

**NUTRIENT MANAGEMENT STUDY REPORT
PURSUANT TO SPECIAL CONDITION I(A)(G) OF
GROUNDWATER DISCHARGE PERMIT NO. SE #2-24**

There are 2 Attachments [#1](#) and [#2](#)

Introduction

The Edgartown Wastewater Commission (the “Commission”) submits this Nutrient Management Study Report to comply with Special Condition I(A)(g) of Groundwater Discharge Permit No. SE #2-24 (the “Permit”). The Permit was issued on March 5, 1999 to the Commission by the Massachusetts Department of Environmental Protection (“DEP”), to authorize the discharge of treated effluent from the wastewater treatment facility located on West Tisbury Road in Edgartown, Massachusetts (the “Facility”), for the period from April 5, 1999 to April 5, 2004.

Special Condition I(A)(g) of the Permit provides as follows:

Using information from the 604(b)(3) study and other sources, the town will prepare a nutrient management study to recommend a long-term strategy for the allocation of nitrogen from the various sources in the Edgartown Great Pond watershed. Included in this study will be a discussion of pond management alternatives to mitigate nitrogen loading impacts.

The full title of the referenced 604(b)(3) study is the “Edgartown Great Pond: Nutrient Loading and Recommended Management Program, 1996-1998” (the “604(b) Study”). That study, which is dated March 1999, was prepared by the Martha’s Vineyard Commission pursuant to Grant #96-04/604, and is sometimes referred to as the “Wilcox Report,” after its principal author, William M. Wilcox. As directed by DEP, the Commission has used that study and other available information to prepare this document.

Executive Summary

Since the issuance of the Permit (as well as previously), the Town of Edgartown, including the Commission, has taken significant steps aimed at protecting and improving the health of Edgartown Great Pond (the “Pond”). In particular, the Town, including the Commission, has sought to identify and implement appropriate ways to reduce and mitigate the impacts of new and ongoing nitrogen loadings to the Pond from various nitrogen sources within the Pond watershed. Based on these ongoing efforts, and for the purposes of fulfilling the requirements of Special Condition I(A)(g) of the Permit, the Commission recommends and reports on each of the following:

- The participation in and funding of the Massachusetts Estuaries Program, a major, long-term study that will collect data, develop nitrogen loading limits and develop site-specific models for the management of water quality within the Pond. (Through this effort, which is ongoing, the Commission believes that the Town will best be able to fulfill the goals of determining an appropriate long-term strategy for the allocation of nitrogen from various sources within the Edgartown Great Pond watershed, and selecting those pond management alternatives that will most effectively mitigate nitrogen loading impacts to the Pond.)
- The continued development and implementation of plans for the periodic breaching and dredging of the Pond.
- The appropriate use of the sluiceway connecting the Pond to Crackatuxet Cove.
- The ongoing management of shellfish resources within the Pond.

- The retention of adequate capacity to provide sewerage connections to 300 homes within the Pond watershed.
- The ongoing review and consideration of potential revisions to pertinent Town bylaws and other existing restrictions that impact the risks of excess nitrogen loadings to the Pond.
- The ongoing management of land use within the Pond watershed.

Each of these efforts is discussed in more detail below.

Background

In 1996, the DEP issued an interim two-year groundwater discharge permit to the Commission, authorizing the discharge of treated effluent from the then-newly constructed upgrade of the Town's wastewater treatment plant (the "Facility"). At that time, the Commission and the DEP jointly agreed on an interim two-year permit because the Martha's Vineyard Commission was planning to perform an independent study of the sources and effects of nitrogen discharges within the Pond watershed (the above-referenced 604(b) Study). Both the Commission and the DEP wanted the benefit of that additional data before finalizing the permit. The 604(b) Study was completed and issued in March of 1999, and the currently effective Permit was issued on March 5, 1999.

