

January 25, 2016

Ms. Purvi P. Patel, EIT  
Massachusetts Environmental Policy Act (MEPA) Office  
Executive Office of Energy and Environmental Affairs  
100 Cambridge Street, Suite 900  
Boston, MA 02114

RE: Proposed Nagog Pond Water Treatment Plant, Acton, Massachusetts  
Expanded ENF and Supplemental Information  
Request for Waiver of Environment Impact Report  
EEA No: 15446

Dear Ms. Patel:

Since our supplemental Environmental Notification Form (ENF) submittal dated December 22, 2015, it has been determined that our proposed method of replacing a section of the existing Nagog Pond intake pipe exceeds a MEPA threshold for completing an Environmental Impact Report (EIR). As you may recall, the proposed method of replacing the existing 16-inch intake line to Nagog Pond includes temporarily dewatering a section of Nagog Pond (approximately 16.23 acres) for up to 4 months. According to a MEPA review threshold (301 CMR 11.03(3)(a)1), an EIR is required if 10 or more acres of any other wetland(s) are proposed to be altered. As such, please find presented herein an Expanded ENF (301 CMR 11.05(7)) and a request for a waiver from completing an EIR (301 CMR 11.11). The goal of this submittal is to provide more extensive and detailed information describing and analyzing the proposed project and its alternatives, and assessing its potential environmental impacts and mitigation measures.

### **Intake Pipe Replacement**

As described in prior ENF submittals associated with the above referenced project, the Town of Concord, Water and Sewer Division of Public Works is proposing to replace the existing 16-inch diameter cast iron intake pipe which has been in use since 1909. The proposed work includes two construction methods: 1) construction excavation done along the pond bottom once it has been dewatered, and 2) fusing and floating the pipe along the water surface, then submerging it into position along the pond bottom. Since the first method of construction exceeds a MEPA review threshold (the temporary alteration of other wetlands), the following supplemental information is presented herein.

The Town of Concord is proposing to temporarily dewater a small section of Nagog Pond (the cove) that is equivalent to 1.3% of the total pond volume and 5.8% of the total pond surface area. The cove is approximately 16.23 acres and when full represents a volume of 19.65 million gallons. Water from Nagog Pond discharges to Nagog Brook, which is a listed cold water fishery (SARIS ID 8246900). However, Nagog Brook has also been determined to be an intermittent stream by the Acton Conservation Commission as the result of a recent Notice of Intent filing and study associated with the Quail Ridge development project.

The Town of Concord currently operates a dam on Nagog Pond which was recently renovated in 2012. The dam includes a 10-ft primary spillway, 20-ft auxiliary spillway, and 24-inch (square) low level outlet operated by a slide gate. The low level outlet was designed and constructed to allow for controlled drainage of the pond and includes a stone approach channel to minimize erosion of the pond bottom and stone/rip rap lined discharge channel for energy dissipation. Cofferdams will be used to separate the cove area from the remainder of the pond and by-pass piping will be used to allow stream flows to Nagog Brook if needed during construction. Since Nagog Pond is a public drinking water supply source, the Town of Concord is proposing to pump the water from the cove area into the remainder of the pond to conserve the water for public consumption.

Temporarily lowering the water level of ponds to expose the pond bottom (sediment) is a common and effective means by which lakes and ponds are maintained, typically for aquatic plant management in New England and the Commonwealth of Massachusetts. There are numerous guidance documents and policies available which have been developed and distributed by various Massachusetts regulatory authorities regarding the management of lake drawdowns (partial list provided in Attachment A). One of the most comprehensive documents was prepared for the Department of Environmental Protection and Department of Conservation and Recreation (Executive Office of Environmental Affairs) – “Eutrophication and Aquatic Plant Management in Massachusetts, Final Generic Environmental Impact Report, 2004” (FGEIR). A review of the documents and information referenced previously indicates that there can be temporary or short term negative environmental impacts which can be mitigated with proper planning and implementation of best management practices. Several recommended performance guidelines include the following:

- Determining if the surface water is a source of public drinking water.
- Contacting the Department of Fish and Wildlife if the drawdown is to exceed 3 feet.
- Beginning the drawdown in early November.
- Achieving the target drawdown by early December.
- Achieving full lake level by early April.
- Maintaining an outflow equivalent discharge rate during drawdown of less than 4 cubic feet per second (cfs) per square mile.
- After drawdown, maintaining stream flows to try and match outflow with inflow, to the greatest extent possible.
- Maintaining an outflow equivalent discharge rate during refill above 0.5 cfs per square mile.

In addition to reviewing the various lake management documentation referenced previously, we contacted Richard Hartley at the Division of Fisheries and Wildlife to discuss the proposed project. Mr. Hartley requested that the Division be contacted during the drawdown period to make observations of any trapped fish and determine if they should be moved. Mr. Hartley also recommended that any outflows to Nagog Brook during the drawdown should be controlled so that target downstream flow rates are not exceeded, which could impact fish spawning.

Supplemental watershed protection plans are described in the Town’s Watershed Protection Plan for Nagog Pond. The Town of Concord is very active in coordinating efforts in both Acton and Littleton to protect the quality of water in Nagog Pond. A copy of the current version (2014) is provided in Attachment B.

Based on our review of the various lake management guidance documents noted previously, our understanding of the project site and features, and our conversation with the Division of Fisheries and Wildlife, we have developed the following recommended best management practices to be implemented during the drawdown and refill of the noted target pond area:

1. The Division of Fisheries and Wildlife will be contacted when the drawdown is going to commence to coordinate a site visit to make observations. Concord will modify the drawdown operations based on recommendations of the Division of Fisheries and Wildlife.
2. A dewatering pumping system will be installed to pump water from the cove to the main body of Nagog Pond. Turbidity curtains will be set up on the both the suction side and discharge side of the dewatering system. Screens on the suction side of the dewatering pumps will be selected based on recommendations provided by the Division of Fisheries and Wildlife.
3. If the low level outlet slide gate is used, a bar rack will be set up ahead of the dam outlet structure to capture any large debris and prevent it from being discharged to Nagog Brook if used. If used, the bar rack will be monitored daily and cleaned as needed to remove debris and maintain flow. In addition, turbidity curtains will be set up and deployed ahead of the dam outlet. These curtains will remain in place for the duration of construction, including drawdown and refill of Nagog Pond.
4. Water quality will be visually observed, monitored, and measured for the duration of the project, including drawdown, construction, and refill. Grab samples representative of the discharge from the Nagog Pond cove area will be collected daily and measured for turbidity. Water quality will also be observed visually and supplemental samples will be taken and analyzed for turbidity if construction activities appear to be negatively impacting water quality. Activities will be adjusted and modified if turbidities greater than 10 NTU are measured.
5. As part of the Order of Conditions received by the Town of Acton Conservation Commission, the project proponent will retain the services of a third party independent Environmental Monitor to observe field conditions during the dewatering process. The Monitor will schedule weekly meetings with the Acton Natural Resources Department to review environmental conditions. Construction activities will be adjusted and modified to address any negative environmental impacts observed.
6. Concerns about water quality and Concord's Filtration Avoidance Waiver under the Surface Water Treatment Rule have limited the use of Nagog Pond for water supply during the past couple of decades to meet peak summer demands, typically from May through August. Therefore, the target window for completing the intake replacement project is September through April. Although the reported "recommended target time period" for beginning a lake drawdown is early November, we are still proposing to begin the process in September. In September, the water levels within Nagog Pond are typically their lowest and this would be advantageous as it would minimize the volume of water required to be removed from the cover area.

In addition, beginning the draw down phase in September rather than November will also achieve a shorter construction duration since the cove will both drain and refill faster. In addition, construction activities will be easier to complete in the fall compared with the

winter. The goal is to complete the replacement of the intake pipe by the end of December, before freezing weather conditions. Freezing conditions will hinder construction activities, prevent the timely and efficient installation of the intake pipe, and extend the duration of construction. A shorter construction duration will also minimize the duration of any short term environmental impacts.

7. As previously mentioned, because Nagog Pond is a surface water supply, the Town of Concord is proposing to pump the water from the Nagog Pond cove area to the main body of the pond (on the other side of the coffer dams). A review of existing available historic Nagog Pond water levels from 1933 through 2015 indicates that there is typically 216 MG of available storage in the main body of Nagog Pond beginning in September. This available volume is more than sufficient to hold the potential volume of ~19 MG from the cove area.
8. A review of existing available information for the period of record indicates that there are discharges from Nagog Pond to Nagog Brook only 1.6% of the time (in days). However, should there be a wetter than normal year preceding or during construction, we have evaluated contingency plans to discharge water to Nagog Brook. Based on the streamflow recommendations included in the FGEIR (2004) referenced previously and the Nagog Pond watershed, the equivalent outflow discharge rate to Nagog Brook should not exceed 4.84 cfs (2,172 gpm) during the drawdown phase. In addition, a minimum target outflow discharge rate of 0.605 cfs (272 gpm) is recommended during the refill phase. Average monthly streamflow, precipitation, and evaporation contributions to Nagog Pond for the period 1960 to 2004 are presented in Table 1. These data were generated using the Firm Yield Estimator Model, Version 2.0 (Levin, S.B., Archfield, S.A., and Massey, A.J., 2011, Refinement and evaluation of the Massachusetts firm-yield estimator model version 2.0: U.S. Geological Survey Scientific Investigations Report 2011-5125, 49 p). The data presented in Table 1 represents the net average monthly inflow to Nagog Pond for the noted period of record. Therefore, for a scenario where the pond is full (or being maintained at a constant level while bypassing inflow) and there are no supplemental withdrawals, then the average monthly discharge from Nagog Pond to Nagog Brook would be equivalent to the net inflow.

