native species, reduces biodiversity, hampers recreational uses, and reduces real estate and aesthetic values.

European Naiad
Najas minor
This species is naturalized in some of the alkaline lakes of Berkshire County. It is identified by the lobed leaf bases and conspicuous leaf serrations. Dense growth can crowd out native vegetation and impede swimming and boating.

Fanwort
Cabomba caroliniana
Fanwort is native to the southern United States and is a very hardy and persistent species that is established in a wide range of aquatic habitats. This species was likely introduced to New England via the aquarium trade and has been established in the acidic waterbodies of Massachusetts for over fifty years. The species is a popular aquarium plant due to its decorative bright green fan-shaped leaves. Like many other exotic species, Fanwort can re-grow from fragments.

Hydrilla
Hydrilla verticillata
Hydrilla has the potential to become a serious problem in Massachusetts, but at this time is only present in one waterbody. Hydrilla has long slender stems that branch out profusely when they reach the water's surface, hindering navigation, recreation, flood retention and driving out native species/ Florida spends millions of dollars annually to manage Hydrilla. This species is currently on the Federal Noxious Weed List and on the Massachusetts Noxious Weed List.

Parrot Feather
Myriophyllum aquaticum
This South American species is established on Long Island, New York and is currently found only in one know location in Massachusetts. Parrot Feather is common in the aquarium/water garden trade and can tolerate the harsh conditions of New England's winters. Once established, *M. aquaticum* can form dense mats on the water's surface that may restrict light to the complete exclusion of other plants, hamper fishing, boating, swimming and other recreational activities.

Purple Loosestrife

Lythrum salicaria
Purple Loosestrife is an invasive non-native plant from Eurasia that was introduced over 200 years ago. Purple Loosestrife often out-competes native plants primarily in wetland areas, resulting in reduced biodiversity, desirable food, nesting sites for wildlife, and fewer stopover sites for migrating birds. Purple Loosestrife spreads rapidly from seed and each plant can produce 1-3 million seeds annually.

South American Waterweed
Egeria densa
This species is native to South America, and due to its popularity as a decorative oxygenating aquarium plant, was likely introduced to Massachusetts' water bodies via the aquarium trade. South American Waterweed is often sold in pet stores under the names *Anacharis*, Brazilian Waterweed and *Elodea*. South American Waterweed spreads very rapidly by fragmentation and can grow to over 30 ft long, out-competing native species for light, space and nutrients. This plant is easily confused with native waterweed, *Elodea sp*, and *Hydrilla*. This plant is found in a handful of Massachusetts waterbodies.

Variable Milfoil
Myriophyllum heterophyllum
Variable Milfoil is a non-native submerged plant that is well established in at least 175 Massachusetts waterbodies. Variable Milfoil is a hardy species that tolerates a variety of aquatic conditions, can grow in over 10 feet of water, and produces dense mats of vegetation that greatly impede boaters, fisherman and swimmers. This species spreads very rapidly from fragments and often dominates a waterbody, out-competing native vegetation, including native milfoil species.

Water Chestnut
Trapa natans
Water Chestnut is a major nuisance in the Concord River and Charles River systems of eastern Massachusetts, and it appears to be rapidly spreading elsewhere in the state. Water Chestnut does not spread from fragments, but produces nuts that sink and remain viable in the sediment for over seven years. It is believed that ducks and geese may be a means of dispersal as they have been observed with the spiny nuts attached to their feathers. This species is on the Massachusetts Noxious Weed List.

Yellow Floating Heart
Nymphoides peltata
This extremely hardy Eurasian species spreads rapidly from seed. The long stems can impede swimming, fishing and boating, and the dense mats of floating leaves can block sunlight to the exclusion of other plants and algae. Yellow Floating Heart displays showy yellow flowers on a rigid stalk several inches above the water's surface, and may be confused with native Little Floating Heart (*N. cordata*).

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Abington	Cleveland Pond	88					x				x			x		
Abington	Cushing Pond	10					x				x					
Abington	Island Grove Pond	38					x		x		x					
Acton	Ice House Pond	12													x	
Acushnet	New Bedford Reservoir	219												x		
Acushnet	Tinkham Pond	194	x													
Agawam	Robinson Pond	4	x													
Andover	Bakers Meadow Pond	18									x					
Andover	Ballardville Impoundment	35					x				x					
Andover	Brackett Pond	17									x					
Andover	Collins Pond	7									x					
Andover	Field Pond	59					x				x					
Andover	Fosters Pond	109					x		x		x					
Andover	Hussey Brook Pond (west basin)	5									x					
Andover	Hussey Brook Ponds			x							x					
Andover	Hussey Pond	2									x					
Andover	Pomps Pond	14					x				x					
Arlington	Spy Pond	103			x											
Ashburnham	Watatic Lake	126												x		
Ashburnham/Ashby	Watatic Pond (little)	28												x		
Ashland	Ashland Reservior	155												x		
Athol	Ellis Pond	67			x		x							x		
Athol	South Athol Pond	76					x									
Athol	White Pond	67					x									
Athol/Orange	Rohunta, Lake	250												x		
Attleboro	Dodgeville Pond	47									x					
Attleboro	Farmers Pond	9									x					
Attleboro	Herbonville Pond	16									x					
Attleboro	Luther Reservoir	12							x		x					
Attleboro	Manchestter Reservoir	218									x					
Attleboro	Mechanics Pond	9									x					
Attleboro	Orrs Pond	48			x						x					
Attleboro/N. Attleboro	Como, Lake	5					x		x		x					
Auburn	Auburn Pond	16					x				x			x		
Auburn	Dark Brook Res. (North Basin)	57			x				x		x					
Auburn	Dark Brook Res. (SouthBasin)	256			x	x			x		x					x
Auburn	Eddy Pond	134												x		
Auburn	Pondville Pond	41					x							x		
Auburn	Stoneville Reservoir (upper)	61					x		x		x					
Auburn	Tinker Hill Pond	16				x			x		x					
Auburn/Worcester	Leesville Pond	96														
Avon	Brockton Reservoir	89					x		x		x					
Avon/Brockton	Waldo Lake	70					x		x		x					
Ayer	Flannagan Pond	87		x			x				x			x		
Ayer	Grove Pond	67		x			x				x			x		
Ayer	Plow Shop Pond	29					x				x					
Ayer	Sandy Pond	74									x					