It is important to note that all of the recommendations presented herein are based upon and build upon the most fundamental and significant action that the Commission and the Town could take -- and have already taken -- to reduce nitrogen loadings to the Pond. That action, of course, was the planning, designing, and constructing a massive upgrade to the original plant. The Facility upgrade required a massive investment by the Town's taxpayers, totaling over \$13,250,000, in state-of-the-art wastewater treatment

technology. The upgraded Facility provides advanced tertiary treatment of the wastewater, which, unlike the technology utilized in the original plant design, removes nitrogen and/or phosphorous from the wastewater, in addition to reducing biochemical oxygen demand (“BOD”) and suspended solids. With the upgrade, for the first time, the Commission is able to reduce significantly the concentration of nitrate-nitrogen in the treated water exiting the system. In addition, the upgrade involved the improvement and expansion of the Town’s existing sewage collection system, including the modification and replacement of pumping stations, the construction of new pumping stations, and the installation of several miles of sewers, force mains, and replacement sewers.

The upgraded Facility went on-line in 1996 and has operated exceptionally well to date. Tests of the Facility’s effluent reveal that nitrate-nitrogen levels have consistently remained well below both design expectations and the Facility’s operational goal of 5 mg/l. The Facility consistently discharges effluent that is cleaner and of higher quality than DEP and EPA require. Indeed, with respect to nitrates, the effluent from the Facility tests cleaner than many brand-name bottled waters, such as Evian and Perrier, according to the information contained on the bottle labels for those waters. In recognition of the Facility’s outstanding performance, both the EPA and the Commonwealth of Massachusetts have bestowed awards upon the Facility.

At a fundamental level, the upgrade project constituted a major mitigation of the environmental impacts of nitrogen loadings resulting from the ongoing generation of wastewater by the Town and its occupants. The long-term strategy recommendations contained herein, therefore, necessarily entail proposals that are less dramatic and ambitious in scope than the Facility upgrade. Like the Facility upgrade, however, all of

these recommendations are aimed at reducing and/or mitigating the impacts of the overall nitrogen loadings to the Pond.

Strategy Recommendations

A. The Massachusetts Estuaries Project.

Numerous scientific uncertainties currently exist with respect to the Edgartown Great Pond and the various management options that might be considered for controlling and managing nutrient loadings within the Pond watershed. For that reason, ongoing study and updated research is a necessary requirement of any effective long-term strategy aimed at restoring, protecting and enhancing the Pond's health and environmental condition. Indeed, additional research was expressly recommended by the 604(b) Study.

Toward that end, the Town is currently participating in the Massachusetts Estuaries Project (the "Estuaries Project"), which is a collaborative effort between the DEP and the University of Massachusetts School of Marine Science and Technology. The Estuaries Project is a six-year, multi-million dollar program that will study and model systems for the management of nitrogen within the 89 embayment systems that comprise the coastline of southeastern Massachusetts. The goal of the project, for the Edgartown Great Pond and each of the other southeastern Massachusetts coastal embayments that are under study, is to identify all of the factors specific to that estuary that cause excessive nitrogen loading. A written summary of the project (a copy of which is attached to this document), explains as follows:

The technical assessment of individual estuaries' potential for assimilating nutrients (primarily nitrogen from human wastewater) is the critical first step of a municipal planning process that culminates in watershed/nutrient management plans. Based on the assimilative capacities (nutrient threshold) of a coastal system, a multitude of infrastructure

and management approaches are recommended to Town Managers. The planning and engineering components of this process are made clearer, more manageable and far more cost effective via the estuaries Project approach.

The Estuaries Project seeks to identify the geographic area contributing nutrients to the Edgartown Great Pond, to determine the Pond's nutrient sources and the nutrient load, and to calculate how great a nutrient load the Pond can tolerate without dramatically changing its character. It is designed to provide water quality, nutrient loading and hydrodynamic information for the Pond, and models that will predict the water quality changes that may result from land use management decisions. Significantly, the Estuaries Project uses a state-of-the-art approach that has been reviewed extensively and approved by both state and federal environmental regulatory agencies.

The work of the Estuaries Project will include further analysis of the Pond's water chemistry, sediment core collection, tidal circulation study and numerical computer modeling to produce a Total Maximum Daily Load ("TMDL") of nitrogen for the Pond that is compatible with the maintenance of water quality. Once the model has been calibrated and validated to existing conditions in the Pond, it will serve as a powerful management tool to evaluate different nitrogen loading scenarios and to test various nitrogen management alternatives, to determine which will be the most effective and least burdensome.