A review and comparison of the recommended outflow discharge rates with the historic net inflow data for Nagog Pond presented in Table 1 indicates that the target maximum outflow rate will allow the cove area to drain during the proposed drawdown period. At a maximum target outflow rate of 2,000 gpm (3.68 cfs/square mile), the cove can be drained in approximately 1 week. In addition, a comparison of the net inflow data presented in Table 1 with the FGEIR (2004) minimum recommended outflow discharge rate of 272 gpm during refilling indicates that filling the cove back up once construction is complete, while maintaining the target outflow rate (272 gpm) should be mutually achievable. If average monthly net inflow conditions exist during the refilling phase, then refilling the cove should be achievable within 2 to 3 weeks (while maintaining the minimum target outflow rate of 272 gpm). An evaluation of the historic Nagog Pond watershed information and FGEIR (2004) flow recommendations suggest that this contingency dewatering approach will be readily achievable.

**Table 1 - Average Monthly Net Inflow to Nagog Pond**

<b>Month</b>	<b>cfs</b>	<b>gpm</b>	<b>MGD</b>
January	3.00	1,345	1.94
February	2.99	1,341	1.93
March	4.66	2,093	3.01
April	3.64	1,633	2.35
May	0.92	414	0.60
June	0.24	109	0.16
July	-0.89	-399	-0.58
August	-0.52	-232	-0.33
<b>September</b>	<b>0.22</b>	<b>99</b>	<b>0.14</b>
<b>October</b>	<b>1.17</b>	<b>527</b>	<b>0.76</b>
<b>November</b>	<b>2.33</b>	<b>1,045</b>	<b>1.50</b>
<b>December</b>	<b>2.82</b>	<b>1,266</b>	<b>1.82</b>

9. In addition to the proposed temporary coffer dams, the Contractor will be required to install a bypass system to transfer water from the main body of Nagog Pond to Nagog Brook, after the cove is drained. The by-pass system will be operated manually to maintain a constant water level within the upper portion of Nagog Pond (to remain impounded). This objective will also allow for any net inflow to Nagog Pond to be discharged to Nagog Brook, if required to meet the recommended guideline from the FGEIR (2004) best management practices. However, since Nagog Brook has been determined to be an intermittent stream, and discharges to Nagog Brook typically occur at a frequency of 1.6% for the period September through December, Concord is not proposing to discharge any water to Nagog Brook unless insufficient volume is available for storage. The by-pass system will be designed to meet historic maximum inflow rates to protect the coffer dams from breaching and also allow for flood capacity and discharge to Nagog Brook.
10. A map of Nagog Pond showing the watershed boundary, 400-ft Zone A buffer, proposed coffer dams to Breezy Point Island, and dewatering pumping system is presented in Figure 1 (refer to Attachment B). A review of Figure 1 indicates that there are five residential properties on Breezy Point Road in close proximity to the target section of Nagog Pond proposed to be dewatered, all located northeast of Breezy Point Island. However, only three of these properties are within the watershed boundary and none of them are within 400-ft Zone A. A review of existing available private well information in Acton indicates that at least two of the noted five houses on Breezy Point Road have private domestic wells (#10 and #14). These two wells are reported to be bedrock wells drilled to depths greater than 300 feet below the surface. Therefore, given the proximity and depths of known and potential domestic water supply wells in relation to the watershed and target area, it is extremely unlikely that the proposed drawdown will have any negative impacts on private water supply wells.
11. During construction, the Contractor will be required to maintain several dewatering pumps to transfer water from isolated low spots in the target dewatered area. Water will either be pumped to another isolated low spot not affecting the construction zone, pumped back into the main body of Nagog Pond, or pumped to the dam outlet zone for

release downstream. Any water which is pumped will be monitored visually for the transport of solids/sediment. If solids/sediments are detected, then they will be allowed to settle within the dewatering area before being discharged to Nagog Pond or Nagog Brook.

12. The Construction Documents for the proposed intake pipe replacement project will include the above described project performance requirements. In addition, the Contractor will be required to prepare and submit a detailed dewatering plan which lists all materials and equipment to be used as well as the means and methods to be undertaken. The dewatering plan will be reviewed and approved by both the Engineer and the Town of Acton Conservation Agent prior to implementation.
13. An examination of historic source water quality information and bathymetry maps of Nagog Pond suggest that there should be no long term effects on the water quality of Nagog Pond resulting from the proposed intake replacement project.
14. Because Nagog Pond has been used for a water supply source for over a hundred years, there is a history of cyclical low water levels which result in exposure of the side slopes along the shoreline. The majority of the shoreline within the cove is made up of coarse gravel, cobbles, and stone, and the side slopes are relatively gradual. Therefore, there does not appear to be a risk of significant shoreline erosion during the dewatering period.
15. There are no reported endangered species or habitat associated with the target dewatering zone. However, there are several plots of wetland plant species along the shoreline within the cove by the dam. The proposed temporary drawdown of the target section of Nagog Pond is not expected to have any long term negative impacts on these native wetland plant species. As indicated previously, the shoreline of Nagog Pond has experienced numerous seasonal drawdowns over the years, although none to the proposed extent since the existing intake pipe was installed in 1909 by means of implementing coffer dams in the same location as those now being proposed.
16. According to the literature, aquatic biota tends to be very resilient and the impacts from any one short duration drawdown are usually temporary. It has been reported that even the complete loss of a year class of fish or elimination of mollusks within a pond section will have little impact on overall lake ecology. However, as indicated previously, the Division of Fisheries and Wildlife will be consulted during the drawdown phase and the project proponent will assist with the implementation of required mitigation activities.

These recommended project implementation plans will be undertaken in addition to the current watershed protection plans included in Concord's Watershed Resource Protection Plan for Nagog Pond (Attachment B). Based on the information presented above, the Town of Concord is seeking a waiver from completing an EIR. The practice of temporarily dewatering sections of ponds and lakes has been used as a tool for responsible lake management in Massachusetts for decades. Various regulatory agencies have completed studies and published guidelines for undertaking the process. We are proposing that the specific information presented herein, and the general information developed by the Massachusetts Department of Environmental Protection and the Department of Conservation and Recreation (Executive Office of Environmental Affairs) relating to lake drawdown management practices indicates that there will be no long term or permanent damage to the environment as a result of drawing down a small section of Nagog Pond (1.3% by volume). Any potential impacts to the environment will be

temporary and mitigated to the greatest extent possible by implementing the above described best management practices and procedures.

### **Response to Public Comments**

In addition to the above request for a waiver, we have been forwarded public comments submitted by Carolyn M. Kiely, on behalf of the Quail Ridge Residents dated January 11, 2016 regarding the above referenced ENF. Please find presented below our responses to the aforementioned Public Comments. We have numbered our responses to correspond with the numbered comments

1. Comment: The ENF does not identify Article 97 of the Massachusetts Constitution as applying to this project.

Response: The relevant land was “taken or acquired” for public water supply purposes, and that public purpose is not changing. Therefore the Article 97 requirements for disposition of public property do not apply. The 2 parcels of land where construction is planned (C4-14 and C4-32) were acquired by the Town of Concord for water supply purposes. The proposed use includes a new Water Treatment Plant and an accessory photovoltaic (PV) solar array to power the facility.

An evaluation of projected electrical loads for the proposed Water Treatment Plant and an electrical harvest analysis for the proposed PV system indicates that over the course of a year the proposed PV will provide approximately 25% of the annual electrical needs. As such, the proposed solar PV is an accessory use for the facility, and should not be classified as a stand-alone facility. References regarding the need for consideration of Article 97 for solar PV in the draft feasibility study prepared in 2013 refer to the development of PV systems on land parcels not for the expressed purpose for providing power to the proposed Water Treatment Plant.

In response to certain public comments, the Town of Concord went back to the Special Counsel which was involved in the original feasibility study to see additional clarification as to the parcels and lot in question. Special Counsel concluded that both parcels were taken or acquired for and dedicated to the support, operation, and management of a public water supply system. Special Counsel also concluded that the proposed PV system is consistent with that public purpose.

2. Comment: Massachusetts Regulations on Water Supply Protection Areas.

Response: The construction of a Water Treatment Plant within a Zone A of a Class A public water supply is not restricted by Massachusetts drinking water regulations. Furthermore, the DEP is supportive of the Commonwealth’s energy goals to expand solar photovoltaic (PV) systems and has developed a policy (DEP Policy 2011-1) to assist public water systems with siting PV

systems within the Zone A of public surface water supplies. In compliance with the above referenced DEP Policy 2011-1, the Town of Concord received presumptive approval from DEP for the PV portion of the proposed project on January 21, 2016.

3. Comment: Wildlife and Wildlife Habitat Impacts.

Response: This public comment is unsubstantiated and lacking any direct facts associated with the assertion that the proposed area to be cleared for PV is thick with wildlife which has migrated since the clearing of adjacent lands for the Quail Ridge golf course and residential development. There is a preponderance of remaining open space on adjacent lands owned both by the Town of Concord and the Town of Acton. With the exception of the land to be cleared for PV, all proposed construction activities on the site are taking place within developed areas which have already been disturbed. The project does include spacing under the proposed PV fencing (4" to 6") for wildlife migration.

4. Comment: Alternatives Analysis

Response: All lands held by the Town of Concord within and around the Nagog Pond watershed were evaluated for locating renewable energy alternatives. Sites with the closest proximity to the target energy demand and energy transmission infrastructure are the most economically and environmentally favorable. Furthermore, due to electrical franchise area restrictions, the Town of Concord cannot transfer electrons generated in Concord to service locations in Acton.

