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EXECUTIVE SUMMARY

Like many Cape Cod estuaries, Pleasant Bay (the Bay) is threatened by excessive loading of nitrogen from development within its watershed. While wastewater from on-site septic systems is the primary source of nitrogen loading, the focus of this project is on controlling fertilizer loadings to the Bay, which are an important secondary source of nitrogen within the watershed. Based on a review of the current fertilizer loading information, and an analysis of options to control future loading, an action plan has been developed that has the potential to reduce the overall controllable nitrogen load to the Bay by 5.2%.

This project, funded through a grant to the Pleasant Bay Alliance from the Cape Cod Water Protection Collaborative, has been designed to investigate the following fertilization issues:

- What is the current contribution of nitrogen from fertilizers in the Pleasant Bay watershed and how significant is it in comparison to that provided by wastewater discharges?
- What current regulations exist in the four Pleasant Bay watershed towns (Brewster, Chatham, Harwich, and Orleans) that support the management of fertilizer use?
- Are there examples from other communities around the country that could be considered for use in the Pleasant Bay watershed?
- What specific recommendations should be considered for Pleasant Bay, what issues exist with their implementation, and what credit towards the nitrogen total maximum daily loads (TMDLs) can be achieved for each?

The Horsley Witten Group, Inc. (HW) and Effective Organics began this project with an in-depth review of the current and future nitrogen loadings to Pleasant Bay based on land use analyses conducted by the Massachusetts Estuaries Project (MEP) as part of their development of nitrogen loading limits or Total Maximum Daily Loads (TMDLs) for the Pleasant Bay sub-watershed. TMDLs are critical contaminant or pollutant thresholds that are protective of the habitat within the Bay. The nitrogen TMDLs are currently being used as the target that must be met by towns within the watershed as part of their watershed planning efforts. A significant reduction below current nitrogen loading rates is often needed to meet these TMDLs.

Using the MEP model for Pleasant Bay, HW quantified the current contribution of nitrogen from fertilizers in the Pleasant Bay watershed and how this compares to wastewater contributions. HW reviewed fertilizer assumptions from the model, and resulting nitrogen loading estimates for each of the 95 sub-watersheds to the Bay, as delineated by the MEP model (Figure ES-1).

Fertilizer applications comprise 15.4% of watershed-based, or controllable nitrogen loading to Pleasant Bay. Golf course fertilizers represent the largest controllable source of nitrogen fertilizer input to the Pleasant Bay watershed at 8.3%, with residential lawn fertilizers representing 6.8% of the watershed load. The MEP model estimates that nitrogen loading from residential lawn fertilizer could potentially increase by 40% under residential build-out conditions.

HW compiled existing municipal and regional regulations and policies for fertilizer management from the Pleasant Bay Towns of Brewster, Chatham, Harwich, and Orleans, as well as the latest Cape Cod Commission Regional Policy Plan, and identified performance standards related to fertilizer management. Most of the existing town regulations were developed with the goal of protecting drinking water supplies and other water resources, and are therefore designed to manage nitrogen loading within the wellhead protection areas to the towns' wells (Zone I and Zone II), and within buffers to resource areas. Existing town regulations do not specifically control loading impacts to Pleasant Bay or other coastal estuaries; however towns offer some protection through buffers to wetland resource areas, which could include Pleasant Bay or one of its sub-watersheds. In addition, the town Conservation Commissions take the opportunity to control lawn size and lawn fertilization practices in the issuance of Orders of Conditions for new projects within their jurisdiction. All four towns within the Bay currently require a 50-foot "no disturb" buffer around wetland resource areas. HW recommends that town Conservation Commissions continue to strictly enforce those provisions and also work with property owners seeking Orders of Conditions on existing developed properties to enhance or restore buffers.

HW conducted a review of fertilizer management strategies used by other municipalities across the country to gain insight into practices used elsewhere that may be applicable for use in the Pleasant Bay Watershed. Based on this search, HW identified and evaluated 16 programs for their applicability within the Pleasant Bay watershed towns, including regulatory programs such as model ordinances and bylaws, non-regulatory programs such as education and outreach, and Best Management Practices (BMPs) for fertilizer applications such as organic lawn care, nutrient management, and golf course management.