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Barnstable	Bearse Pond	65					x		x							
Barnstable	Long Pond	50						x								
Barnstable	Wequaquet Lake	654					x									
Barre	Gatson Pond	16							x							
Barre	Powder Mill Pond	18							x							
Becket	Center Pond	125		x	x						x					
Becket	Greenwater Pond	88	x		x						x			x		
Becket	Long Bow Lake	35	x								x					
Becket	Robin Hood Lake	45	x		x											
Becket	Silver Shield Pond	330	x													
Becket	Ward Pond	25									x					
Becket	Yokum Pond	109			x											
Becket/Otis	Shaw Pond	100			x						x					
Bedford	Fawn Lake	9									x					
Belchertown	Arcadia Lake	40					x							x		
Belchertown	Holland, Lake	12					x							x		
Belchertown	Metacomet Lake	74					x							x		
Bellingham	Silver Lake	70	x								x			x		
Bellingham	Jenks Reservoir	27	x						x		x			x		
Bellingham/Blackstone	Hiawatha, Lake	63												x		
Bellingham/Milford	Beaver Pond	114							x							
Bellingham/Milford	Box Pond	46	x								x					
Berlin	Gates Pond	84									x					
Beverly/Wenham	Wenham Lake	225									x					
Billerica	Nutting Lake	28									x				x	
Billerica	Richardson Pond (north)	5	x								x					
Billerica	Winning Pond	23			x											
Blackstone	Forge Pond	15									x			x		
Blackstone	Harris Pond	93					x		x		x					
Blanforth	Blair Pond	35					x									
Boston	Chestnut Hill Reservoir	101									x					
Boston	Jamacia Pond	63									x					
Boston/Dedham	Sprague Pond	13									x					
Boxford	Baldpate Pond	55		x			x									
Boxford	Four Mile Pond (lower)	25									x					
Boxford	Howes Pond	7									x					
Boxford	Lowe Pond	32					x				x					
Boxford	Sperrys Pond	6									x					
Boxford	Spofford's Pond	27									x					
Boxford	Stevens Pond	12									x					
Boxford	Stiles Pond	60									x					
Boxford/North Andover	Town Pond	23									x					
Boylston	Rocky Pond	60												x		
Boylston/Clinton/Sterling	Wachusetts Reservior	4135			x		x				x			x		
Braintree	Sunset Lake	57			x											
Brewster	Cliff Pond	193	x													
Brewster	Little Cliff Pond	33	x													

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Bridgewater	Carver Pond	35												x		
Bridgewater/Raynam	Nippenicket, Lake	354					x				x					
Brimfield	Sherman Pond	86												x		
Brimfield/Monson	Dean Pond	12												x		
Brimfield/Sturbridge	East Brimfield Reservoir	420									x			x		
Brockton	Ellis-Bret Pond										x					
Brockton	Porters Pond (lower)	6					x		x							
Brockton	Thirty Acre Pond	30	x				x		x							
Brockton	Upper Porters Pond	6					x		x		x					
Brookfield/Sturbridge/East B.	Quacumqausit Pond	218			x		x		x							
Burlington	Butterfield Pond	7									x					
Burlington	Mill Pond Reservoir	7									x					
Canton	Bolivar Pond	22					x		x							
Canton	Forge Pond	25	x													
Canton	Reservoir Pond	243					x				x			x		
Canton/Randolph	Ponkapoag Pond	203			x						x			x		
Canton/Stoughton	Glen Echo Pond	16												x		
Carlisle/Chelmsford	Fisk Street Pond	28									x					
Carver	Federal Pond	129					x							x		
Carver	Muddy Pond	64					x		x							
Carver	North Center Street Pond	12							x							
Carver	Sampson Pond	310					x									
Carver/Middleborough	Fuller Street Pond	21												x		
Carver/Plymouth	East Head Reservoir	105							x							
Carver/Plymouth	Fresh Meadow Pond	59					x		x							
Charlton	Glen Echo Pond	112							x							
Charlton	Granite Reservoir	198												x		
Charlton	Little Nugget Pond	14							x							
Charlton	Pikes Pond	32									x					
Charlton	Railroad Pond	6												x		
Charlton/Oxford	Buffem Pond	22	x											x		
Charlton/Oxford	Buffemville Reservoir	186							x					x		
Chelmsford	Elm Street Pond	42									x					
Chelmsford	Newfield Pond	77		x	x		x				x					
Chelmsford	Russell Mill Pond	20									x				x	
Chelmsford/Westford	Hart Pond	91					x				x					
Cheshire/Lanesboro	Cheshire Res. (middle basin)	132		x	x						x					
Cheshire/Lanesboro	Cheshire Res. (north basin	218		x	x						x					
Cheshire/Lanesboro	Cheshire Res. (south basin)	67		x	x						x					
Chester/Huntington	Littleville Reservoir	275									x					
Chicopee	Chicopee Reservoir	29	x													
Clarksburg	Mauserts Pond	49					x		x							
Clinton	Coachlace Pond	33	x								x					
Clinton	Lancaster Pond	18							x		x					
Clinton	South Meadow Pond (east basin)	68							x		x					
Clinton	South Meadow Pond (west basin)								x		x					
Concord	Batesman Pond	20									x					

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Concord/Framingham	Great Meadows Pond #3	53									x				x	
Danvers	Crane River Pond	18	x													
Danvers	Porters Pond	20	x													
Danvers	Putnamville Reservoir	270									x					
Danvers	Waters River Pond	57	x													
Dartmouth	Noquochoke Lake (North Basin)	110												x		
Dartmouth	Noquochoke Lake (South Basin)	19												x		
Dartmouth	West Noquochoke Pond	20												x		
Dighton	Muddy Cove Pond	23									x					
Dighton/Somerset	Broad Cove Pond	79	x													
Douglas	Dudley Pond	7	x						x							
Douglas	Hunt Pond	2							x							
Douglas/R.I.	Wallum Lake	332	x													
Douglas/Sutton	Manchaug Pond	348		x					x					x		
Dover	Lyman Pond	3									x					x
Dover	Powisset Pond	6												x		
Dracut/Tyngsboro	Long Pond	163		x												
Dudley	Easterbrook Pond	5									x					
Dudley	Hayden Pond	41												x		
Dudley	Larner Pond	25							x					x		
Dudley	Low Pond	3												x		
Dudley	Merino Pond	72							x							
Dudley	New Pond	30							x							
Dudley	Packard Pond	6							x							
Dudley	Shepherd Pond	18	x													
Dudley	Sylvestri Pond	18									x			x		
Dudley	Wallis Pond	23							x							
Dudley/Charlton	Gore Pond	169												x		
Dudley/Charlton	Pierpoint Meadow Pond	90												x		
Duxbury	Island Creek Pond	43					x									
Duxbury	Lorings Bog Pond	28												x		
Duxbury	Mill Pond	13									x					
Duxbury	North Hill Marsh	38							x							
Duxbury	South River Pond	4							x							
Duxbury/Pembroke	Chandler Pond (lower)	30					x				x					
Duxbury/Pembroke	Chandler Pond (upper)	10												x		
East Bridgewater	Robbins Pond	124							x							
East Brookfield/Brookfield	Quaboag Pond	531	x		x		x				x			x		
Easton	Longwater Pond	12									x			x		
Easton	New Pond	16					x		x		x					
Easton	Reservoir	30									x					
Easton	Shovel Pond	10									x			x		
Easton	Ward Pond	9									x					
Easton/Stoughton	Ames Long Pond	75					x				x		x	x		
Egremont	Long Pond	163			x											
Egremont	Mill Pond	20									x					
Erving	Northfield Mountain Reservior	360									x					