Regarding alternative locations for the Water Treatment Plant building, we have already described the analysis and reason for siting the proposed facility on the same location as the existing. The proposed location minimizes the need for additional blasting and clearing of subsurface bedrock by making use of the areas where it has already been removed. Furthermore, constructing the building on the existing developed site minimizes the need for additional disturbances and development.

5. Comment: Stormwater Analysis

Response: The effects of the proposed PV system on stormwater runoff were evaluated. A hydrologic study on the response of stormwater to solar farms was recently published in the ASCE Journal of Hydrologic Engineering (Hydrologic Response of Solar Farms, Lauren M. Cook and Richard H. McCuen, May 2013). The study evaluated the runoff for pre- and post- PV system conditions. The results of the study found that solar panels themselves do not have a significant effect on the runoff volumes, peaks, or times to peak. However, the ground cover under and between the panels can effect runoff. For this reason, the use of low maintenance meadow grass was proposed for the PV areas. A buffer strip at the

downstream end of the panel rows will also be included for energy dissipation.

6. Comment: Mitigation Measures

Response: The proposed mitigation measures are assumed to be acceptable and sufficient. The project proponent will consider additional mitigation measures if they are recommended by the Executive Office of Energy and Environmental Affairs.

7. Comment: Public Benefit to Acton.

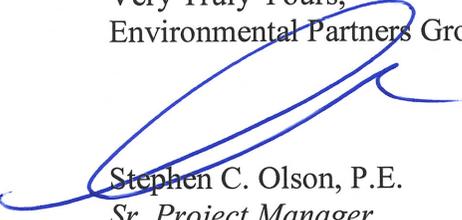
Response: The project is being proposed in the Town of Acton, on land owned by the Town of Concord. The proposed project not only provides regulatory compliance with the federal Safe Drinking Water Act, Long-term Enhanced Surface Water Treatment Rule, it will increase the reliability and availability of this essential source of drinking water and fire protection to both residential and commercial customers in Acton (along a large corridor of Route 2A). In addition, the use of on-site photovoltaic power will off-set the electrical needs to operate the facility which benefits society in general, including the residents of Acton.

8. Comment: Septic Issue.

Response: The requirement for obtaining approval of the proposed Title 5 septic system is noted in Attachment I (refer to item #11, 310 CMR 15.000).

If you should have any questions or require additional information, please do not hesitate to contact me at (617) 657-0255. I can also be reached via e-mail at [sco@envpartners.com](mailto:sco@envpartners.com).

Very Truly Yours,  
Environmental Partners Group, Inc.



Stephen C. Olson, P.E.  
*Sr. Project Manager*

Encl:

Attachment A: Lake Management Resource Materials, Partial Bibliography  
Attachment B: Town of Concord, Watershed Resource Protection Plan, Nagog Pond  
Attachment C: Figure 1 – Nagog Pond Watershed

CC: Christopher Whelan, Town Manager  
Richard Reine, Public Works Director  
Alan Cathcart, Concord Water/Sewer Division, Superintendent  
Concord Public Works Commission  
Town of Acton, Conservation Commission  
Town of Acton, Planning Department  
Town of Acton, Board of Selectmen

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*Attachment A*

*Lake Management Resource Materials, Partial Bibliography*

1. Commonwealth of Massachusetts Water Resources Commission. *"Policy on Lake and Pond Management for The Commonwealth of Massachusetts."* Letter. 13 June 1994. MS. Department of Environmental Management, Boston, Massachusetts.
2. Langley, Lealdon, Lisa Rhodes, and Michael Stroman. *Guidance for Aquatic Plant Management in Lakes and Ponds As It Relates to the Wetlands Protection Act.* N.p.: Massachusetts Department of Environmental Protection, 2004. Print.
3. *"Lake and Pond Management."* Massachusetts Nonpoint Source Pollution Management Manual. N.p.: n.p., n.d. 7-1--9. Print.
4. Mattson, Mark D., Paul J. Godfrey, Regina A. Barletta, and Allison Aiello. *Eutrophication and Aquatic Plant Management in Massachusetts - Final Generic Environmental Impact Report.* Rep. Amherst: U of Massachusetts Research Center, 2004. Print.
5. Robinson, Michelle. *The Massachusetts Lake and Pond Guide.* N.p.: Massachusetts Department of Conservation and Recreation Lakes and Ponds Program, 2005. Print.
6. Wagner, Kenneth J., Ph.D. *The Practical Guide to Lake Management in Massachusetts - A Companion to the Final Generic Environmental Impact Report on Eutrophication and Aquatic Plant Management in Massachusetts.* Westford: n.p., 2004. Print.

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*Attachment B*  
*Town of Concord, Watershed Resource Protection Plan, Nagog Pond*

**Town of Concord  
Watershed Resource Protection Plan  
Nagog Pond  
1991**

(Revised: July 1998, August 2011, December 2014)

**WATERSHED RESOURCE PROTECTION PLAN SUMMARY**

This revision to the Town of Concord's Watershed Resource Protection Plan serves as an update to the 1991 Watershed Protection Plan (last amended August 2011). This document contains updated maps of the Nagog Pond Watershed to identify land use along with current and potential contamination sources.

**NAGOG POND OVERVIEW**

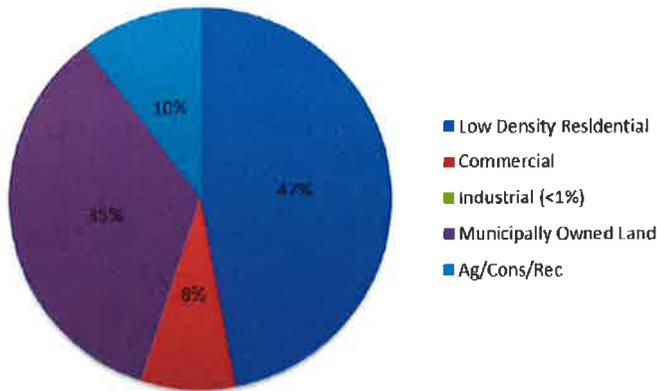
Concord Public Works, Water and Sewer Division (CPW) is responsible for the operation and management of the Nagog Pond public water supply. In 1991, the Nagog Pond Watershed Resource Protection Plan (WRPP) was developed, identifying existing land-uses and associated threats to this unfiltered water supply. The plan is updated every three years, in accordance with MassDEP's guidance document, *Developing a Local Surface Water Supply Protection Plan*, to ensure changes in land-uses are evaluated and managed in a manner that is consistent with the Town of Concord's water supply interests.

**WATERSHED DESCRIPTION**

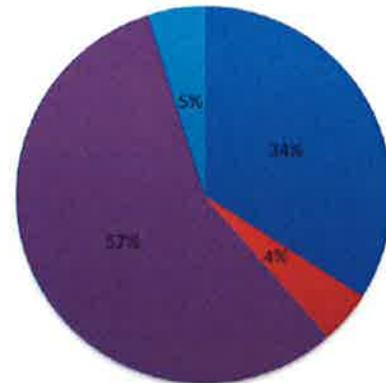
Nagog Pond is located approximately 5-miles north of Concord in the towns of Acton and Littleton, MA. Nagog Pond is a great pond with the majority of recharge coming from surface runoff, ground water recharge (thought to be through fractures), and very limited tributary flow during times of high precipitation. Nagog Pond has a surface area of just under one half of a square mile (0.44sq mi) with a corresponding watershed area of 1.25 square miles.

The watershed is comprised of low density residential, commercial, and industrial property, as well as municipal lands. The municipally owned land is designated for several different uses including water supply, conservation/open space, and agricultural purposes. As of November 2014, an inventory of land-use activity within the Nagog Pond watershed is as follows:

Watershed – Zone B



Zone A



## REGULATORY DEFINITIONS - SURFACE WATER PROTECTION AREAS

### Zone A

- the land area between the surface water source and the upper boundary of the bank;
- the land area within a 400-foot lateral distance from the upper boundary of the bank of a Class A surface water source (Nagog Pond)
- the land area within a 200-foot lateral distance from the upper boundary of the bank of a tributary or associated surface water body.

### Zone B

- the land area within ½ mile of the upper boundary of the bank of a Class A surface water source (Nagog Pond), or edge of watershed, whichever is less, and
- shall always include the land area within a 400-foot lateral distance from the upper boundary of the bank of the Class A surface water source.

### Zone C

- the land area not designated as Zone A or B within the watershed of a Class A surface water source as defined at 314 CMR 4.05(3)(a).

Because the Nagog Pond watershed is relatively small in area, the majority of the watershed is delineated and subsequently managed and protected as Zone A (Figure 1).

For a more detailed historical description, please reference the 1991 Watershed Protection Plan, available for viewing at Concord Water and Sewer Division, 135 Keys Road, Concord, MA 01742.

## **LAND USE ASSESSMENT**

A brief synopsis of notable land-use changes which have occurred since the development of the original WRPP are highlighted below. These changes are generally grouped chronologically within each designated land-use category. Future action items associated with each designated land-use category are also underscored in each narrative and summarized in Appendix 1.

### **Agricultural Land Activities**

#### **1991-2011**

*Nagog Hill Farm:* In 2000, the Town of Littleton purchased approximately 48 acres of watershed land (from the Morrison Family) which is zoned for agricultural use. A small lot encompassing the original farm house located on this parcel was subdivided and sold to a private entity as a single family residence (91 Nagog Hill Road). The Town of Littleton currently leases the remainder of this land to a private contractor who continues to use a large portion of this land, approximately 28 acres, as active orchard, doing business as Nagog Hill Farm. 20 acres of the original parcel immediately borders Nagog Pond and has been allowed to return to its natural, undisturbed condition, since 2005. This has effectively eliminated its draw as an attractive nuisance for both humans (recreational) and gathering/resting area for waterfowl.