Based on analyses of the MEP model, existing regulations of Pleasant Bay towns, and fertilizer management practices across the country, HW initially identified 17 strategies that were presented for consideration by the Pleasant Bay Alliance Watershed Work Group. These strategies were then the focus of a detailed discussion at a May 26, 2010 Work Group meeting to select the following six strategies for further analysis:

1. Management strategies to minimize fertilizer applications on municipal properties, athletic fields and parks;
2. Strategies to minimize, to the extent feasible, fertilizer applications on golf courses, as they represent 8.3% of the total controllable nitrogen load to Pleasant Bay;
3. Enforcement of 50-foot no disturb buffers around wetland resource areas, and restoration or enhancement of wetland buffers on existing properties where possible;
4. Outreach and education techniques for year-round residents, second home owners, and landscape professionals to encourage improved fertilizer practices;
5. Training for turf grass managers to encourage fertilizer and landscaping practices to minimize the use of nitrogen; and
6. Regulations to reduce the size of lawns created through future development within the watershed, as fertilizer applications from existing residential development constitutes 6.8% of the controllable load to the Bay.

A summary of the benefits of these recommendations, implementation issues and costs are provided in Table ES-1, and they are discussed in more detail in Section 5 of the report.

Table ES-1. Summary of Fertilizer Management Recommendations

Strategy	Potential Reduction in N Fertilizer Load Leached		Implementation		Long Term Needs	Comments
	Lbs/ Year	% of Current Controllable Load	Needs	Initial Timing		
1. Municipal fertilizer best management practices	200	0.2%	General bylaw or municipal policy	3-6 months	Annual training of municipal staff	This would show the Town plays a leadership role in nutrient management
2. Golf course fertilizer management with targeted nitrogen reduction	3,650	3.5%	Agreement, General bylaw or municipal policy	3-6 months	Town staff time to review golf course fertilizer application data	This would be developed and adapted in consultation with golf course managers and municipal officials
3. Continued enforcement of "No-disturb" buffers	n/a	n/a	Ongoing enforcement of required buffers	3-6 months	Conservation Commission staff time to review applications	This provides an opportunity to improve buffers on existing, developed lots.
4. Public education and outreach	1,560	1.5%	Education and outreach	12 months to start; ongoing after that	Ongoing investment in outreach	This would help build support and consensus for policies, bylaws, and zoning amendment
5. Turfgrass Management Training	n/a	n/a	Develop-ment of training course	3-6 months	Ongoing investment in training professionals	This would help build support and buy-in among professionals
Total (Existing N Load)	**5,410**	**5.2%**				
6. Lawn size limit for new development (future load)	1,333	1.3%[1]	Zoning amendment	3-6 months	Planning Board staff time to review applications for new development	Reductions can be easily calculated, but only apply to new development

[1] *This percentage was calculated based on current loads, because future loads are unknown for the watershed. This strategy addresses future development.*

During the development of these strategies, HW met with Brian Dudley of the Massachusetts Department of Environmental Protection (DEP) to discuss DEP's opinion on how specific approaches to fertilizer management could help reduce nitrogen loading to reach the TMDLs for the embayment system. According to DEP's initial guidance, the strategies must show a direct, verifiable reduction in nitrogen loading for credit to be given towards a particular TMDL. Examples that could be verified include the reduction in lawn area on a property, a restriction in new lawn sizes, or quantifiable changes in fertilizer practices at municipal fields or golf courses. DEP also remains open to discussing how fertilizer reductions achieved through education and outreach could be achieved and quantified. The concept of a pilot outreach program was discussed to evaluate the extent of change in homeowner practices over time. The strategies discussed below take these issues into consideration.

Adoption of the five strategies targeting current nitrogen loading (i.e., the first five listed above and in Table ES-1 could result in an overall nitrogen loading reduction of approximately 5,400 pounds (lbs)/year, which represents 5.2 % of the controllable nitrogen load within the watershed (Table ES-1). In addition, the sixth and last strategy targeting residential lawns for future development could result in reduced nitrogen loads associated with future development.

While these actions, on their own, do not solve the water quality problems experienced in Pleasant Bay, they can play an important role in the overall water quality management of the Bay, driven by the wastewater planning efforts in each watershed town.

1.0 INTRODUCTION

Pleasant Bay is a coastal estuary that, like many on Cape Cod, is threatened by excessive loading of nitrogen from development within its watershed. The primary source of nitrogen within the watershed is wastewater from on-site septic systems. A secondary source is fertilizers applied to lawns, gardens, golf courses, and athletic fields.