The work product concerning the Edgartown Great Pond that is to be generated by the Estuaries Project is expected to include the following:

- watershed delineation, based upon the new USGS West Cape Model;
- validation of the watershed area and discharge based upon measured stream discharges;

- nitrogen loads to each embayment (and selected sub-embayments) from its associated watershed (includes term for natural attenuation during transport) and nitrogen recycling from the bay bottom;
- assessment of current and historical trends in nutrient related health of each sub-embayment, based upon D.O., benthic animals, macroalgae, and eelgrass coverage;
- hydrodynamic analysis of each system, including circulation, volumetric exchange and analysis of the potential for enhancement of flushing;
- water quality model (validated) which maps the nitrogen distribution throughout each estuary under:
 - present conditions;
 - build-out of watershed;
 - increased tidal exchange (if possible);
 - no anthropogenic nitrogen input from watershed;
 - nitrogen source relocation, restoration of tidal restricted wetland, or other, as appropriate;
- critical nitrogen load for each sub-embayment (pounds per embayment) for wastewater planning; and
- implementation guidance from DEP indicating new (and old) approaches for achieving nitrogen reductions (as needed).

In part because of the extensive data about the Edgartown Great Pond that has already been gathered, via the 604(b) Study and otherwise, the Pond was chosen to be

among the first water bodies analyzed by the Estuaries Project. The Town of Edgartown has already committed funding to the project, and supplied the requisite three years of water quality monitoring data that is being used as the baseline data for the assessment of the Edgartown Great Pond. It is the Commission's understanding that the Estuaries Project team has also completed its own additional data-gathering at the Pond, and is working on a report that is expected to be ready by the summer of 2004.

The Commission expects that the work of the Estuaries Project will significantly enhance the Town's ability to make future decisions with respect to nutrient management for the Pond. The Commission considers this work to be the fundamental component of a sound long-term strategy for managing the nitrogen sources within the Pond watershed, and managing the Pond so as to mitigate the adverse impacts of excess nitrogen loadings.

B. Breaching and Dredging of the Pond.

One way of optimizing the water quality in the Edgartown Great Pond is to work towards reducing the discharge of nitrogen into the Pond watershed. Another complementary approach is to work towards enhancing the ability of the Pond to absorb and/or flush out the nitrogen that does reach its waters. In terms of the latter approach, the Commission recommends that the Town continue its periodic breaching of the Pond, in accordance with the master plan for dredging work established by the Dredge Advisory Committee.

As noted in the 604(b) Study, the Pond is breached to the Atlantic Ocean by excavating a trench through the barrier beach at intervals of about three months. The breaching has the effect of allowing an exchange of water in the Pond with the water in the ocean. This practice has been a routine part of management practice in support of the

control and enhancement of the shellfisheries within the Pond, according to a 1998 report by Arthur G. Gaines, Jr., Ph.D., “Nutrient Loading Limits of Edgartown Great Pond, Edgartown, Massachusetts.” (See Gaines Report, page 7.) Dr. Gaines expressed concern that “[p]resent practice in opening the Pond is inadequate to ensure sufficient flushing to manage salinity level, or to remove significant quantities of nitrogen from the Pond.” (*Id.*) He recommended that good management of the Pond should include, among other things, “enhanced flushing of the Pond.” (*Id.* at 36.)

William Wilcox, in the 604(b) Study, also recommended increasing the water exchange during openings of the Pond to the ocean, and identified this as one of the “primary options to improve pond capability to handle nitrogen loading.” (604(b) Study, Executive Summary at ii.) According to Mr. Wilcox, “Once the pond level has been lowered, it is important for the opening to persist long enough to remove enough nitrogen to the ocean so that pond impacts are minimized.” (*Id.* at 2.) Thus, the 604(b) Study recommended that steps be taken to allow the Pond to remain open to the ocean after each breaching event, to allow for a longer and more thorough flushing period, and the removal of additional quantities of nitrogen from the Pond.