CPW is aware that the Orchard has historically drafted water from Nagog Pond to supplement seasonal irrigation needs. CPW is not aware of any formal “withdrawal” rights which would either authorize or curtail this activity. Due to the limited and intermittent nature of this activity, CPW is not aware of the actual volume of water which is drafted from Nagog Pond during any given year. CPW’s primary interest is to ensure any potential cross contamination risks are averted. The agricultural withdrawal is performed using a portable, tractor mounted pumping unit which is parked on the shore of Nagog Pond. This water is pumped to an irrigation pond which is subsequently used for drip irrigation for the rock fruit trees. A small spill containment vessel has been noted to be positioned beneath locations where fuel or fluid could be released from the tractor located on the shore of Nagog Pond.

#### **2011-2014**

*Nagog Hill Farm:* CPW continued to engage the management of Nagog Hill Farm on an as-needed basis to ensure standard operating practices are performed with due consideration of potential impacts to the water quality in Nagog Pond, especially with respect to routine pesticide/herbicide application and storage activities. Proper storage and containment of onsite chemicals like pesticides and fertilizers continue to be evaluated using the guidance of MassDEP Drinking Water Regulations 310CMR 22.00, Massachusetts Department of Agricultural Resources (MDAR) regulations and the Town of Littleton Bylaws.

The manager of these operations has served in the same capacity for decades and is well aware of CPW’s water protection concerns and interests. Additionally, as

the manager of an active orchard, he is aware of his obligation to submit an annual Pesticide Use Report to MDAR by May 15<sup>th</sup> of each year. Copies of these reports have also been provided to CPW, upon request.

*Equestrian Activities:* Nagog Pond has three active horse stables within or adjacent to the watershed at the following locations; Windflower Farm, located at 12-14 Breezy Point Road, Lythrum Farm, located at 310 Nagog Hill Road, and Hybrid Farm located at 210 Nagog Hill Road. A description of each operation follows;

Windflower Farm: The residence at 14 Breezy Point Road maintains a horse stable which is used to house two horses and two ponies, as well as to provide riding lessons. This 6.5 acre property has 3.6 acres in the Nagog Pond Zone A and 4.0 acres in the Nagog Pond watershed (Zone B). Historically, the owner of this residence has not been especially receptive to communications initiated by CPW staff; however, some improvement has been noted more recently. Manure is collected daily in large rubber tubs and is taken off-site by students, neighbors, or a local organic farm for use in gardens.

Lythrum Farm: This farm is comprised of a 9-stall barn and an indoor riding arena used for dressage (horse ballet). The farm staff collects manure twice per day (except for during deep snow) and deposits it in a concrete holding area behind the barn. It is then moved to a composting area at the rear of the property. This 4.1 acre property has a negligible area in the Nagog Pond Zone A and 4.0 acres in the Nagog Pond watershed (Zone B). The composting area is within the watershed.

Hybrid Farm, Inc: This farm is not within the Nagog Pond watershed, but is adjacent to the Acton Conservation Trails. The owner of the farm informed CPW staff that these trails are not used by their facility for trail riding. The manure is collected in a large dumpster-like container and is removed on a monthly basis by a contractor.

In 2013, CPW reached out to the Acton Board of Health to seek support and assistance in the development of a program where stable owners would be provided guidance and encouragement to voluntarily adopt Best Management Practices (BMP's), specifically with respect to the handling and storage of manure.

#### **Future Interests**

*Nagog Hill Farm:* CPW will continue to engage the management of Nagog Hill Farm on an as-needed basis to ensure standard operating practices are performed with due consideration of potential impacts to the water quality in Nagog Pond, especially with respect to routine pesticide/herbicide application and storage activities. Proper storage and containment of onsite chemicals like pesticides and

fertilizers will continue to be evaluated using the guidance of MassDEP Drinking Water Regulations 310CMR 22.00, Massachusetts Department of Agricultural Resources (MDAR) regulations and the Town of Littleton Bylaws.

CPW will continue to perform annual audits of the orchard operation and request copies of the annual Pesticide Use Report submitted to MDAR by May 15<sup>th</sup> of each year.

*Equestrian Activities:* CPW will continue to seek the support and assistance of the Acton Board of Health in the development of a program to ensure stable owners are provided with guidance and encouragement to voluntarily maintain Best Management Practices (BMP's), specifically with respect to the handling and storage of manure. As time permits, CPW may explore potential funding sources/incentives which could be drawn upon to help create an environmentally responsible and sustainable manure management program.

## **Residential/Commercial Development**

### **1991-2011**

*354B Great Road, Acton - Quail Ridge Country Club:* In 2001, this 140-acre property was redeveloped from open space into an 18-hole golf course (Quail Ridge Country Club). The most notable interest identified by the Town of Concord during this development was the permitting of large withdrawal groundwater wells for irrigation purposes. In 2008, Quail Ridge Country Club filed for bankruptcy. Later that same year, Acton approved the use of a secondary access road to future development across a portion of the Ozone facility easement utilized by Concord Water. The property was auctioned off as land available for a 174 unit residential sub-division.

### **2011-2014**

*354B Great Road, Acton - The Residences at Quail Ridge:* This 140-acre property is in the process of being redeveloped from a pre-existing 18-hole golf course to a 174 unit senior residential housing development (~56 acres) with an adjacent 9-hole golf course. The residences are currently being constructed by Pulte Homes. While most of this land is located outside of the Nagog Pond watershed, a small portion (c. 1 acre) of this property falls within the Nagog Pond Zone A. CPW staff have commented on design and construction activities associated with this development to ensure environmental controls have been installed with appropriate consideration of short and long-term impacts on Nagog Pond. In response to comments submitted by CPW, all residential structures will be located outside the Zone A of Nagog Pond.

*91 Nagog Hill Road, Littleton – Former Morrison Property:* A small section (1.4 acres) of the Morrison Property noted above was purchased by the Fuhrer family in August of 2013. The new owners have upgraded a failing septic system and are currently renovating the house. Littleton Board of Health denied the owners'

request to add more bedrooms based on existing Deed Restriction and site constraints.

*15 Great Road, Littleton – Village Green:* This 54 acre parcel of land zoned for residential use is currently being developed by Omni Properties into a residential cluster development. 13 acres of this parcel is located within the Nagog Pond watershed. A ground water discharge (GWD) site has been permitted by MassDEP in an area which straddles the watershed boundary. CPW staff worked closely with the Town of Littleton, the developer, the design engineer (Places Associates), and associated sub-consultants throughout the design and permitting process to ensure that Nagog Pond watershed protection interests were covered pre-, post- and during construction. Construction of this development commenced in the summer of 2014 and is expected to be completed in 2015.

#### **Future Interests**

*354B Great Road, Acton - The Residences at Quail Ridge:* Staff will continue to monitor the development of this 140-acre property as it is transformed from a pre-existing 18-hole golf course to a senior residential housing development (~56 acres) with an adjacent 9-hole golf course. CPW will continue to follow development and, as a direct abutter, will attempt to work with both the developer and the Town of Acton to ensure any proposed impacts from this development, direct or indirect, are done with due consideration of Nagog Pond protection interests.

*91 Nagog Hill Road – Former Morrison Property:* CPW staff will continue to monitor the construction of this single family residential development to ensure appropriate environmental controls are in place to protect Nagog Pond. Once the new owners occupy this residence, staff will reach out and educate them as to their proximity to a public water supply and our interests as they relate specifically to the protection of Nagog Pond. CPW staff will continue to monitor construction daily.

*15 Great Road, Littleton – Village Green:* CPW staff will continue to monitor the development of this 54 acre parcel of land, with specific attention placed on the 13 acres of this parcel located within the Nagog Pond watershed. CPW will review monthly GWD monitoring reports which have been required by MassDEP to verify no adverse groundwater quality impacts occur, which could potentially influence the recharge to Nagog Pond.

#### **Stormwater Management – Public/State Right of Ways**

##### **1991-2011**

*Nagog Park:* In 1990, Nagog Park, a 47 acre commercial development located within the watershed due east of Great Road, was designed and constructed. As part of this project, a storm water collection system was installed, diverting

stormwater into Little Nagog Pond (Scupper Pond) and out of the Nagog Pond watershed to the northeast into the Nashoba Brook watershed.

*Great Road Reclamation Project:* In 1999, The Massachusetts Department of Transportation (*Mass DOT*) initiated a road reclamation project which included a large section of Great Road with a portion of it located within the Nagog Pond watershed. CPW provided design input and engineering support to ensure catch basins located within the limit of work were effectively diverted away from Nagog Pond and into Little Nagog Pond and that a double-height granite curb stop was installed. Little Nagog Pond is hydraulically separated from Nagog Pond with its overflow directed to the Nashoba Brook watershed. The only catch basin located on Great Road which is not diverted to Little Nagog Pond is located near the parking lot of a commercial property (presently identified as the “Tire Barn”). This catch basin is furnished with an oil/gas water separator and discharges to a retention swale located at the intersection of Nashoba Road and Great Road, which eventually flows to Nagog Pond (only under extreme precipitation events).

*Mass DOT Winter Road Maintenance:* CPW continues to monitor Nagog Pond for potential water quality impacts attributed to winter maintenance/deicing activities performed along Great Road by Mass DOT. This effort includes routine inspection of roadway conditions along with annual inquiries to Mass DOT to ensure they remain vigilant and aware of our water supply concerns and interests while providing encouragement to ensure their operations personnel adhere to best management practices when it comes to deicing agent application rates and maintenance practices.