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Fairhaven	Long Road Pond									x						
Fitchburg/Westminster	Sawmill Pond	61									x			x		
Fitchburg/Westminster	Snows Mill Pond	35							x							
Foxboro	Beaumont Pond	9									x					
Foxboro	Carpenter Pond	28							x		x					
Foxboro	Cocasset Lake	35									x			x		
Foxboro	Furnace Lake	15							x							
Foxboro	Gavins Pond	17									x			x		
Foxboro	McAvoy Pond	11														
Foxboro	Neponset Reservoir	268					x		x		x					
Foxboro	Vandys Pond													x		
Framingham	Farm Pond	149		x	x		x									
Framingham	Framingham Reservoir # 1	162			x						x			x		
Framingham	Framingham Reservoir # 3	237			x						x					
Framingham	Gleason Pond	12									x					
Framingham	Learned Pond	34									x			x		
Framingham	Saxonville Pond	59					x				x					
Framingham/Ashland	Framingham Reservoir # 2	125									x					
Framingham/Ashland	Washakum Pond	81									x			x		
Franklin	Beaver Pond	21					x				x			x		
Franklin	Mine Brook Pond	72									x					
Franklin	Pleasant Street Pond	45	x								x					
Franklin	Spruce Pond	3									x			x		
Franklin	Uncas Pond	18												x		
Freetown	Forge Pond	51							x							
Freetown	Freetown Pond	16												x		
Gardener	Bents Pond	9									x					
Gardener	Kendall Pond	23							x							
Gardener	Parker Pond	26					x									
Georgetown	Pentucket Pond	85					x									
Gill	Bartons Cove			x	x		x									
Gloucester	Babson Reservoir	27									x					
Gloucester	Banjo Pond (upper)	11									x					
Gloucester	Fernwood Lake	26									x					
Gloucester	Haskell Pond	48									x					
Gloucester	Lily Pond	31									x					
Gloucester	Mill Pond	21	x													
Gloucester	Niles Pond	35	x								x					
Gloucester	Strangman Pond	3									x					
Gloucester	Wallace Reservoir	23									x					
Grafton	Fisherville Pond	57									x					
Grafton	Hayes Pond	6					x				x					
Grafton	Hovey Pond	19	x		x		x				x					
Grafton	Ripple, Lake	63					x		x		x					
Grafton	Silver Lake	23							x							
Grafton/Shrewsbury	Windle Pond	5									x					
Granby	Forge Pond	72									x					

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Great Barrington	Mansfield Pond	25		x	x						x					
Groton	Baddacook Pond	76					x				x			x		
Groton	Knops Pond	204					x							x		
Groton/Pepperell	Pepperell Pond	297		x			x								x	
Halifax	Monponsett Pond (east basin)	245			x		x							x		
Halifax/Hanson	Monponsett Pond (west basin)	258					x		x							
Hamilton	Beck Pond	40									x					
Hamilton	Gravelly Pond	46									x					
Hamilton	Round Pond	37									x					
Hamilton/Essex	Chebacco Lake	209		x			x				x					
Hancock	Whitman Pond	10													x	
Hanover	Sandy Bottom Pond	135	x													
Hanover	Forge Pond	20	x	x			x				x					
Hanover/Hanson	Factory Pond	45									x					
Hanson/Pembroke	Indian Head Pond	121					x							x		
Hardwick	Hardwick Pond	68					x							x		
Harvard	Bare Hill Pond	316							x		x				x	
Harvard	Robbins Pond	15		x					x		x					
Hinsdale	Plunkett Reservior	73			x	x										
Hinsdale/Peru	Ashmere Lake	217		x	x						x					
Holden	Chaffin Pond	104					x		x		x					
Holden	Dawson Pond	21					x				x			x		
Holden	Eagle Lake	84			x									x		
Holden	Holden Res # 1	119							x							
Holden	Kendall Reservior	164							x							
Holden	Maple Spring Pond	34							x		x					
Holden	Stump Pond	27														
Holden	Unionville Pond	23	x		x				x							
Holden/Princeton	Quinapoxit Reservoir	261									x					
Holland	Hamilton Reservoir	249	x											x		
Holland	Holland Pond	65							x							
Holliston	Factory Pond	10							x					x		
Holliston	Houghton Pond	17									x			x		
Holliston	Winthrop, Lake	150														
Holyoke	Ashley Cutoff	31									x					
Holyoke	Bray, Lake	12		x							x					
Holyoke	Log Pond Cove	19														
Holyoke	McNulty Park Pond														x	
Holyoke	Whiting Street Reservoir	4			x						x					
Holyoke	Wright Pond	25									x					
Hopedale	Hopedale Pond	95					x		x		x			x		
Hopedale	Spindleville Pond	12									x					
Hopkinton	Whitehall Reservoir	575					x				x		x	x		
Hopkinton/Milford	North Pond	239					x					x		x		
Hubbardston	Bringham Pond	45							x							
Hubbardston	Moosehorn Pond	62												x		
Ipswich	Bull Brook Reservoir	10									x					