This project, funded through a grant to the Pleasant Bay Alliance from the Cape Cod Water Protection Collaborative, has been designed to investigate the following fertilization issues:

- What is the current contribution of nitrogen from fertilizers in the Pleasant Bay Watershed and how significant is it in comparison to that provided by wastewater discharges?
- What current regulations exist in the four Pleasant Bay watershed towns (Brewster, Chatham, Harwich, and Orleans) that support the management of fertilizer use?
- Are there examples from other communities around the country that could be considered for use in the Pleasant Bay watershed?
- What specific recommendations should be considered for Pleasant Bay; what issues exist with their implementation; and what credit towards the Total Maximum Daily Loads (TMDLs) can be achieved for each?

The Massachusetts Estuaries Project (MEP) has conducted a detailed land use assessment to quantify the nitrogen loading to Pleasant Bay (MEP, 2006). In addition, MEP developed a hydrodynamic model to predict the level of nutrient loading that is protective of the habitat within the Bay (MEP model). The critical loads or TMDLs are currently being used as targets that must be met by towns within the watershed as part of their watershed planning efforts. A significant reduction below current loading rates is needed to meet the TMDLs.

The goal of this project is to evaluate how managing fertilizer use within the watershed can contribute to meeting the TMDLs for Pleasant Bay or its sub-watersheds. While wastewater management is the primary approach to meeting the TMDLs, fertilizer management may support these efforts by reducing infrastructure needs of subsequent phases of a respective towns' Comprehensive Wastewater Management Plan (CWMP) implementation, or may provide a viable alternative in limited number of sub-watersheds where the control of fertilizers may be sufficient to meet a TMDL. The sub-watersheds where this will be most effective are those where nitrogen loading is predominately a result of fertilizer use (e.g., golf courses), rather than a combination of fertilizer use and wastewater (e.g., residential properties).

2.0 CURRENT FERTILIZER LOADINGS TO PLEASANT BAY

Based on a review of the MEP model for Pleasant Bay, the Horsley Witten Group Inc. (HW) was able to quantify fertilizer use and associated nitrogen loading for the Pleasant Bay watershed. HW reviewed the loading assumptions used within the model and separated loads by nitrogen fertilizer source, including existing and future residential properties, golf courses, and municipal parcels such as athletic fields and playgrounds. HW also identified three sample sub-watersheds with different land use characteristics to analyze existing nitrogen loads for these watersheds

based on model assumptions, to help document outreach success, and to serve as potential examples for pilot outreach locations (see Appendix A).

2.1 MEP MODEL - LOADING ASSUMPTIONS

The Pleasant Bay MEP model accounts for nitrogen from both controllable sources (i.e., human input) including fertilizers, impervious surfaces, and wastewater (both from septic systems and wastewater treatment facilities), and from sources outside the watershed such as atmospheric deposition on natural areas and water bodies. The MEP model also accounts for nutrient loading attenuation from water bodies. This analysis of the MEP model focuses on fertilizer inputs to the Pleasant Bay sub-watersheds and does not account for attenuation, which potentially occurs for certain sub-watersheds. Assumptions and sources for nitrogen inputs to the Pleasant Bay watershed model are listed below.

It should be noted that the MEP model assumes a 20% leaching rate for fertilizer applications to turf (e.g., lawns and golf courses). A 2008 literature review by Dr. Petrovic, commissioned by the Pleasant Bay Alliance, indicated that a fertilizer leaching rate of 10% for lawns and golf courses is appropriate. A 2009 Massachusetts Department of Environmental Protection (DEP) study, conducted by HW, confirmed that based on Cape Cod soils and other factors, existing literature supports a 20% leaching rate for lawns and golf courses. TMDL estimates are based on the MEP model and its assumptions, and any credit from fertilizer reduction to the Pleasant Bay watershed would likely use similar assumptions. Fertilizer leaching rates were therefore not analyzed as part of this project, and the 20% leaching rate assumption is provided here for reference.

<u>Residential properties</u>

- Fertilized lawn area for transient and non-transient residences (Source: CCC Technical Bulletin 91-001, "Nitrogen Loading"): 5,000 square feet (sq. ft.)
- Nitrogen application to residential lawns (Source: Howes Lawn Survey in Poppy, Three Bay Watersheds): 1.08 pounds (lbs)/1,000 sq. ft.
- Leaching rate for residential applications (Source: Howes Lawn Survey in Poppy, Three Bay Watersheds): 20%

<u>Cranberry bogs</u>

- Area actively used: 85% of parcel
- Nitrogen application (Source: Howes and Teal, 1995): 31 lbs/acre (0.72 lbs/1,000 sq. ft.)
- Leaching rate (Source: Howes and Teal, 1995): 66% (i.e., 34% attenuation)

<u>Municipal Properties</u>

- Nitrogen application to public parks/school properties (Source: CCC Technical Bulletin 91-001, "Nitrogen Loading"): 3 lbs/1,000 sq. ft.
- Leaching rate for municipal applications (Source: Howes): 20%