Road Salting – Over the past 10 years, sodium concentration in Nagog Pond has remained stable, with results ranging from ~17-25 ppm. Any variation does not appear to correlate to seasons or precipitation events.

Road Sanding – CPW provides periodic check-ins with Mass DOT to ensure proper catch basin maintenance activities are performed along Great Road. If CPW staff observe catch basins that are not draining properly, Mass DOT is notified directly.

*Municipal Stormwater Management:* Eight outfalls located within Town maintained Right-of-Ways (including Littleton and Acton), specifically along Nashoba Road and Nagog Hill Road, drain directly/indirectly towards Nagog Pond. All other municipal catch basins are directed into properly maintained infiltration swales.

Catch basins within the watershed are inspected in the spring and fall by CPW staff (at least once during wet weather conditions) to ensure that they are flowing and properly maintained. If structural or operational issues are identified, the responsible department/agency is contacted.

*Groundwater Seepage:* In 2007, an unknown source of groundwater appeared to be seeping onto and across Great Road in the general area of Nagog Woods Condo and Apartment Complex. This was reported by CPW to Mass DOT (formerly MA Highway) shortly after upgrades were made to Great Road to accommodate the Avalon Acton apartment development project (adjacent to Nagog Park). In December of 2008, seepage was again noted to emanate in this same general area. As an emergency measure taken to prevent ponding and potentially dangerous icing conditions from occurring on Great Road, the flow was diverted into a small, newly created drainage swale which feeds directly into Nagog Pond.

The seepage continues to be observed in times of high groundwater, but has little to no flow in the late summer, fall, or winter. Water quality samples have been taken at the site and indicate a wide range in sodium concentration and bacteria counts. There has been no correlation established between quality and time of year or rate of flow. Mass DOT is aware of this situation and our water quality concerns.

#### **2011-2014**

*Nagog Hill Road Culvert Replacement (2012):* CPW provided comments to the Town of Littleton Highway Department and their consulting engineer Green International in the design and reconstruction of a pre-existing culvert. The culvert crosses under Nagog Hill Road near the Littleton/Acton town line and included an opportunity to improve upon short-term and long-term environmental monitoring and controls required for enhanced protection of Nagog Pond. The culvert is designed to carry stormwater flow from an existing drainage system that only surcharges during large recharge/precipitation events.

*Nashoba Road Reconstruction (2014):* CPW provided comments to the Town of Littleton Highway Department and their consulting engineer Green International to improve drainage and stormwater treatment to the maximum extent practicable as part of the reconstruction of Nashoba Road. The original design was improved upon by super-elevating the road in a manner that maximized drainage swales and catch basin sumps for increased sediment removal. CPW has been monitoring construction and temporary stormwater controls throughout the construction process. Nashoba Road reconstruction is scheduled to be completed in 2015. Acton Engineering Department has indicated that once the Littleton reconstruction activities have been completed, they may evaluate stormwater management improvement opportunities at the intersection of Great Road and Nashoba Road.

*Great Road Sidewalk Extension Project – Acton:* CPW provided comments to the Town of Acton Engineering Department on a proposed project which will improve drainage and stormwater treatment to the maximum extent practicable relating to the installation of ~2000 feet of new sidewalk along Great Road.

The original design called for stormwater to be diverted directly to Nagog Pond. Based on CPW comments, the stormwater will be diverted to Little Nagog Pond (Scupper Pond). Phase I (Upper Nonset Path to 531 Great Road) was completed in Fall 2014, and Phase II (531 Great Road to Lower Nonset Path) is tentatively scheduled to be completed in 2015/2016 once required easements and permits are obtained.

### **Future Interests**

*Nagog Hill Road Reconstruction:* Littleton Highway Department recently sought and received Special Town Meeting approval (2014) for the acceptance of Nagog Hill Road as a public way. Their interest is to design and reconstruct a portion of Nagog Hill Road. CPW will work with Littleton Highway Department and their consulting engineer to ensure Concord's watershed protection interests are incorporated into the design and construction plans.

*Great Road Sidewalk Extension Project – Acton – Phase II:* CPW will continue to work with the Town of Acton and contractors during the design and construction of Phase II of the Great Road Sidewalk Extension Project to ensure Nagog Pond is protected during and after construction to the maximum extent practicable.

*Great Road – Widening Project:* In direct response to traffic impacts planned as part of the aforementioned Village Green Residential Development at 15 Great Road Littleton, a section of Great Road will be widened to accommodate appropriate turning radii required for the new access road. CPW staff will monitor construction activities relating to this specific phase of work to ensure Concord's watershed protection interests, most notably relating to stormwater controls, are appropriately addressed during construction.

*Groundwater Seepage:* CPW has coordinated with the Town of Acton during phase II of design and permitting of a new sidewalk and drainage improvements along Great Road opposite Nagog Pond and in the same general area as the 'seepage.' CPW will continue to monitor rate of seepage and evaluate needs accordingly.

### **Municipal Land Activity**

#### **1991-2011**

*Palmer Land Swap:* In 2003, CPW completed a land "exchange" with the Palmer Family Trust, involving an area of approximately 3.7 acres. This action was precipitated by Town Meeting vote in 1994 (and reauthorized at a 1998 Town Meeting - Article 39), instructing the Concord Board of Selectmen to make a formal offer for this swap. The land belonging to the Town of Concord was identified on tile Town of Acton Assessors Maps as parcel 29, sheet 04, consisting of 3.75 acres. The land conveyed to the Town of Concord in exchange for this parcel is situated near Nagog Brook and approximately 300 feet from

Nagog Pond. With the construction of an ozone treatment facility in 1996, the Town-owned land, originally purchased for a chlorination facility was no longer necessary. It was also entirely surrounded by Palmer family land. The Palmer land that was exchanged for this land directly abuts the ozone facility property and further secured Town access to the facility.

*281 Nagog Hill Road, Acton:* In the late 1990's Acton Water District (AWD), swapped parcel C4-24, with the Conant Family (151 Nagog Hill Road Acton). This parcel is currently undeveloped and there are no current plans for development. The Conant family has historically been good land stewards to AWD, 80% an AWD Zone II is owned by the Conant Family.

*Hiking/Recreation Trails:* Littleton and Acton have active recreation "trail" committees whom have repeatedly expressed interest in connecting open space trails on conservation lands via Town of Concord owned lands which were procured for the purpose of water supply protection. CPW has routinely had to remind these committees that passive recreation, including use of land for hiking, is not consistent with the MassDEP approved 1991 Watershed Resource Protection Plan and is in conflict with lands purchased by the Town of Concord for the sanitary protection of Nagog Pond.

*Nagog Pond Dam Improvements:* Nagog Pond Dam is located on the south-east shore of Nagog Pond in Acton, Massachusetts and is listed on the National Inventory of Dams (MA00129). The dam was originally constructed in 1909 as part of the development of Nagog Pond for use as an active water supply for the Town of Concord.

Nagog Pond Dam is an approximately 170-foot long concrete and earthen structure with a 10-foot wide uncontrolled spillway, a 20-foot wide broad created auxiliary spillway, gated low level outlet, and a water supply intake structure. The dam has a maximum structural height of approximately 15-feet and a maximum reported capacity of 3,140 acre-feet. The dam is regulated by the Massachusetts Department of Conservation and Recreation Office of Dam Safety (DCR) as a large size, significant (Class II) hazard potential dam.

In November 2008, the Town of Concord was directed by the DCR to conduct a Dam Safety Phase I and II inspection. Pare Corporation (Foxborough, MA) performed a Phase II Dam evaluation in accordance with the Office of Dam Safety. Their findings indicated that Nagog Pond Dam was in poor condition. Their recommendation includes the rehabilitation of the concrete dam, intake piping, spillway, and gate/control valves. Investigation by Pare Cooperation showed that the dam was structurally sound and keyed into the bedrock below. In 2012, the Nagog Pond Dam was rehabilitated by removing any of the loose and spalling concrete. The dam face was then reinforced and covered with shotcrete (flowable concrete).

## **2011-2014**

*Acton Trails Committee Lands:* CPW has been working directly with the Acton Trails Committee and Acton Natural Resources to effectively manage and discourage public access onto CPW owned lands. Increased signage has been evaluated to more clearly notify patrons when they are leaving Acton Lands. CPW is also working on closing off secondary trails which lead to or are closer to the shore of Nagog Pond. Redirecting foot traffic to an established trail will allow for improved monitoring of trail condition and watershed protection impacts.

*Nagog Pond Dam Rehabilitation:* In 2013, J. D'Amico Inc. (Randolph, MA) completed reconstruction of Nagog Pond concrete dam, which is 15 foot high and 168 foot long. Their work included removal and replacement of deteriorated concrete along the entire dam structure, the replacement of the low level outlet gate and installation of precast concrete culvert sections for outlet channel.

*Nagog Pond Intake Pipe Inspection (2012):* The structural and operational condition of the Nagog Pond intake pipe, installed in 1909, is of questionable integrity.

### **Future Interests**

CPW will continue to be vigilant in re-enforcing its need to monitor and control its land which may be subjected to encroachment by foot traffic and recreation, which may in turn increase erosion or potentially introduce exotic species to the watershed. CPW will evaluate opportunities to work with neighboring communities on public education, including signage, to maintain the balance of interest and water supply protection, especially within the Zone A of Nagog Pond.

*Nagog Pond Dam:* Monthly visual dam inspections are performed by CPW staff.

*Nagog Pond Intake Pipe:* CPW is currently working with consulting engineers at Environmental Partners Group to design a full intake line replacement and extension. This project is expected to be coordinated with the upgrade of the Nagog Pond (Ozone) treatment facility and is estimated to begin 2016-2018.