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Ipswich	Hood Pond	67									x					
Kingston	Crossman's Pond	15							x							
Kingston	Pembroke Street South Pond	16					x									
Kingston	Reeds Millpond	10					x									
Kingston	Russell Pond	14									x					
Kingston	Smelt Pond	44												x		
Lakeville/Freetown	Long Pond	1721					x				x			x		
Lakeville/Middleboro	Assawompset Pond	2404					x				x					
Lakeville/Middleboro	Pocksha Pond	230					x				x					
Lakeville/Rochester/Freetown	Quittacas Pond (big &little)	297	x				x									
Lakeville/Rochester/Middlebor	Quittacas Pond (great)	1185					x									
Lancaster	White Pond	43												x		
Lanesborough	Berkshire Pond	22														
Lanesborough/Pittsfield	Pontoosac Lake	467		x	x	x					x				x	
Lee/Lenox	Laurel Lake	165	x	x	x	x					x					x
Lee/Tyringham	Goose Pond (lower)	225			x						x					
Lee/Tyringham	Goose Pond (upper)	45			x											
Leicester	Bouchard Pond	4												x		
Leicester	Cedar Meadow Pond	146					x		x							
Leicester	City Pond	5							x							
Leicester	Greenville Pond	30												x		
Leicester	Greenville Pond West	7							x							
Leicester	Rochdale Pond	41							x							
Leicester	Sargent Pond	69							x							
Leicester	Waites Pond	54							x		x					
Leicester/ Paxton	Smiths Pond	20									x					
Leicester/ Paxton	Southwick Pond	36	x													
Leicester/Spencer	Burncoat Pond	122							x							
Lenox/Lee	Woods Pond	122									x				x	
Leominster	Rockwell Pond	10							x		x					
Leominster	Samoset, Lake	44												x		
Leverett	Leverett Pond	65			x	x										x
Lincoln	Farrar Pond	126			x						x			x		
Lincoln	Sandy Pond	162									x					
Lincoln	Todd Pond	5							x		x					
Lincoln	Twin Pond	6									x					
Littleton	Fort Pond	100	x								x					
Littleton	Long Pond	88	x	x							x			x		
Littleton/Acton	Nagog Pond	824									x					
Littleton/Ayer	Spectacle Pond	70					x							x		
Ludlow	Haviland Pond	25	x													
Ludlow	Minechaug Pond	21									x					
Ludlow/Wilbraham	Red Bridge Pond	83									x					
Lunenburg	Shirley Reservoir	376			x	x	x							x		
Lunenburg/Leominister	Whalom Pond	99		x	x						x			x		
Lynn	Breeds Pond	177									x					
Lynn	Flax Pond	71		x							x					

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Lynn	Floating Bridge Pond	8	x								x					
Lynn	Hawkes Pond	73									x					
Lynn	Sluice Pond	50			x											
Lynnfield	Pilling Pond	96									x					
Lynnfield/Peabody	Suntaug Pond	153									x					
Manomet	Beaver Dam Pond	29					x									
Mansfield	Plain Street Pond	15					x		x		x					
Mansfield	Sweets Pond	18									x			x		
Marlborough	Hager Pond	28									x					
Marlborough	Millham Reservoir	69									x					
Marlborough/Hudson	Fort Meadow Reservoir	284	x		x						x					
Marshfield/Duxbury	Black Mountain Pond	16												x		
Mashpee	Jim Pond	11							x							
Medfield	Jewells Pond	3												x		
Melrose	Swains Pond	5					x									
Mendon	Nipmuck Pond	85									x					
Middleborough	Savery Pond	27					x									
Middleborough	Woods Pond	52					x		x							
Middleton	Boston Brook Pond (lower)	15									x					
Middleton	Boston Brook Pond (upper)	7									x					
Middleton	Creighton Pond	22									x					
Middleton	Middleton Pond	135									x					
Milford	Cedar Swamp Pond	95							x							
Milford	Louisa Lake	19									x			x		
Millbury	Brierly Pond	18												x		
Millbury	Dorothy Pond	148		x	x									X		
Millbury	Howe Pond	6							x							
Millbury	Woolshop Pond	8		x					x		x					
Millbury	Howe Reservoir (West Basin)	3							x							
Millbury	Howe Reservoir (East Basin)	13							x							
Millbury	Mayo Pond	8	x													
Millbury	Riverlin Street Pond	7		x										x		
Millbury/Sutton	Hathaway Pond	10	x													
Milton	Popes Pond	13									x					
Milton	Russell Pond	6		x							x					
Milton	Turners Pond	11									x					
Monson	Chicopee Brook Pond	13									x					
Monson	Paradise Lake	20												x		
Monterey	Buel, Lake	194			x	x					x					x
Monterey	Garfield, Lake	262		x	x						x					
Monterey	Stevens Pond	30		x	x											
Montgomery	Westfield Reservoir	34							x							
Nantucket	Long Pond	77	x													
Natick	Cochituate, Lake (fisk pond)	13		x	x						x			x		
Natick	Cochituate, Lake (south basin)	233		x	x						x			x		
Natick	Dug Pond	49		x												
Natick	Fisk Pond	68									x			x		

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Natick	Jennings Pond	10									x					
Natick/Framingham/Wayland	Cochituate, Lake (north basin)	195												x		
Natick/Wayland	Cochituate, Lake (middle basin)	131			x									x		
Natick/Weston	Nonesuch pond	35		x							x					
Needham	Kendrick Street Pond	49									x					
New Bedford	Sassaquin Pond	34	x								x					
New Marlborough	Cookson Pond	17	x													
New Marlborough	Thousand Acre Swamp	155			x				x							
New Marlborough	York Lake	36	x													
New Salem/Orange/Athol	Rohunta, Lake (south basin)	41	x				x							x		
Newbury	Quills Pond	4							x		x					
Newburyport	State Street Pond	5					x				x					
Newton	Crystal Lake	24									x					
Newton	Hammond Pond	21									x					
Norfolk	Populatic Pond	40									x					
North Andover	Brook Street Pond										x					
North Andover	Farnam Street Pond	8									x					
North Andover	Salem Pond	17									x					
North Andover	Stearns Pond	41							x		x					
North Andover	Sudden Pond	6	x						x							
North Andover	Town Street Pond	24									x					
North Attleboro	Falls Pond North	62							x		x					
North Attleboro	Falls Pond South	60									x			x		
North Attleboro/Plainville	Whiting Pond	21	x								x					
North Brookfield/East Brookfie	Lashway, Lake	270					x									
North Brookfield/New Braintre	Brooks Pond	190												x		
North Reading	Bradford Pond	17									x					
North Reading	Eisenhauers Pond	10									x					
North Reading	Martins Pond	92				x	x				x					
North Reading	Swan Lake	46									x					
Northampton	Roberts Meadow Reservoirs	23	x													
Northborough	Bartlett Pond	45		x	x		x				x					
Northborough	Chauncey Pond (little)	45												x		
Northborough	Smith Pond	18									x					
Northbridge	Arcade Pond	18					x		x							
Northbridge	Fish Pond	8					x							x		
Northbridge	Linwood Pond	61					x		x		x					
Northbridge/Sutton	Meadow Pond	45					x				x					
Northbridge/Sutton	Whitins Pond	167					x		x		x					
Norton	Barrowsville Pond	38									x					
Norton	Meadow Brook Pond	13									x					
Norton	Winneconnet Pond	148					x				x			x		
Norton/Attleboro	Chartley Pond	38									x					
Norton/Mansfield	Norton Reservoir	529					x				x			x		
Norwell	Jacobs Pond	59			x		x				x					
Norwell	Torrey Pond	20					x									
Norwood	Ellis Pond	19					x				x				x	