It should be noted that no fertilizer loads were estimated for municipal properties in the watershed, but the assumptions above were listed in the model. Based on an analysis of aerial photography and MassGIS land use within the Pleasant Bay watershed, HW determined that the

watershed includes approximately 15.4 acres of athletic fields. Assuming that nitrogen is applied to these fields at a rate of 3 lbs/1,000 sq. ft. with a 20% leaching rate, this nitrogen input represents approximately 400 lbs, or 180 kg across the watershed. This estimate does not include other fertilized municipal properties such as "high-visibility" properties for each municipality (e.g., Town Hall or a downtown park).

Commercial properties

No fertilizer loads were estimated for commercial properties in the Pleasant Bay watershed. This is consistent with most, if not all of the other MEP models (Ed Eichner, SMAST personal communication).

Golf courses

The Pleasant Bay watershed includes four major golf courses. The MEP model nitrogen loading assumptions differ for various types of turf and for each golf course. Table 1 summarizes the nitrogen loading applications used for each golf course and turf type as represented in the model. Current golf course practices are discussed in Section 2.3 and for the most part, represent a reduction in fertilization. The model assumes a constant leaching rate for golf courses of 20%; therefore application rates reported in Table 1 should be multiplied by 20% to obtain nitrogen leached for each turf type.

Table 1. Pleasant Bay golf course nitrogen application rates by turf type (Source: MEP model)

Golf Course Name	N Fertilizer Application Rate by Turf Type (lbs/1,000 sq. ft./year)			
	Green	Tee	Fairway	Rough
Cape Cod National Golf Club	4.5	2.25	1.75	2
Captains Golf Course	6	5.5	4.5	4.5
Eastward Ho! Country Club	3	3	3	2
Chatham Seaside Links	3	3	3	2

2.2 MEP MODEL - PLEASANT BAY LOADINGS

Using the Pleasant Bay MEP model, HW calculated nitrogen inputs for existing and future residential lawns, cranberry bogs, cemeteries, and golf courses. HW also estimated this load as a function of the total nitrogen load to the watershed (i.e., controllable sources, and natural and atmospheric sources) and as a function of the controllable sources (i.e., including wastewater and impervious cover runoff). Results of nitrogen applied and leached for each land use are summarized in Table 2 both in lbs and kilograms (kg) per year. Municipal and commercial land uses did not show any fertilizer inputs in the model, and are therefore not reported in Table 2.

Table 2. Pleasant Bay fertilizer loads applied and leached by land use category (Source: MEP model)

Land Use Input	N Fertilizer Applied		N Fertilizer Leached			
	(lbs/yr)	(kg/yr)	(lbs/yr)	(kg/yr)	(% of total in Pleasant Bay)	(% of controllable sources)
Golf course	42,900	19,460	8,580	3,892	4.6%	8.3%
Cranberry bog	705	320	141	64	0.08%	0.14%
Cemetery	1,045	475	209	95	0.11%	0.20%
Residential lawns - existing	35,165	15,950	7,033	3,190	3.8%	6.8%
Total existing	**79,815**	**36,205**	**15,963**	**7,241**	**8.6%**	**15.4%**
Residential lawns - future	13,325	6,045	2,665	1,209	N/A	N/A

Golf courses represent the largest controllable source of nitrogen fertilizer input to the Pleasant Bay watershed. The MEP model estimates that build-out would include an additional 2,468 residential properties for a total residential fertilizer input to the watershed of approximately 13,325 lbs/year or 6,045 kg/year, representing almost a 40% increase in residential fertilizer loads, or almost 3% of the current controllable load to Pleasant Bay. This indicates that new development may represent a significant increase of nitrogen input from fertilizer sources.

2.3 PLEASANT BAY WATERSHED FERTILIZER PRACTICES

HW contacted municipal staff and golf course superintendents to confirm nitrogen loading on municipal properties and golf courses within the watershed.

Municipalities (fields and lawns)

HW contacted municipal staff in charge of lawn care on town-owned properties in each of the four towns, and received information from three towns. These included staff from the Departments of Public Works (DPW), Parks and Recreation, and Parks and Beaches. Overall, most Towns currently only fertilize fields and high-visibility areas (e.g., Town Hall), which are of limited extent within the watershed.

Brewster (Source: Robert Bersin, DPW)
Most municipal land is not fertilized in Brewster. Within the Pleasant Bay watershed, the Town of Brewster only applies fertilizer to fields near Freeman's Way, but applications are limited because the area is within the zone of contribution to a public water supply well.