According to research by Dr. Gaines, an opening of the Pond to the ocean for 12 days is necessary to allow for 90% of the Pond water to be exchanged with ocean water. (604(b) Study at 2 and 77, citing Gaines (1993).) In the mid-1990s, according to research by Mr. Wilcox, the Pond openings typically lasted for about one week. (*Id.*, citing Wilcox (1997).) Since the 604(b) Study and the issuance of DEP’s 1999 groundwater discharge permit to the Commission, the Town has made a substantial and concerted effort to accomplish the recommended longer openings of the Pond to the

ocean. Specifically, under the guidance of the Town's Dredge Advisory Committee, the Pond inlet (the tidal delta) was dredged in 2001, as part of a five-year Dredging Master Plan. This dredging effort proved to be very successful, and led to a 77-day opening of the Pond between April 3rd and June 20th of 2001.

Notably, the benefits of the dredging work on the Pond's inlet, in terms of increasing the average length of the Pond openings, are continuing. In the spring of 2002, the Pond was opened on April 5th and remained open until April 21st (16 days). It was opened again on November 26th and remained open until December 1st (5 days). In the spring of 2003, the Pond was opened on March 18th and remained open until April 9th (22 days). It was opened again on June 14th and remained open until July 23d (39 days). Thus, the Town's program for periodically dredging the Pond's inlet has proven to be an effective and important part of the overall management of the Pond in a manner that is expected to reduce the Pond's nitrogen levels.

In 2001, Town's Dredge Advisory Committee completed a new five-year master plan for the dredging program, which included returning to the Pond for periodic additional dredging. This work is ongoing; as of early January 2004, maintenance dredging of the Pond's opening channel was just being completed. The Commission recommends that the Town's dredging program, in conjunction with the breaching of the Pond, be actively continued, in order to manage and reduce nitrogen levels in the Pond.

C. The Sluiceway Between the Pond and Crackatuxet Cove.

In March of 2003, the reconstruction of a permanent cement sluiceway to connect the Edgartown Great Pond to Crackatuxet Cove, an adjacent coastal pond, was completed. The sluiceway enables the Pond's water table to be maintained at a height

sufficient to allow for the breaching of the Pond to the ocean, while also allowing for the Pond to be drained when required by weather conditions. The sluiceway was in place for the June 2003 Pond opening and so, despite heavy rainfall, Town authorities were able to wait for appropriate weather to breach the Pond.

This sluiceway revitalization is one of the nutrient management options that was recommended by the 604(b) Study. The reconstructed sluiceway provides a new management tool that may be used in the future to help reduce nitrogen levels in the Pond's waters. Specifically, the ability to calibrate and adjust the water levels in the Pond, in relation to Crackatuxet Cove, may be used in planning the timing of future Pond openings, to allow Pond openings to be accomplished at times when they might reduce nitrogen levels most effectively. Similarly, the sluiceway may be used to calibrate limited drops in the depth of the Pond's water table, which breaching alone cannot accomplish.

While the potential benefits of this new Pond management tool have not yet been fully realized, the Commission recommends that the new sluiceway be considered not only for its obvious use of maintaining the Pond's water table and salinity at optimum levels, but also as a possible aid to future efforts aimed at reducing nitrogen levels within the Pond.

D. Management of Shellfish Resources Within the Pond.

Among the recommendations set forth in the 604(b) Study for improving the Edgartown Great Pond's ability to handle nitrogen loadings is the restoration of shellfishery within the Pond. (604(b) Study, Exec. Summary of ii.) For many years, the Town's Shellfish Department has been working to do just that. The link between

shellfish and nitrogen reduction, as explained in the 604(b) Study, is the natural food chain. Nutrients, including nitrogen, pass from soluble form to phytoplankton, to the zooplankton which graze on them, to shellfish which filter them out of the water column. Shellfish (and other fish), which are the “nutrient end products,” can then be harvested and thereby removed from the Pond. (604(b) Study at 79.) In short, cultivating a viable shellfishery in the Pond is an organic method of reducing the nitrogen in the Pond’s water.