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Oakham	Dean Reservoir	64												x		
Oakham/Spencer	Browning Pond	106							x					x		
Orange	Mattawa Lake	112												x		
Otis	Benton Pond	63	x		x											
Otis	Big Pond	331									x					
Otis	Hayden Pond	36			x				x							
Otis	Hayes Pond	53	x													
Otis	Watson Pond		x													
Otis/Blanford	Otis Reservoir	1200	x		x						x					
Oxford	Hudson Pond	17	x								x					
Oxford	McKinstry Pond	16							x							
Oxford	Stump Pond	18												x		
Oxford	Stumpy Pond	8							x							
Oxford	Texas Pond	27									x					
Palmer	Forest Lake	44			x						x					
Palmer	Palmer Reservior	8									x					
Palmer	Thompson Lake	115									x			x		
Paxton/Holden	Asnebumskit Pond	34	x								x					
Peabody	Browns Pond	26									x					
Peabody	Cedar Pond	11	x													
Peabody	Crystal Pond	11	x								x					
Peabody	Devils Dishfull Pond	26							x		x					
Peabody	Elginwood Pond	11									x					
Peabody	Pierces Pond	5	x								x					
Peabody	Spring Pond	10									x					
Peabody	Winona Pond)	92							x		x					
Pembroke	Chaffin Reservoir	16							x							
Pembroke	Furnace Pond	107									x					
Pembroke	Oldham Pond	235									x					
Pepperell	Heald Pond	26									x					
Petersham	Connor Pond	21									x					
Petersham	Pottapaug Pond	549							x							
Petersham	Town Barn Beaver Pond	11	x													
Petersham etc.	Quabbin Reservoir	25000	x						x							
Pittsfield	Onota Lake	617		x	x	x					x				x	x
Plainville	Chestnut Street Pond	10									x					
Plainville	Fuller Pond	4	x						x		x					
Plainville	Turnpike Lake	114					x				x			x		
Plainville	Wetherells Pond	13	x								x					
Plainville/Foxboro	Mirimichi, Lake	170					x		x		x					
Plymouth	Briggs Reservior	28					x		x							
Plymouth	Cooks Pond	23					x									
Plymouth	Deer Pond	11							x							
Plymouth	Foundary Pond	7	x													
Plymouth	Halfway Pond	232							x							
Plymouth	Island Pond	12	x				x							x		
Plymouth	Little Sandy Pond	29							x							

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Plymouth	Long Island Pond	30					x							x		
Plymouth	MicaJah Pond	20							x							
Plymouth	North Triagle Pond	20							x							
Plymouth	Rocky Pond (little)	11							x							
Plymouth	Russell Mill Pond	42									x					
Plymouth	Ship Pond	10	x								x					
Plymouth	Triangle Pond (south)	15							x							
Plymouth/Wareham	White Island Pond (east basin)	159					x									
Princeton/Leominister	Paradise Pond	63												x		
Quincy	Blue Hills Reservoir	14	x						x							
Raynham	Gushee Pond	26					x							x		
Raynham	Johnsons Pond	13					x				x					
Revere	Seaplane Basin	53	x													
Richmond/Pittsfield	Richmond Pond	218		x	x						x					
Rochester	Leonards Pond	54							x							
Rockland	Studley's Pond	29									x					
Rockport	Cape Pond	41	x								x					
Rockport	Rum Rock Lake	9									x					
Rowley	Mill Pond (lower)	14													x	
Rutland	Demond Pond	119							x							
Rutland	Long Pond	168									x			x		
Rutland	Moulton Pond	77	x						x							
Saugus	Griswold Pond	13					x				x			x		
Saugus	Pearce Lake	19	x								x					
Saugus	Silver Lake	13									x					
Saugus	Spring Pond	9			x		x				x			x		
Saugus/Lynn	Birch Pond	80									x					
Saugus/Lynn	Walden Pond	223									x					
Savoy	Bog Pond	40							x							
Scituate	Musquashcut Pond	71	x								x					
Scituate	Old Oaken Bucket Pond	12							x		x					
Scituate	Tack Factory Pond	7									x			x		
Seekonk/Pawtucket R.I.	Pawtucket Reservoir	30									x					
Sharon	Billings East Pond	3												x		
Sharon	Briggs Pond	17							x							
Sharon	Manns Pond	11					x									
Sharon	Massapoag Lake	397					x							x		
Sharon	Upper Leach Pond	25									x					
Sheffield	Fawn Lake	6			x											
Sheffield	Mill Pond	107	x		x										x	
Sherborn	Little Farm Pond	22									x					
Shrewsbury	Brooklawn Parkway Pond	2									x					
Shrewsbury	City Farm Pond	2									x					
Shrewsbury	Shirley Street Pond	17									x					
Shrewsbury/Boylston	Newton Pond	48					x							x		
Shrewsbury/Grafton/Worceste	Flint Pond (north basin)	84			x		x				x					
Shrewsbury/Grafton/Worceste	Flint Pond (south basin)	170			x		x				x			x		