Chatham (Source: Dan Tobin, Parks and Recreation)
Most municipal land is not fertilized in Chatham. Athletic fields, high school grounds, and areas of a high-use park are the most fertilized areas, with three applications per year (late spring in

mid to late May; late summer in mid to late August, and late fall around Veteran's Day) totaling three lbs nitrogen per 1,000 sq. ft. High-visibility areas (e.g., Town Hall, Main street parks) are fertilized with a single application a year (late spring) of one lb/1,000 sq. ft.

Orleans (Source: Paul Fulcher, Parks and Beaches)
Most municipal land is not fertilized in Orleans; only irrigated areas (i.e., fields and high-visibility areas) are fertilized. The Town of Orleans has been changing their fertilizer practices recently, with no fertilizer applied last year, and a switch to organic products this year. Please note that switching to organic nitrogen sources may not result in a direct decrease in nitrogen impact. This is dependent on the type of organic fertilizer used.

Golf courses

HW reviewed the Pleasant Bay Alliance's 2007 survey of turf areas and fertilizer application practices among three golf courses (i.e., Cape Cod National Golf Club, Captains Golf Course, Eastward Ho! Country Club) in the Pleasant Bay Watershed. HW then compared these loads to the MEP model assumptions for each of the three golf courses. Details of the estimate for each golf course are provided in Appendix B. Table 3 compares the applied nitrogen fertilizer load for 2004, 2005, and/or 2006 to the modeled load (please note that only 20% of that load is assumed to leach into the groundwater). It shows that for 2005 and 2006, actual nitrogen fertilizer applications were lower than estimated by the MEP Model for the Cape Cod National Golf Club, but that they are significantly higher for the Eastward Ho! Country Club. The differences for Eastward Ho! may be accounted for by the fact that more recent loadings were based on a more accurate and higher measurement of turf type area coverage than are included in the MEP model, as well as higher application rates for some turf types.

HW also contacted the golf course superintendents of all three golf courses to verify that these fertilizer inputs are still current. HW was able to obtain recent (2009) fertilizer loads from Eastward Ho! Country Club and Captain's Golf Course, but not from the Cape Cod National Golf Club. These data are also reported in Table 3, and show that nitrogen loading from Captain's Golf Course has been recently significantly reduced (close to 40%). The Captain's Golf Course superintendent indicated that they have been able to reduce their fertilizer use significantly for all turf types by replacing urea with a slow release fertilizer. This has reduced their need to fertilize while maintaining a similar turf quality.

Table 3. Nitrogen leached from fertilizer applications to three Pleasant Bay golf courses - applied and modeled (Sources: modeled loads from MEP model, applied loads from 2004 to 2006 from the 2007 Pleasant Bay Alliance report for applied loads, and recent applied loads from conversations with golf course superintendents - see Appendix B for data)

Golf Course	Year	N Fertilizer Load (lbs/year, or %)			
		Applied	Modeled	Applied - Modeled	
Cape Cod National Golf Club	2004	7,296	7,120	176	2%
	2005	5,333		-1,787	-25%
	2006	5,716		-1,404	-20%
	Average	**6,115**		**-1,005**	**-14.1%**
Eastward Ho! CC	2005	10,430	6,745	3,685	55%
	2006	11,321		4,576	68%
	2009	10,066		3,321	49%
	Average	**10,606**		**3,861**	**57%**
Captains Golf Course	2007 report[1]	26,626	26,681	55	0. 2%
	2009	16,433		-10,248	-38%
	Average	**21,530**		**-5,097**	**-19%**

[1] *The Captains Golf Course data from the 2007 Pleasant Bay Alliance report did not specify the year for which the data apply.*

Table 3 shows some instances of significant reductions in nitrogen fertilizer loads from golf courses compared to the MEP model. The reductions represent progress toward achieving TMDLs that could be credited to the respective towns. In addition, nearly all courses have introduced sections of natural rough that are not fertilized and are rarely mowed. Courses also have adopted foliar application practices that are deemed more accurate than granular fertilizer application. Further research is needed to determine whether or how foliar applications might affect leaching rates. Courses have also adopted an "as needed" approach to fertilizing that emphasizes plant health over "greenness". These practices and the data in Table 3 reflect a growing shift toward more economical use of fertilizers.