It is not, however, a simple or problem-free method. “Dermo,” a parasitic protozoan that attacks oysters, continues to be a problem in the Edgartown Great Pond. In 2002, the Town’s Shellfish Department and other groups concluded a two-year study utilizing cultured oysters in the Pond, and found significant mortality from these populations of oysters. The Shellfish Department continues to pursue monitoring, studies and management efforts to address the dermo problem, and other issues affecting shellfish resources within the Pond.¹

In recent years, there have been some improvements and encouraging accomplishments with respect to the Pond’s shellfishery. For example, the dredging work described above, by allowing for extended openings of the Pond to the ocean, promises to increase the salinity of the Pond’s waters. This is expected to enhance the health and productivity of the shellfish population within the Pond.

¹ For example, surveys of the low populations of eelgrass in numerous ponds, including Edgartown Great Pond, are ongoing, and in 2001, the Shellfish Department assisted William Wilcox with an eelgrass transplant project, in which eelgrass was taken from outside Eel Pond and successfully transplanted to Edgartown Great Pond.

Indeed, state officials have recognized the efforts and progress made by the Town to improve and enhance the shellfishery in the Pond. In August of 2003, Secretary Ellen Roy Herzfelder of the Executive Office of Environmental Affairs visited the shores of the Pond and formally announced the reopening of the Pond to shellfishing.

Secretary Herzfelder praised the efforts of the Town and the others to improve the water quality in the Pond, particularly by means of the Facility upgrade, in addition to dredging, revitalizing the sluiceway, and participating in the Estuaries Project.

The Commission recommends that the Town's Shellfish Department continue its efforts to maintain and enhance the shellfishery in the Edgartown Great Pond.² Likely, the ongoing programs for breaching and dredging the Pond will continue to be important to the success of these efforts.

E. Retention of Capacity to Sewer Homes Within the Watershed.

The 604(b) Study recommended that the Commission retain the capacity to collection, and process through the Facility, the wastewater from 300 houses within the recharge area (the Pond watershed). (604(b) Study at iii and 93.) The Commission has retained that capacity to date, as recommended.³ In addition, in June of 2001, the Commission established sewerage connections to serve a 238-acre golf club facility

² The 604(b) Study also outlined, as an option for improving the Pond's capability to handle nitrogen loading, efforts to boost the population of anadromous fish, such as alewives, within the Pond. The ecological role of alewives is quite complicated, however, and some studies have concluded that alewives are net importers of nutrients to the ponds which they spawn. Given the complexities and apparent uncertainties on this point, the Commission does not at this time make a specific recommendation regarding alewives or other anadromous fish.

³ Significantly, the 604(b) Study did *not* recommend that the Commission take immediate steps to connect 300 homes within the Pond watershed to the Facility. Rather, the 604(b) Study suggested that "[o]nce loading and loading limits are clear either connect 300 houses to the Treatment Plant *or use the capacity as needed elsewhere.*" (604(b) Study, Exec. Summary at page iii (emphasis added).)

within the watershed, and thereby substantially reduced the nitrogen loadings to the Pond that would otherwise result from the use of that property, as developed. The Commission estimates that when the golf course facility has been fully built out as planned, approximately 94% of the total annual nitrogen loadings that would otherwise be deposited from the golf club property (if septic systems were used) into the Pond watershed will have been eliminated, as a result of this sewerage connection. This reflects an estimated reduction, by approximately 115 kilograms per year, of the nitrogen that would otherwise be deposited into the Pond watershed from that property.

F. Revisions to Pertinent Town Bylaws and Regulations.

Many options for improving the management and mitigation of nitrogen loading impacts to the Pond can only be accomplished through additions and amendments to existing Town bylaws and regulations. Accordingly, the Commission recommends that ongoing consideration be given to the presentation of appropriate proposed amendments, through the submission of articles to the Annual Town Meeting warrant.

Recently, changes were made to Town bylaws and regulations that enhance the protection of the Pond. For example, the Town voted to amend the Pond Advisory Committee's duties to provide that the Committee shall function as a Site Review Committee for the Conservation Commission. This new role will enable the Committee to help guide new and existing property owners as they develop their building and land use plans. Among the considerations that the Committee will weigh in its review process are the size of the lot, the placement of the structure on the lot (*i.e.*, how far back from the Pond it will be), and the number of linear feet of the structure that will be exposed to the Pond and public view.