APPENDIX B

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Shrewsbury/Worcester	Quinsigamond Lake	475		x	x		x				x			x		
Somerset	Somerset Reservoir	153	x								x					
South Attleboro/Pawtucket, R.	Ten Mile Reservation		x								x					
South Hadley	Lower Pond	6			x						x				x	
South Hadley	Upper Dam Pond	11													x	
Southampton	Tighe Carmody Reservoir	340	x													
Southborough/Marlboro	Sudbury Reservoir	1292									x					
Southbridge	Hatchet Reservoir # 4	64							x							
Southwick	Congamond Lake 1	267		x	x											
Southwick	Congamond Lake 2	48		x	x											
Southwick	Congamond Lake 3	135		x	x											
Spencer	Thompsons Pond	117			x									x		
Spencer/Charlton	Cranberry Meadow Pond	63							x							
Spencer/Leicester	Stiles Reservoir	346							x							
Springfield	Bass Pond	12	x						x		x					
Springfield	Dimmock Pond	10							x							
Springfield	Five Mile Pond	36	x								x			x		
Springfield	Long Pond	18							x		x			x		
Springfield	Lookout, Lake	7									x					
Springfield	Loon Pond	29									x					
Springfield	Mill Pond	15									x					
Springfield	Mona, Lake	11									x					
Springfield	Noonan Cove	4									x					
Springfield	Porter Lake	28									x					
Springfield	Watershops Pond	157									x					
Sterling	East Waushacum Pond	188									x					
Sterling	Stuarts Pond	45												x		
Sterling	West Waushacum Pond	112							x							
Stockbridge	Stockbridge Bowl	374			x						x					
Stockbridge/Sheffield	Averic, Lake	38			x						x					
Stoughton	Farrington Pond	5									x			x		
Stoughton	Pinewood Pond	21									x			x		
Stoughton	Town Pond	6					x		x							
Stoughton	Woods Pond	21							x		x					
Stow/Hudson	Boons Pond	175					x							x		
Sturbridge	Alum Pond (big)	195							x							
Sturbridge	Cedar Pond	146		x										x		
Sturbridge	Pistol Pond	6	x													
Sturbridge	Walker Pond	103												x		
Sudbury	Stearns Mill Pond	19									x					
Sudbury	Willis Lake	68									x					
Sudbury/Marlborough	Grist Mill Pond	16									x					
Sunderland	Cranberry Pond	24			x											
Sutton	Aldrich Pond	2					x							x		
Sutton	Arnold Pond	15									x					
Sutton	Clark Reservoir (pond)	32							x							
Sutton	Girard Pond	2					x		x							

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Sutton	Marble Pond	11									x			x		
Sutton	Number 1 Pond	10							x							
Sutton	Putnam Pond	30									x					
Sutton	Reservoir No. 4	10							x							
Sutton	Schoolhouse Pond	6		x					x							
Sutton	Silbey Reservoir	37	x								x					
Sutton	Stevens Pond	84					x									
Sutton	Thompson Pond	8									x					
Sutton	Tuckers Pond (West Basin)	28												x		
Sutton	Welsh Pond (sutton)	8									x			x		
Sutton	Woodbury Pond	7					x		x					x		
Sutton/Milbury	Slaughterhouse Pond	50									x					
Sutton/Millbury	Singletary, Lake	330			x						x			x		
Sutton/Northbridge	Swan Pond	31												x		
Taunton	Big Bear Hole Pond	37			x		x		x							
Taunton	Kings Pond	28	x								x					
Taunton	Richmond Pond	6					x									
Taunton	Rico, Lake	166			x		x		x		x					
Taunton	Sabbattia Lake	237					x		x		x			x		
Taunton	Segreganset River Pond	15	x													
Taunton	Three Mile River Impoundment	15					x									
Taunton	Watson Pond	94					x				x			x		
Taunton	Whittenton Impoundment	20					x				x			x		
Taunton/Raynam	Prospect Hill Pond	42									x					
Taunton/Sharon	Middle Pond	19			x		x				x					
Templeton	Bourn-Haley Pond	27							x							
Templeton	Partridgeville Pond	39												x		
Tewksbury	Ames Pond	82							x		x					
Tewksbury	Long Pond	39									x					
Tewksbury	Round Pond	25									x					
Tolland	Noyes Pond	166												x		
Tyngsborough/Dracut	Mascopic Lake	209					x									
Upton	Mill Pond	9					x							x		
Upton	Pratt Pond	38					x							x		
Upton	Taft Pond	12												x		
Upton	Williams Street Pond	5									x					
Upton / Grafton	Wildwood, Lake	38					x				x			x		
Upton/Milford	Fisk Mill Pond	16									x			x		
Uxbridge	Capron Pond	15					x		x							
Uxbridge	Ironstone Reservoir	26					x		x							
Uxbridge	Lee Reservoir	9												x		
Uxbridge	Pout Pond	9							x							
Uxbridge	Rice City Pond	91	x		x						x				x	
Uxbridge	Rivulet Pond	9							x					x		
Uxbridge	West River Pond	37					x		x							
Uxbridge	Whitin Pond	23					x		x							
Uxbridge/Sutton	Lackey Pond	117	x								x					

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Wakefield	Crystal Pond	80									x					
Wakefield	Quannipowitt, Lake	254		x							x					
Wales	George Pond	93												x		
Walpole	Bird Pond	25									x					
Walpole	Clark Pond	6												x	x	
Walpole	Cobbs Pond	24					x		x		x					
Walpole	Memorial Pond	7									x					
Walpole	Turner Pond	17					x									
Walpole/Norwood/Westwood	Willetts Pond	200							x		x					
Waltham	Hardys Pond	41		x							x				x	
Waltham/Lincoln	Cambridge Reservoir	549									x					
Waltham/Newton	Charles River Lakes District	190			x		x				x				x	
Ware	Beaver Lake	149			x						x			x		
Wareham	Dicks Pond	40	x						x							
Wareham	Glen Charlie Pond	185	x						x							
Wareham	Mill Pond	150												x		
Wareham	Parker Mill Pond	105												x		
Wareham	Tremont Mill Pond	50												x		
Wayland	Dudley Pond	84		x	x											
Wayland	Heard Pond	71			x						x				x	
Webster	Webster Lake	1181			x		x							x		
Wellesley	Waban, Lake	108			x	x					x					
Wellesley/Natick	Morses Pond	116			x		x				x			x		
Wenham	Coy's Pond (middle pond)	25									x					
Wenham/Hamilton	Pleasant Pond	43				x			x		x					x
West Bridgewater	Mill Pond	8			x											
West Bridgewater	West Meadow Pond	125									x			x		
West Brookfield	Wickaboag Pond	320												x		
West Stockbridge	Shaker Mill Pond	20		x	x										x	
Westborough	Assabet River Reservoir	333			x						x					
Westborough	Chauncey Lake	177			x											
Westborough	Hocomonco Pond	27									x					
Westfield	Buck Pond	25												x		
Westfield	Horse Pond	30			x											
Westfield/Southampton	Pequot Pond	154			x									x		
Westford	Nabnasset Pond	115		x										x		
Westford	Sought for Pond	106			x											
Westford/Littleton/Groton	Forge Pond	198			x		x									
Westhampton	Pine Island Lake	54							x							
Westminister	Crocker Pond	96							x							
Westminster	Round Meadow Pond	54							x		x					
Westminster	Wyman Pond Reservoir	200					x							x		
Weston	Norumbega Reservoir (South)	14									x					
Weston	Weston Reservoir	60									x					
Weston	Weston Station Pond	63									x					
Weston	Norumbega Reservoir (North)	36									x					
Westwood	Buckmaster Pond	27							x							