3.0 OVERVIEW OF CURRENT TOWN REGULATIONS RELATED TO FERTILIZER MANAGEMENT

HW compiled current municipal and regional regulations and policies for fertilizer management from the Towns of Brewster, Chatham, Harwich, and Orleans, and from the Cape Cod Commission. HW also reviewed the latest Cape Cod Regional Policy Plan to identify performance standards for fertilizer management. For each Town, HW reviewed regulations covering the following areas:

- Town Code/General Rules and Regulations or Bylaws;
- Zoning;
- Board of Health;
- Subdivision Rules and Regulations; and

- Conservation Commission.

Web addresses for these regulations are provided as hyperlinks embedded within the text of this document for future reference. For each set of regulations available electronically, HW conducted keyword searches to quickly identify sections referring to lawns, nutrient loading, or fertilizer management. The keywords used in the search included: lawn, nitrogen (and all words starting with the letters "nitr" to cover nitrate and nitrite), nutrient, fertilize (and all words starting with the letters "fert" to cover fertilization and fertilizer), and pesticide. In addition, HW reviewed each town's wetlands protection regulations to determine the extent of a wetland resource area buffer they required.

HW then reviewed and assessed all regulation sections related to fertilizer and nitrogen management to identify how they address nitrogen and fertilizer management for lawns, golf courses, or other areas. Some sections were not directly relevant as they used these keywords in other contexts, such as wastewater, aquaculture, cranberry farming, or nutrient retention by salt marshes and wetlands. Relevant sections have been copied into this section, with the most applicable sentence(s) highlighted, for easy access and review.

3.1 SUMMARY OF FINDINGS

Most of the existing regulations were developed with the goal of protecting drinking water supplies, and are therefore designed to manage nitrogen loading within the Zone II wellhead protection areas to the towns' wells and other water resources. In these regulations, the primary source of nitrogen being regulated is wastewater discharge through septic system effluent; although, there is mention of fertilizer impacts within some of the Town's regulations, and some require that fertilizer loadings be included in any required nitrogen loading analysis.

It is important to note that the existing town regulations do not specifically control fertilizer loading impacts to Pleasant Bay or other coastal estuaries. However, the Orleans wetlands protection regulations provide the opportunity to restrict lawn sizes or eliminate lawns entirely within 100 feet of a wetland resource area, which could include Pleasant Bay or one of its sub-watersheds. The Brewster Zoning Bylaw also limits cultivated lawn sizes to 10% of the lot area within the Groundwater Protection District. In addition, it should be noted that based on discussions with the Pleasant Bay Alliance Watershed Work Group, many, if not all Conservation Commissions take the opportunity to control lawn size and lawn fertilization practices in the issuance of Orders of Conditions for new projects within their jurisdiction. Conservation Commissions in each of the four towns have adopted a requirement for a 50-foot no-disturb buffer to wetland resource areas. However, many existing properties that come before Conservation Commissions have little or no buffer, and the creation or enhancement of buffers on these properties often can be negotiated as part of mitigation to obtain an Order of Conditions. Further specifics on each town's regulations are provided below.

Some of the local regulations provide specifications for topsoil requirements and fertilizer application rates. However, these standards vary among the Towns. It is recommended that a set of standard requirements based on the same best management practices used for outreach to

homeowners and lawn care professionals (see section 5.4) be developed and recommended to the Towns for inclusion in planning, health and conservation regulations.

3.2 BREWSTER

Based on our review of the Town of Brewster's bylaws and regulations (listed below), the only regulation related to nitrogen fertilizer applications is the Zoning Bylaw for the Groundwater Protection District, and limits cultivated lawn to 10% of the lot area. Other regulations require nutrient loading analyses for environmental protection. HW is aware of the Town of Brewster's Water Quality Committee, but could not find related regulations online.

Town Code and Bylaws
General Legislation - Chapter 83, Development Review
Article III - Development Standards
§ 83-8. Environmental protection requirements
F. Water quality and usage. [Added 11-20-1995 FYTM, Art. 14]

(1) If a project lies within a zone of contribution, a cumulative nitrogen loading calculation shall be submitted to the Plan Review Committee, and review by the Water Quality Review Board shall be required.
(2) Applicants of projects that do not encroach upon the Groundwater Protection District may be required to submit a cumulative nitrogen loading calculation in accordance with the standards outlined in the most current EIR CCC Nitrogen Loading Calculation Technical Bulletin.

Also see Zoning Bylaw and Subdivision Rules and Regulations under Planning Board.

Board of Health
No relevant regulation Board of Health regulation based on the key word search.

Conservation Commission
Wetlands Protection Bylaw & Regulations
No relevant regulation: "fertilizer" terminology used in cranberry bog and aquaculture contexts, and "nitrogen and phosphorous" used in the context of nutrient retention by salt marshes and wetlands; however, regulations identify a 50-foot buffer for the protection of coastal beaches, dunes, banks, and salt marshes and ponds.