A second change designed to protect the Pond is the recent amendment of the zoning bylaws for the Edgartown Ponds Area District, to prohibit the use within “Zone 3” of synthetic products, such as fertilizers, herbicides, fungicides, insecticides, nematicides, rodenticides and/or other quick release chemicals. This amendment extends the ban on inorganic fertilizers and other chemicals, which previously applied only to land within 300 feet of the Pond, to include land that lies up to 700 feet from the Pond, as well.

As noted in the 604(b) Study, there are additional possibilities for Town regulation aimed at controlling nitrogen discharges to the Pond, via new requirements potentially to be imposed by the Planning Board, the Board of Health, the Conservation Commission and/or otherwise. The Wastewater Commission supports and recommends the ongoing consideration of potential changes in pertinent Town bylaws and other regulations to accomplish this goal. In particular, the Commission recommends that continued consideration be given to the possibility of new regulations aimed at requiring or providing additional incentives for the use of enhanced denitrifying septic systems and other advanced on-lot treatments of wastewater, particularly for year-round homes within the Edgartown Ponds Area District. Further, the Commission is supportive of efforts to limit the size of managed lawns within the Pond District.

The Commission also recognizes that private efforts are vital to the effective protection of the Pond. For example, in 2002, the Great Pond Foundation published its second information pamphlet, entitled “Making the Case of Nitrogen Reduction in the Edgartown Great Pond Watershed,” which was widely distributed to those within the watershed. Such educational efforts, as well as critical funding support for numerous projects, including the above-described Estuaries Project, are essential to the overall

effort, shared by the Town and many others, to protect the Pond. The Commission recommends that these and various other important efforts by private organizations and individuals be encouraged and supported, wherever appropriate.

G. Land Use Management Within the Watershed.

The 604(b) Study included a comprehensive build-out analysis of the Edgartown Great Pond watershed. To date, that analysis remains the most current and complete study of the build-out potential, and the corresponding potential nitrogen loadings, within the watershed. The ongoing work of the above-referenced Estuaries Project, however, is expected soon to update and supplant the build-out analysis contained in the 604(b) Study. At that point, more refined calculations can be made, and more refined land use management options can be developed on the basis of the updated information.

In the meantime, the Commission recommends that the Town continue to give consideration to potential acquisitions of open space within the Pond watershed for conservation purposes, where and when feasible. In 1998, for example, the Town acquired over 188 acres of vacant land, of which approximately one-third is estimated to lie within the Edgartown Great Pond watershed. Of the portion of that land within the watershed, approximately three-quarters was made subject to a conservation restriction, thereby creating the third-largest land bank reservation on Martha's Vineyard. As a result, substantial acreage within the watershed was permanently protected from development, and the total potential for nitrogen loadings to the Pond was reduced.

The Commission recognizes that feasible and affordable opportunities to permanently protect large tracts of open space within the Pond watershed will likely be

very few and far between, in the future. Nonetheless, the Commission recommends that the Town continue to be on the lookout for such opportunities.

Conclusion

The Town has already taken a number of critical steps to improve the health of Edgartown Great Pond, and continues to work towards the goal of reducing nitrogen discharges and mitigating the impacts of nitrogen loadings to the Pond. The actions and recommendations outlined in this report, and the ongoing study in the form of the Estuaries Project, represent the Commission's current approach to this goal.

As noted above, the Commission has determined that participation in the Estuaries Project is the most effective and substantial way of satisfying the requirements of Special Condition I(A)(g) of the Permit that call for (a) "a long-term strategy for the allocation of nitrogen from the various sources in the Edgartown Great Pond watershed," and (b) "a discussion of pond management alternatives to mitigate nitrogen loading impacts." That Town has firmly committed itself to the work of the Estuaries Project. Because that work is still being conducted, however, the Commission is not yet in a position to report on the substantive results. In the meantime, the Commission offers the comments and recommendations set forth in this report to satisfy Special Condition I(A)(g) of the Permit.

The Commission welcomes any comments on this report, as well as any assistance that the DEP may offer to support the Town's long-term nitrogen management efforts and to help restore, preserve and enhance Edgartown Great Pond.

Dated: January 23, 2004

Attachment (Summary of Estuaries Project and Project Deliverables)

There are 2 Attachments [#1](#) and [#2](#)