## **Wildlife Impacts/Management**

### **1991-2011**

*Waterfowl:* In the summer of 1997, a notable increase in seagull activity was identified within the Nagog Pond Watershed. Intense bird mitigation efforts were performed over several years, including the eventual elimination of a significant food source (i.e. active piggery located outside of watershed but within close proximity of flight, successfully reduced the attractive nuisance of Nagog Pond for seagulls.)

In 2009, at the request of Tom Tidman, Town of Acton Natural Resource Director, CPW authorized the establishment of a limited scale loon nesting

program. The interest in establishing a loon habitat within Nagog Pond was considered to be consistent with the natural protection of this great pond.

*Beavers:* CPW have monitored changes to the known beaver lodges (at least twice per year) and, when activity is identified, works with a licensed beaver trapper in accordance with the Massachusetts Division of Fisheries and Wildlife regulations. The current trapping season is November 1-April 15. Emergency trapping activities performed outside this season require filing with MassDEP for a Determination of Threat to Public Water Supply due to Beavers or Muskrat.

## **2011-2014**

*Waterfowl:* In recent years, the population of nuisance birds (i.e. seagulls, geese) has been reduced to an estimated 0-50 per day. CPW has continued to perform surveillance of open areas of watershed lands which can create attractive roosting sites or inadvertent food sources (such as open food-waste dumpsters in the Nagog Park area). There is no evidence that area residents or restaurant patrons are feeding the birds or engaging in any activities that would encourage the gulls or other waterfowl to continually visit the Nagog Pond watershed. When needed, during routine inspections, bird harassment activities have been employed.

Loon nesting platforms remain in 'Fort Pond Brook' Cove (pulled to the side) and the cove to the west of the dam. Both are inactive but have been left in place per request of Acton Natural Resources. Lee Attix, from BioDiversity Research Institute (Gorham, ME) visited Nagog Pond with CPW staff during 2013 and 2014 to evaluate potential loon nesting locations. No loon nesting sites were identified but the Nagog Pond Caretaker has reported to hear loon calls at dusk. Attix believes the loons associated with Nagog nest at another local water body and come to Nagog Pond to feed.

*Beavers:* There are currently three inactive beaver shore lodges which have been identified within the Nagog Pond watershed (Figure 2). CPW has been monitored activity of these beaver lodges (at least twice per year) and, when an active presence is identified, has retained the services of a licensed beaver trapper. All trapping is performed in accordance with the Massachusetts Division of Fisheries and Wildlife regulations, which limit trapping to November 1-April 15. Emergency trapping activities performed outside this season require filing with MassDEP for a Determination of Threat to Public Water Supply due to Beavers or Muskrat. There has been no observed evidence of beavers at Nagog Pond since 2012.

## **Future Interest**

*Waterfowl:* CPW will continue surveillance of watershed lands which can create open roosting sites or food sources for waterfowl (such as improperly maintained dumpsters in the Nagog Park area). If needed, bird mitigation methods will be supported by boat or shell cracker guns.

CPW staff will contact BioDiversity Research Institute (Gorham, ME) if there are any loon sightings.

*Beavers:* CPW will continue to monitor the watershed for beaver activity including the three inactive beaver shore lodges located around Nagog Pond (Figure 2). Should activity be identified, CPW will retain the services of a licensed beaver trapper in accordance with the Massachusetts Division of Fisheries and Wildlife regulations. The current trapping season is November 1-April 15. Emergency trapping activities performed outside this season require filing with MassDEP for a Determination of Threat to Public Water Supply due to Beavers or Muskrat.

### **Underground Storage Tanks**

At this time, CPW is unaware of any underground storage tanks located within the watershed.

### **Public Education/Awareness**

CPW tries to use a direct and personal approach with residents and individuals who have the most contact with the Nagog Pond watershed. During routine inspections, CPW staff will often stop and talk to those people they meet along the way or knock on residents' doors to say hello and reiterate the importance of protecting Nagog Pond.

#### **1991-2011**

Coordination with Littleton Conservation Trust and Acton Eagle Scouts in 2007 yielded the installation of an informational kiosk at the Sarah Doublet Forest parking area on Nagog Hill Road.

*Household Hazardous Waste Disposal:* Beginning in the fall of 2010, CPW invited Nagog Pond watershed residents to participate in the Town of Concord's Hazardous Waste and Unwanted Medication collection program when offered.

#### **2011-2014**

*Household Hazardous Waste Disposal:* CPW continued to invited residents within the Nagog Pond watershed to participate in the Town of Concord's Hazardous Waste and Unwanted Medication collection program when offered.

*Direct Mailings:* CPW distributed educational mailings to residents within the Nagog Pond watershed at least annually and occasionally more frequently as resources permit. The content of these mailings was intended to maintain general awareness of best management practices for residential land-use activities which occur within the water resource protection area. Topics included;

- ◆ Proper septic tank maintenance
- ◆ Accepted and prohibited recreational activities
- ◆ Ways residents can help protect Nagog Pond
- ◆ Proper hazardous material and medication disposal

### **Future Interests**

*Household Hazardous Waste Disposal:* CPW will invite residents within the Nagog Pond watershed to participate in the Town of Concord's Hazardous Waste and Unwanted Medication collection program when offered (generally twice per year).

*Direct Mailings:* CPW distributes educational mailings to residents within the Nagog Pond watershed at least annually and occasionally more frequently as resources permit. The content of these mailings are intended to maintain general awareness of best management practices for residential land-use activities which occur within the water resource protection area. In the past, topics have included;

- ◆ Proper septic tank maintenance
- ◆ Proper lawn care
- ◆ Accepted and prohibited recreational activities
- ◆ Ways residents can help protect Nagog Pond
- ◆ Proper hazardous material and medication disposal

Ideas for future outreach include educational information on

- ◆ Management of dog and livestock waste
- ◆ Proper household garbage storage and composting

*One-on-One Communications:* CPW staff makes an effort to personally reach out to residents in the watershed. If we notice that someone has recently moved in, we will stop by to introduce ourselves, provide them with a history of Nagog Pond, and share our watershed protection interests.

### **Watershed Surveillance**

#### **1991-2011**

CPW began to employ the Nagog Pond Caretaker as part of our 1991 Watershed Resource Protection Plan.

#### **2011-2014**

In 2012, CPW created a part-time position for a Watershed Ambassador. This individual provides intermittent watershed surveillance and outreach during off-hours. This increased presence at unpredictable times, including weekends, has been effective in expanding outreach and direct messaging for casual recreation activities.

### **Future Interests**

CPW staff will continue to perform daily watershed protection inspections and will work to continue Watershed Caretaker and Watershed Ambassador programs.

### **Inter-municipal Coordination**

CPW maintains a solid and professional working relationship with municipal departments within both Littleton and Acton including the Police Departments,

Fire Departments, Planning and Engineering Departments, Acton Trails Committee, Littleton Conservation Trust, Town Boards and Committees, Town Building, Planning, Natural Resources and Engineering Departments, Health Department, Highway Departments (including Mass DOT), etc.

**WATERSHED SAMPLING PLAN**

Nagog Pond is generally a well-mixed reservoir with little significant stratification during the hot summer months and winters where substantial ice cover is present. Based upon decades of water quality monitoring activities, water quality within Nagog Pond is considered to be relatively stable throughout the year. While sample methodologies and strategies have varied and evolved over the years, the current program is summarized below.

**Water Quality Monitoring Plan (Base)**

Sample Location: Raw Water Sample Tap (before any treatment)

<b>Parameter</b>	<b>Frequency</b>
Fecal Coliform Bacteria	As req. by 310 CMR 22.00
Cryptosporidium and Giardia	Monthly
Secondary Contaminants	Monthly
Sodium	Quarterly
Chlorophyll a	Quarterly
Nitrate and Nitrite as N	Quarterly
Total Phosphorus	Quarterly
Inorganic Contaminants	Yearly
Volatile Organic Compounds	Yearly
Synthetic Organic Compounds	Yearly

**Enhanced Water Quality Monitoring**

In the event that any of the General Water Quality parameters measured exceed a Maximum Contaminant Level (MCL) for an unknown reason, grab samples will be taken at the seven locations as noted on Figure 2 to help identify a potential source(s). Sampling parameters will be determined according to the specific exceedance noted.

**Nagog Pond Characterization**

During the warmer months, CPW will attempt to perform a monthly water quality profile of the pond using seven sampling locations (Figure 2), as resources permit. This initiative includes surface and/or depth samples to help characterize Nagog Pond water quality. This data will be evaluated to help identify any potential water quality problems that may have a point source, such as failing septic systems or nutrients from runoff.

Parameters of interests may include:

- ◆ Fecal Coliform Bacteria
- ◆ Specific Conductivity
- ◆ Nitrate and Nitrite as N
- ◆ Total Phosphorus

- Turbidity
- Dissolved Oxygen

### **Wet Weather Characterization**

In an effort to characterize storm water and agricultural inputs, CPW began wet weather cove sampling to establish a dry and wet weather baseline for fecal coliform, nutrients, and turbidity data, beginning in 2014. Data is being collected in the coves close to following locations: Fort Pond Brook, Nagog Hill Farm, Cobb property and Breezy Point

### **WATERSHED PROTECTION AND MANAGEMENT CONTROLS**

CPW has purchased over 89 acres of land within the Nagog Pond watershed and works with other municipal and private land owners to aid in the protection of Nagog Pond water quality. For all intents and purpose, potential changes in land-use activities are negligible, as the watershed has effectively reached build-out. CPW has not purchased any new land for several decades.

### **Watershed Control**

Currently, CPW owns 19% of the land in the Nagog Pond watershed and 41% of the land in the Nagog Pond Zone A.