Part II. Regulations for Coastal Wetlands

2.02 Coastal Beaches (3); 2.03 Coastal Dunes (3); 2.05 Coastal Banks (2); 2.06 Salt Marshes (2)(c); 2.07 Salt Ponds (3); and 2.09 Banks of or Land Under the Ocean, Ponds, Streams, Rivers, Lakes, or Creeks that Underline an Anadromous/Catadromous Fish Run ("Fish Run") (3):

*No activity, other than the maintenance of an already existing structure, which will result in the building within or upon, removing, filling, or altering of a [**resource area**] or of any land within 50 feet of the [**resource area**] shall be permitted by the Conservation Commission, except for activity which is allowed under a variance from these regulations granted pursuant to Section 5.01.*

Part III. Regulations for Inland Wetlands

3.02 Vegetated Wetlands (Wet Meadows, Marshes, Swamps and Bogs) (3)

No activity, other than the maintenance of an already existing structure, which will result in the building within or upon, removing, filling, or altering of a bank, on land within 50 feet of any bank, shall be permitted by the Conservation Commission, except for activity which is allowed under a variance from these regulations granted pursuant to Section 5.01.

Planning Board

Zoning - Chapter 179

Article X1 - Groundwater Protection District

§ 179-60. Performance standards.

To preserve the natural land surface providing high-quality recharge to the groundwater, to limit sewage flow and fertilizer application to amounts which will be adequately diluted by natural recharge and to prevent the discharge or leakage of toxic or hazardous substances into the groundwater resource, all uses shall meet the following performance standards:

A. The concentration of nitrate nitrogen resulting from domestic wastewater disposal and from fertilizer application, when diluted by rainwater recharge on the lot, shall not exceed five parts per million (ppm). A demonstration of compliance to this section shall be to the satisfaction of the Board of Health. Compliance with this standard is presumed under the following conditions:

(1) All uses:

(a) A sewage flow as determined by Title 5 of the State Environmental Code not exceeding 110 gallons per day (gpd) per 10,000 square feet of lot area and less than 10% of the lot area maintained in cultivated lawn.

(b) Compliance shall otherwise be certified by a registered professional engineer in sanitary or civil engineering and will require a special permit.

Subdivision Rules and Regulations - Chapter 290

§ 290-10. Definitive plans.

B. Developments of 10 or more lots.

(3) The Board, as part of a review for a preliminary subdivision plan, submitted in accordance with the requirements of § 290-9, may specify which of the following topics shall be evaluated, and the level of detail required for each topic, in the environmental and community impact analysis and submitted with the definitive plan. If no preliminary subdivision plan is submitted, the environmental and community impact analysis shall evaluate all of the following topics:

(h) Environmental analysis for nonresidential subdivisions: A comparative environmental analysis shall be submitted for nonresidential subdivisions and for other cases where the Board determines it appropriate in light of special circumstances. The scope of such analysis, including development alternatives to be compared and consequences to be studied, shall be as agreed to by the Board but will normally be required to include at least one major alternative to the plan proposed, with as much of the following information as determined by the

Planning Board to be necessary for plan evaluation. The traffic analysis shall be consistent with Traffic Impact Guidelines, January 15, 1990, appended hereto. The analysis shall indicate differences among alternatives regarding;

[1] Impact upon ground- and surface water quality and level including estimated phosphate and nitrate loading on groundwater and surface water from sewage disposal systems, lawn fertilizer and other activities within the development.

3.3 CHATHAM

Based on the review of the Town of Chatham's bylaws and regulations (listed below), the Town does not appear to have any regulation related to nitrogen fertilizer applications for lawns. The entire Town was declared an "Area of Nitrogen Concern" on July 12, 2004 under the Board of Health Regulations. Other Town Regulations discuss potential nutrient loading issues in groundwater and surface water related to fertilization and wastewater, but do not set fertilizer standards.

General Rules and Regulations (Town Code)

The Town Code does not mention nutrients, but mentions nitrogen loading from lawns related to a calculation worksheet unavailable online. The Nitrogen Loading and Calculation Worksheet is discussed under Town of Chatham Code Chapter A502-1: List of Rules and Regulations of Chatham Town Agencies, for the Board of Health.

"(Principally from individual sewage disposal systems and fertilizers from lawn care practices)"

We could not find the worksheet online to assess it.