COMMUNITY	WATERBODY NAME	ACRES	Common Reed	Curly Pondweed	Eurasian Milfoil	European Niad	Fanwort	Hydrilla	Milfoil sp	Parrot Feather	Purple Loosestrife	S. Am. Waterweed	Swollen Bladderwort	Variable Milfoil	Water Chestnut	Yellow Floating Heart
Westwood	Storrow Pond	4												x		
Westwood/Dover	Noannet Pond	58									x			x		
Weymouth	Accord Pond										x					
Weymouth	Whitmans Pond	210					x									
Whately	Northampton Reservoir	65							x							
Whitman/Whitman	Hobart Pond	15									x			x		
Wilbraham	Spectacle Pond	16							x		x					
Wilmington	Lubber Pond East	7									x					
Wilmington	Lubber Pond West	9									x					
Wilmington	Silver Lake	28									x					
Winchendon	Monomock, Lake	592												x		
Winchester	Winter Pond (big and little)	17									x					
Winchester/Arlington/Medford	Upper Mystic Lake	167		x												
Windsor	Windsor Pond	44			x											
Woburn	Horn Pond	104		x												
Worcester	Bell Pond	7									x					
Worcester	Coes Reservoir	90			x						x					
Worcester	Cook Pond	20					x		x							
Worcester	Curtis Pond (N. Basin)	36					x									
Worcester	Curtis Pond (S. basin)	18									x					
Worcester	Indian Lake	193			x						x					
Worcester	Middle River Pond	16									x					
Worcester	Patch Reservoir	31									x					
Worcester	Salisbury Pond	18									x					
Wrentham	Archer, Lake	79	x								x	x				
Wrentham	Crocker Pond	16		x							x					
Wrentham	Joes Rock Pond	12									x					
Wrentham	Pearl, Lake	218			x						x			x		
Wrentham	Route One Pond (west)	9							x							
Wrentham/Cumberland RI	Miscoe Lake	43					x		x							
Wrentham/Norfolk	Mirror Lake	55		x												
Yarmouth	Little Sandy Pond	14							x							

APPENDIX C- Information on DAR Plant Ban

As of January 1, 2006 the Massachusetts Department of Agriculture has banned the importation, sale and distribution of over 140 plants that are to be considered noxious or invasive in Massachusetts.

Background Information
Invasive species are considered the second greatest threat to native biodiversity. A recent study found that of 81 rare plants in New England, 37% of their populations are threatened by invasive species, and 42% of federally listed endangered plants are threatened by invasive species. Many of these invasive species are spread by the aquarium and garden trade when they accidentally escape cultivation. Following in the footsteps of New Hampshire, which launched their plant ban in 2004, Massachusetts developed the 2006 state plant ban in an effort to protect the Commonwealth's biodiversity and to promote native alternatives.

Banned Aquatic Species

- Ambulia (*Limnophila sessiliflora*)
- Anchored Water Hyacinth (*Eichhornia azurea*)
- Arrowhead (*Sagittaria sagittifolia*)
- Brazilian Waterweed (*Egeria densa*) (Anacharis)
- Chinese Water Spinach (*Ipomoea aquatica Forsk.)*
- Common Reed (*Phragmites australis*)
- Curly Pondweed (*Potamogeton crispus*)
- Eurasian milfoil (*Myriophyllum spicatum*)
- European Naiad (*Najas minor*)
- Exotic Burreed (*Sparganium erectum*)
- Fanwort (*Cabomba caroliniana*)
- Giant Salvinia (*Salvinia sp.* 4 species)
- Hydrilla (*Hydrilla verticillata*)
- Miramar Weed (*Hygrophila polysperma*)
- Oxygen Weed (*Lagarosiphon major*)
- Parrot Feather (*Myriophyllum aquaticum*)
- Purple Loosestrife (*Lythrum salicaria*)
- Variable Milfoil (*Myriophyllum heterophyllum*)
- Water Chestnut (*Trapa natans*)
- Water Yellow Cress (*Rorippa amphibia*)
- Yellow Floating Heart (*Nymphoides peltata*)
- Yellow Iris (*Iris pseudacorus*)

How were these plants chosen?
During the past three years, the Massachusetts Invasive Plant Advisory Group (MIPAG) developed specific criteria to determine if the proposed plants were Invasive, Likely Invasive or Potentially Invasive. The research and plant evaluations prepared by MIPAG members were important when deciding which species would be included in the state plant ban. MIPAG members represent a diverse and voluntary collaboration between leading state scientists, federal and state agencies, land trusts, nurseries and landscape associations, land managers, and scientific and academic institutions.

How will the ban be enforced?
As of January 1, 2006 it is illegal for pet stores to sell any of the banned plants, although several terrestrial species have been granted a "phase out" period to allow retailers to sell existing stock and avoid economic loss. The ban will not affect existing plantings. If a retailer is caught selling these species, the plants may be confiscated or repeat offenders may be fined $1000.00/day.

For more information...
Contact the Department of Agricultural Resources at 617-626-1700
or visit their website www.mass.gov/agr/farmproducts/Prohibited_Plant_Index2.html

APPENDIX D- Potential Future Aquatic Plant Threats

These following species occur on the MIPAG *Likely Invasive* or *Potentially Invasive* List, or have been recommended by experts in the field (Les Merhoff, University of Connecticut, and Barre Hellquist, Mass College of Liberal Arts) as species that are potential risks to Massachusetts and need to be evaluated further. Some of these species have not been documented in MA, but exist along the borders, while others have scattered occurrences in the state.

Heart-shape False Pickerelweed
Monochoria vaginalis
This species is native to tropical Australia and Asia, and has recently invaded California. Due to its invasive nature, it has been included on the Federal Noxious Weed List and on the Massachusetts Noxious Weed List. It is believed that this species was introduced to California in contaminated rice seeds, and has continued to spread. *M. vaginalis* prefers pools, stagnant backwaters, swamps, ditches, rice fields, canals and mudflats.
(Monochoria hasta is also included on the Massachusetts Noxious Weed List.)