CPW works closely with land owners within the watershed, and specifically within the Nagog Pond Zone A, in regards to land management. When a property is on the market, CPW communicate with residents to express our interest in the outright purchase of a property or the purchase of a conservation restriction, which limits the future use and development of the parcel to protect Nagog Pond water quality.

Currently, the land that CPW owns is being protected and there are no plans for development or sale of this land.

### **Municipal Land Use Improvements**

CPW works closely with the towns of Littleton and Acton, as well as with Mass DOT, to evaluate opportunities to improve local road and shore conditions.

### **Public Access and Recreation Controls**

Land owned and controlled by CPW is posted with signage which reads, 'No Trespassing – Public Water Supply'. These signs are located at key locations on existing trails and around the shore where public access is prohibited (Figure 2). These signs are used for public awareness, deterrents and when required, to support enforcement actions.

Daily watershed inspections take place year round. The level and depth of inspection varies according to the weather, season, and time of day. A watershed inspection log is kept by CPW staff.

### **Wildlife Management**

Please reference: Wildlife Impacts/Management.

### **In-Lake Management**

Please reference: Nagog Pond Characterization.

CPW is working with the Concord Natural Resources Department to identify potential invasive plants within the pond and watershed. This survey will evaluate the need to develop an aquatic plant management plan.

## **REGULATORY CONTROLS**

### **State and Federal**

CPW makes its best effort to comply with all State and Federal water supply protection regulations.

Massachusetts General Law, CHAPTER 266, Section 123A, makes trespassing on water supply lands a criminal offence and provides the mechanism to fine or imprison violators.

*Section 123A. (a) Whoever willfully trespasses upon any public source of water or public water supply facilities or land after having been forbidden to do so by a person who has lawful control of the water, facilities or land, or an agent of such a person, whether directly or by notice posted on such water supply facility or land, shall be punished by a fine of not less than \$250 nor more than \$1,000.*

*(b) Whoever commits any offense described in subsection (a) with the intent to corrupt, pollute or defile such public source of water shall be punished by a fine of not less than \$1,000 nor more than \$5,000 or by imprisonment in the house of correction for not more than 2 years or in state prison for not more than 5 years or by both such fine and imprisonment. Whoever is convicted of a second or subsequent violation of this subsection shall be punished by a fine of not less than \$1,000 nor more than \$10,000 or by imprisonment in state prison for not less than 5 years nor more than 10 years or by both such fine and imprisonment.*

*(c) In addition to the punishments outlined in subsections (a) and (b), restitution in the amount of costs associated with water quality analysis and any subsequent investigation to determine water safety and security of the facilities or land may be ordered by a court after a hearing relative to such restitution.*

*(d) A law enforcement officer may arrest, without a warrant, any person that the officer has probable cause to believe has violated this section.*

## **Local**

Neither Acton nor Littleton has a surface water supply protection bylaw in place because they obtain their drinking water supply from groundwater sources located in different watersheds. Written requests to incorporate surface water supply protection measures in support of Concord's Nagog Pond protection strategy have been made without success.

## **EMERGENCY PLANNING**

CPW has a working Emergency Response Plan (ERP) that is updated annually and has worked with Pare Corporation to develop an Emergency Action Plan as an Appendix to this ERP that focuses on imminent failure of the Nagog Pond Dam.

Coordination with Acton and Littleton First Responders along with the State Police will be done on an as-needed basis and as time permits to discuss potential Nagog Pond watershed and dam issues and/or emergencies.

Mass DOT has made upgrades to the infrastructure along Great Road to prevent automobile accidents from having a negative impact on Nagog Pond. These upgrades include the following:

- ◆ Catch basins direct water and any potential spills away from Nagog Pond
- ◆ Reinforced guardrail/guiderail – Supports have been placed every 2 feet as opposed to the standard of every 4 feet.

## **EDUCATION**

Please Reference section entitled "Public Education/Awareness"

## **STAFFING**

All CPW staff assists with the implementation of the Nagog Pond Watershed Resource Protection Plan to varying degrees. The following is a list of the various job titles and how each position assists with Nagog Pond.

### **Water/Sewer Superintendent (full time)**

Responsible for all aspects of Nagog Pond Watershed Protection Planning efforts

### **Environmental and Regulatory Coordinator (full time)**

Maintains Nagog Pond Watershed Resource Protection Plan

Monthly dam inspection

Water quality sample collection and data analysis

### **Public Works Supervisor (full time)**

Supports watershed sampling, management and inspection initiatives

### **Water Systems Operator (full time)**

Daily Nagog Pond watershed inspection on routine site visits

**Watershed Ambassador (part time)**  
Off-hour surveillance and outreach.

**Nagog Pond Caretaker**

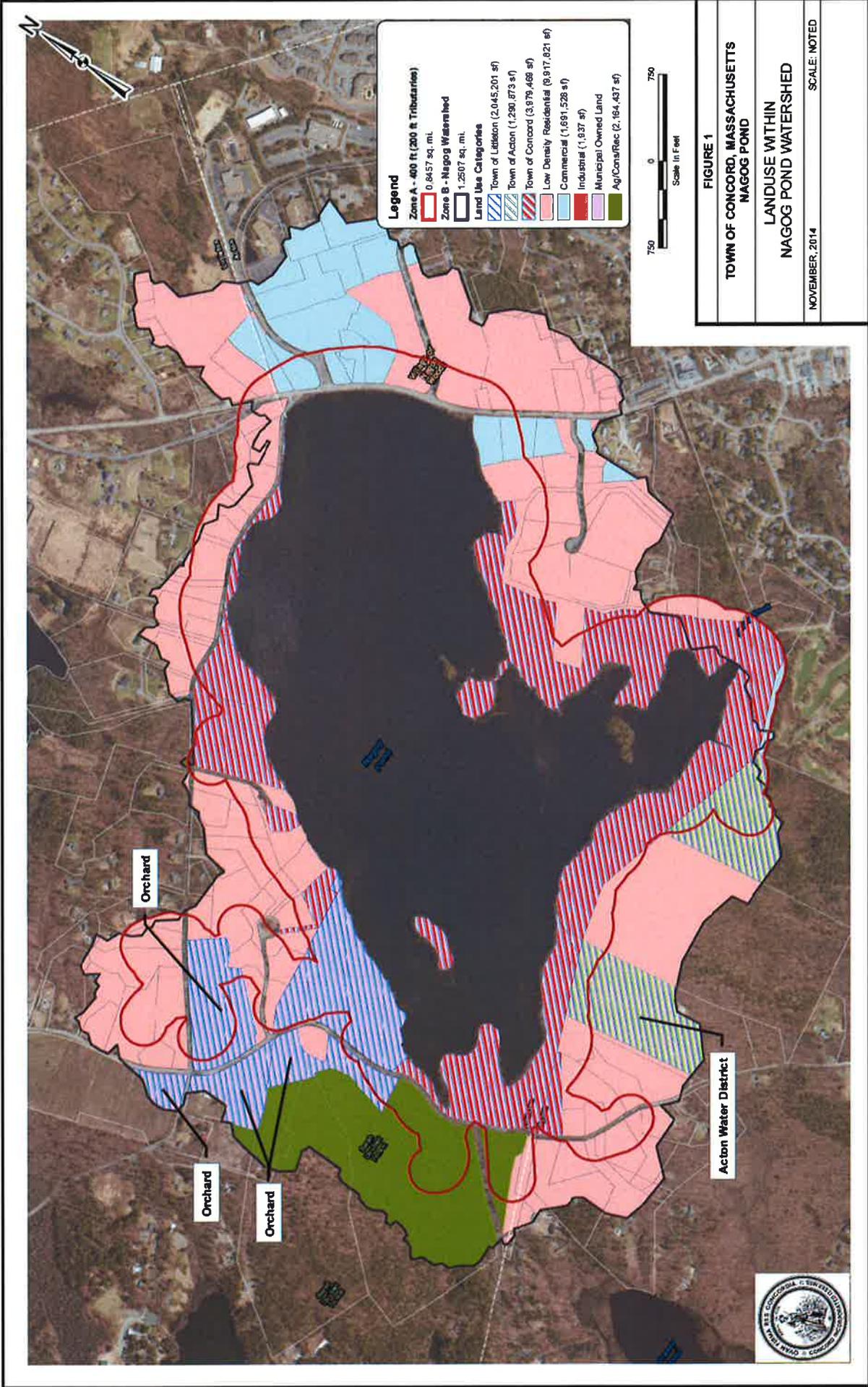
One individual that lives on Nagog Pond serves as a watchful eye over the pond