Exotic Waterweed
Egeria najas
This species was recommended by Barre Hellquist as a species on potential concern and one that we should consider evaluating further to determine if it should be included on the DAR List of Banned Plants. It has proven to be highly invasiveness in other parts of the world that have climates similar to New England. It is easily confused with Hydrilla and South American Waterweed *(Egeria densa).*

Flowering Rush
Butomus umbellatus
This wetland species has invaded the waterways of bordering states including Connecticut, New York and Vermont. This emergent species has become established in Lake Champlain and the Connecticut River.

Forget-Me-Not
M. scorpioides
This species was recommended for additional evaluation by the Massachusetts Invasive Plant Advisory Group (MIPAG). Although, his species is a common garden favorite, when it invades an area near a stream is can form a dense monoculture which diminishes the biodiversity of the area, and the seeds are often spread to new locations in moving water.

Frog Bit
Hydrocharis morsus-ranae
This species was recommended by Barre Hellquist and MIPAG as a species of potential concern, and one that requires further evaluation. It has proven to be very invasive in other parts of the world where the climate is similar to New England.

Mosquito Fern, Water Velvet
Azolla pinnata
This non-native small, free floating aquatic fern that can spread very rapidly, forming dense mats that impede fishing, boating and other recreation, reduce oxygen levels in the water, and drive out native species. In nitrogen poor environments, the genus *Azolla* has a competitive advantage over other species because of its symbiotic relationship with blue-green algae (cyanobacteria), which has the ability to fix nitrogen. This species is easily by boats and humans. This species is currently listed on the Federal Noxious Weed List and the Massachusetts Noxious Weed List.

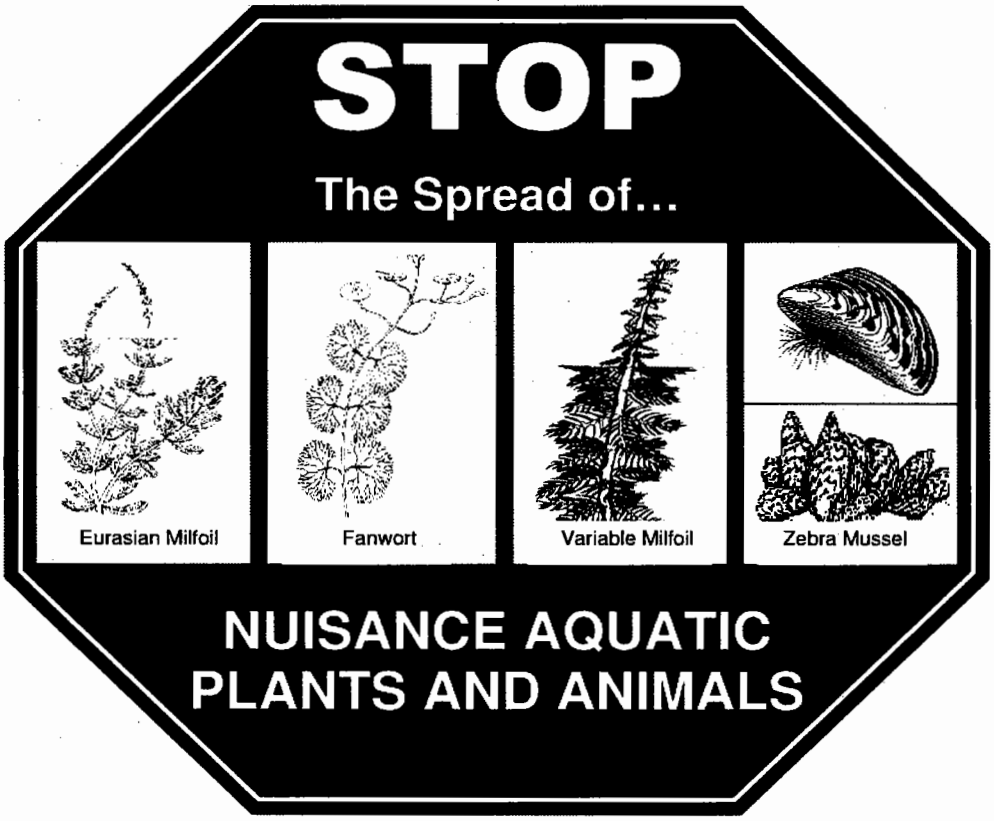
Mud Matt
Glossostigma diandrum
This tiny non-native plant has been documented in Connecticut and New Jersey and threatens to invade Massachusetts. It is considered to be potentially invasive and currently being evaluated. It is not invasive in its native habitat, New Zealand, but some US states (Washington, Oklahoma) have banned the sale of this popular ornamental plant.

Pond water-starwort
Callitriche stagnalis Scop.
This species is native to Europe and north Africa, and has been reported in a few locations in Massachusetts. This species spreads rapidly by seeds, and is currently banned in Connecticut

Swamp Stonecrop
Crassula helmsii
This species is native to Australia and New Zealand, and since its introduction to the United Kingdom, has become a considerable pest. This species spreads rapidly by fragmentation and asexual reproduction and is easily carried to new locations by boats and other human activity. This vigorous species forms dense mats that out-compete native species and impede recreational uses on the waterbodies that it invades. It prefers wetlands, lakes, ponds, ditches, slow moving waters and damp ground, and tolerates a range of conditions, including freezing temperatures. Due to its proven its invasiveness in other parts of the world with climates similar to that of New England, this species was recommended by Barre Hellquist as one to consider a potential threat.

Water shamrock
Marsilea quadrifolia L.
Water Shamrock is a member of the fern species and has been documented in a few locations in Massachusetts. This species is native to Europe and first arrived in America in 1862. This species can form monocultures that can crowd out native species. Water Shamrock thrives in shallow lakes and ponds, slow moving streams and damp shorelines. This plant is occasionally sold in the water garden trade, and although it has not caused a serious problem in Massachusetts yet, it has the potential to do.

APPENDIX E Boat Ramp Sign



HELP PROTECT OUR LAKES AND PONDS

- Remove ***ALL*** plants and animals from boat, trailer, anchors, fishing gear and dive gear.
- Flush engines and dispose of bait, bilge water and bait bucket water on land away from shore.
- Never release any plant or animal into a body of water, unless it came out of that body of water.
- Dispose of all foreign matter far from water!

For information or to report an infestation, please contact:

Massachusetts
Department of Conservation and Recreation
Lakes and Ponds Program
508-792-7423 x304 or 617-626-1411
or visit www.mass.gov/lakesandponds

Stephen R. Pritchard
Secretary

dcr
Massachusetts

Stephen H. Burrington
Commissioner