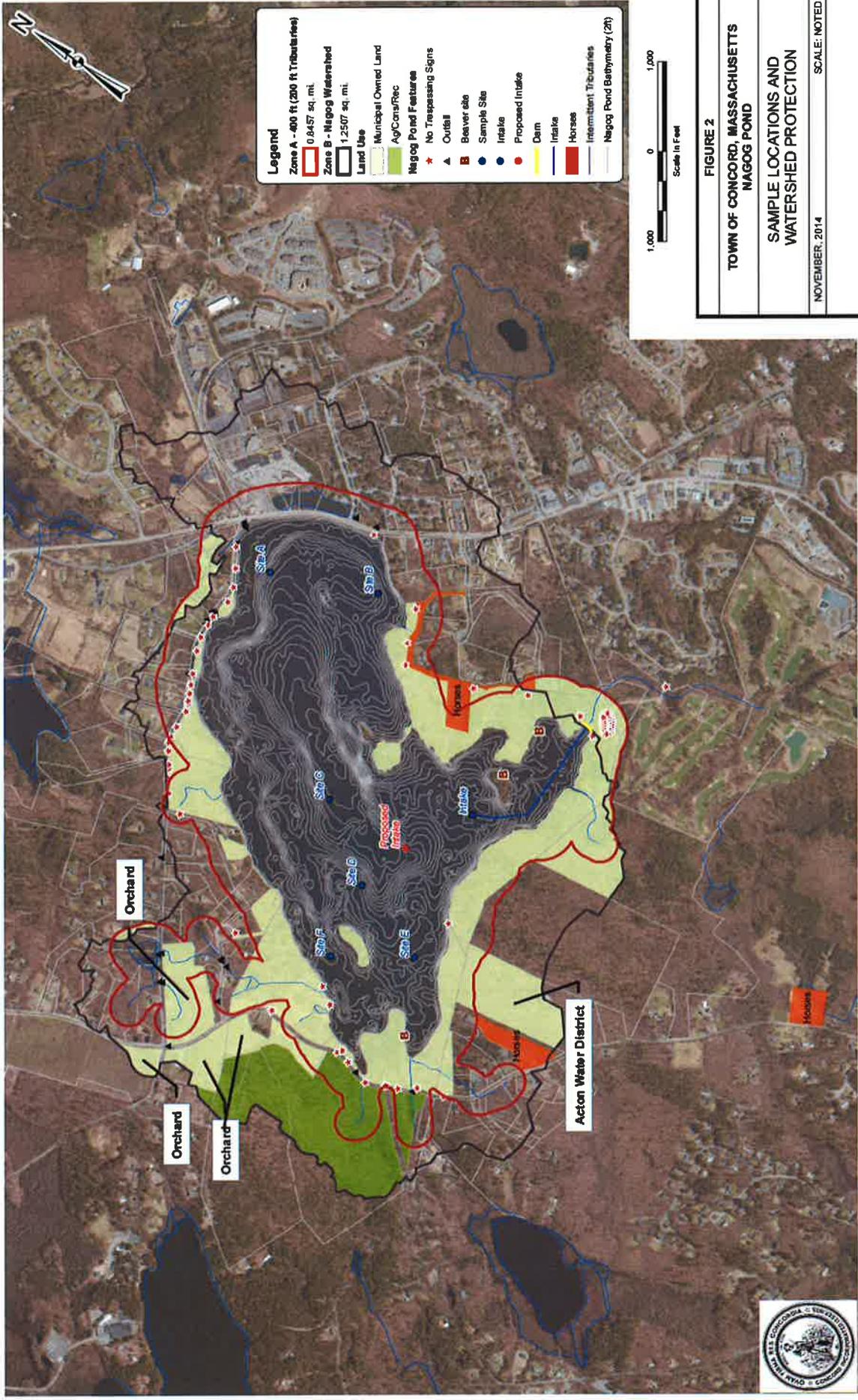
This individual is authorized by CPW to perform the following duties;

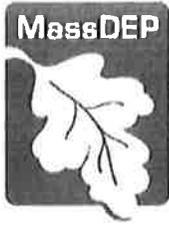
- ◆ Event initiated patrol of pond (to respond to or assess unauthorized activity)
- ◆ Watchman of CPW watershed protection equipment (including motor boat, fuel, life-vests, sample equipment, etc.)

**NAGOG POND WATERSHED RESOURCE PROTECTION PLAN UPDATES**

The Nagog Pond Watershed Resource Protection Plan shall be updated at a minimum of every three years per MassDEP Guidance: Developing a Local Surface Water Supply Protection Plan.







Commonwealth of Massachusetts  
Executive Office of Energy & Environmental Affairs

## Department of Environmental Protection

One Winter Street Boston, MA 02108 • 617-292-5500

Charles D. Baker  
Governor

Karyn E. Polito  
Lieutenant Governor

Matthew A. Beaton  
Secretary

Martin Suuberg  
Commissioner

February 27, 2015

Alan Cathcart, Superintendent  
Water & Sewer Division  
Town of Concord  
135 Keyes Road  
Concord, MA 01742

RE: Approval of Watershed Resource Protection Plan Update for Nagog Pond

Dear Mr. Cathcart:

Thank you for submitting the Watershed Resource Protection Plan updates for Nagog Pond. I have reviewed the content and would like to commend you and your staff on the many programs that you implement to protect Nagog Pond. The stormwater improvements and your collaboration with so many entities to achieve source water protection are impressive.

Sincerely,

Kathy Romero  
Drinking Water Program

cc: Tom Mahin, Drinking Water Program Chief, MassDEP NERO

file name: Y:DWP Archive\Boston\Concord Water Department -- PWS ID #3067000 - Source Protection -- Protection Plan -- 2015-02-27

The Commonwealth of Massachusetts  
Department of Environmental Protection  
Drinking Water Program



2015

*Public Water System Award*

is presented to

Concord Water Department

PWS ID #3067000

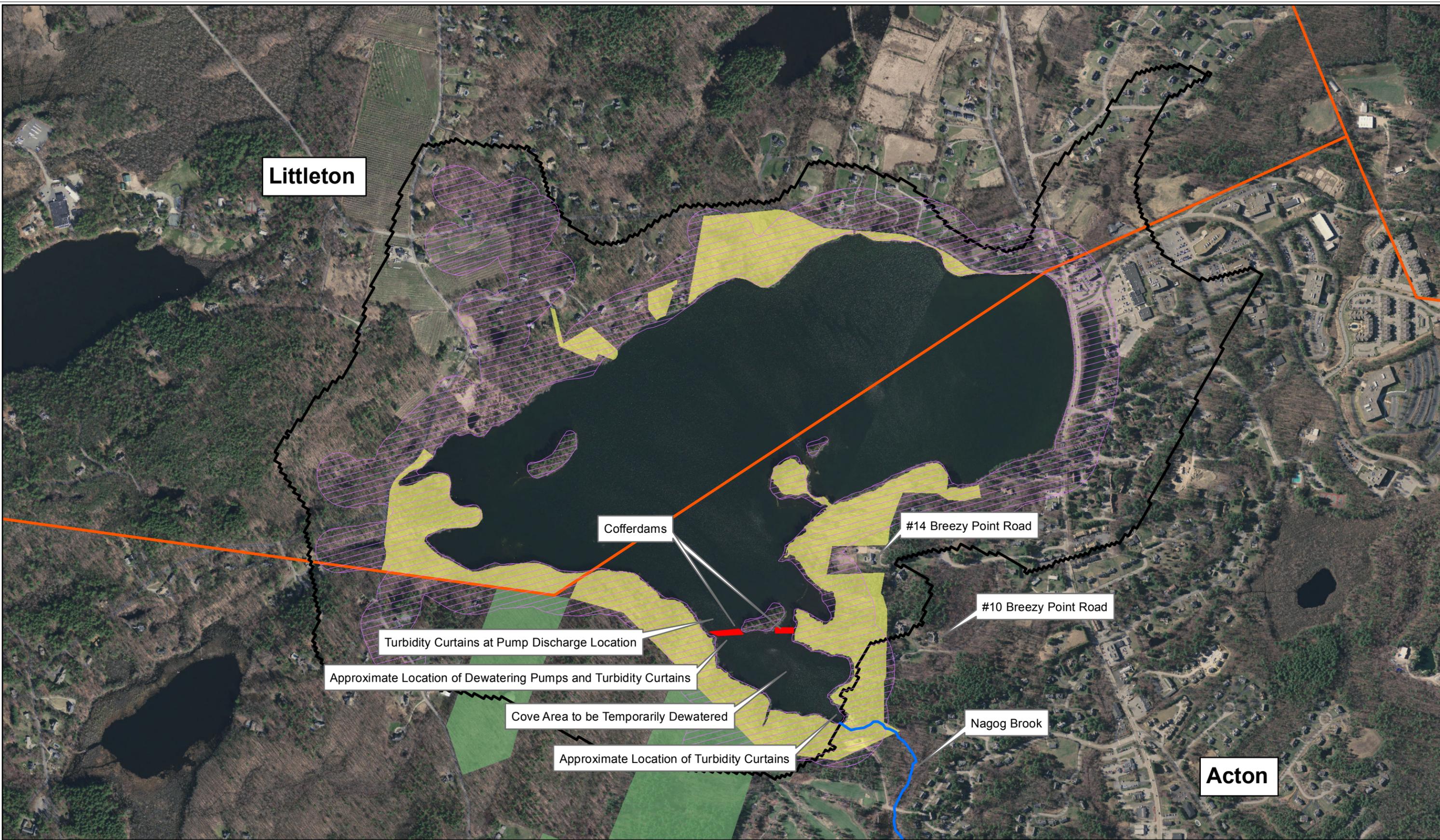
For Outstanding Performance  
and Achievement in 2014.

A handwritten signature in blue ink, appearing to read "Yvette dePeiza".

Yvette dePeiza - Program Director  
MassDEP Drinking Water Program

---

*Attachment C*  
*Figure 1 – Nagog Pond Watershed*



Littleton

Acton

Cofferdams

#14 Breezy Point Road

#10 Breezy Point Road

Turbidity Curtains at Pump Discharge Location

Approximate Location of Dewatering Pumps and Turbidity Curtains

Cove Area to be Temporarily Dewatered

Approximate Location of Turbidity Curtains

Nagog Brook

0 400 800 1,600 2,400 Feet

1 in = 800 feet

**Environmental Partners**  
A partnership for engineering solutions. GROUP

**Legend**

- Watershed
- Town of Concord Property
- Town Border
- Zone A
- Town of Acton Property



**Figure 1**  
**Nagog Pond Watershed**  
**Town of Concord, MA**  
**January 2016**