Chapter 208 Peace and Good order, Paragraph 11 Protection of freshwater ponds

"No foreign matter in the form of poisons or chemicals (including pesticides and herbicides) shall be put into any freshwater pond unless approved by the Board of Health and the Conservation Commission."

Board of Health

Nitrogen Loading Regulation

These regulations mention "nitrogen contaminant and nutrient loading" from fertilizer, but only address loads related to on-site sewage disposal systems.

"The two principal sources of nitrogen contamination and nutrient loading are sewage effluent from individual on-site sewage disposal systems and fertilizers from lawn care practices."

"This regulation represents the minimum steps necessary to protect the public health from the adverse effects of the discharge of nitrates and other contaminants from individual on-site sewage disposal systems into the town's ground and surface waters."

Conservation Commission

Wetlands Protection Bylaw - Chapter 272

No relevant regulation based on the key word search.

Wetlands Protection Regulations
Mention of fertilizer, nutrient, and nitrogen descriptive only, but not directly relevant (e.g., found in a fisheries, shellfish, and wildlife feeding context; or as a potential impact to surface and ground water without stating how to address it): *"Overuse of fertilizers and pesticides threatens water quality of vernal pools, which are highly dependent on runoff as a water source."*

A 50-foot no disturb buffer is however required for upland resource areas adjacent to wetlands.

Part IV. REGULATIONS FOR ADJACENT UPLAND RESOURCE AREAS

4.01 Adjacent Upland Resource Areas

(2) Definitions

(c) "No Disturb Zone" means that part of an adjacent upland resource area that extends 50 feet landward from an abutting resource area and which is designated by the Commission to be an area where no substantial activity, other than the maintenance of an already existing structure, which will result in the building within or upon, filling, removing, dredging, or altering of land, shall be permitted by the Commission, except for that which is allowed under a Conservation Variance.

Planning Board

Subdivision Regulations

Only mention of "fertilizer" under Appendix A - Specifications for Excavation/Construction Within Public Ways/ Section II: Specifications/ E. Shoulders

"Lawns will be rebuilt with a minimum of four (4) inches of loam, fertilizer, rolled and seeded."

Zoning Bylaw

No relevant regulation based on the key word search.

3.4 HARWICH

Based on our review of the Town of Harwich's bylaws and regulations (listed below), the Town encourages the use of low maintenance plants with limited fertilizer requirements, and limits overall fertilizer applications for topsoiling to 20 lbs/1,000 sq. ft. under Subdivision Rules and Regulations. This application rate appears to be high compared to other requirements, and modeled applications. In water resource protection districts, the Town also limits fertilizer applications to three lbs/1,000 sq. ft. of lot area per year, and the total area of land under cultivation to 8% of the total lot area. The Conservation Commission may impose lower fertilization application rates under its Wetland Protection Regulations.

Town Code

Nitrate and nitrogen are discussed in the context of wastewater only.

Chapter 400 - Subdivision of Land and Site Plan Special Permits
Article II Subdivision of Land
§ 400-14. Required improvements and specifications for construction.

L. Topsoiling and hydroseeding (Figure 8).

(1) All areas which are disturbed by the construction shall be graded to blend into undisturbed areas and shall be loamed to a depth of four inches, fertilized, and

hydroseeded. Loam obtained from the stripping operations may be used and/or loam may be furnished from off site by the contractor. All areas shall be given an application of lime (dolomitic limestone) and commercial fertilizer of an 8-6-4mixture. The rate of application of lime shall be 45 pounds per 1,000 square feet and the rate of fertilizer application shall be 20 pounds per 1,000 square feet.

Table 7 - Typical Planting Schedule (In Appendix 2 to Chapter 400)

Symbol	*Quantity*	*Common Name*	*Type**	*Size*	*Spacing*	*Comments*
	10	*Eastern Red Cedar*	*E, S*	*3'*	*5' O.C.*	*Parking screen*
	5	*American Holly*	*E, T*	*3'*	*6' O.C.*	*Parking screen*
	12	*Japanese Beach Rose*	*D, S*	*3 gal.*	*Random*	*Parking setback*
	4	*Winterberry Holly*	*D, S*	*3 gal.*	*1/island*	*Int landscaping*
	4	*Green Ash*	*D, T*	*8'*	*1/island*	*Int landscaping*
	8	*Red Oak*	*D, T*	*8'*	*Random*	*Parking setback*
	4	*Common Bayberry*	*D, S*	*30"*	*Random*	*Parking setback*

**** Types:***
E = Evergreen
D = Deciduous
S = Shrub
T = Tree

Note: The above species are examples only of native plantings that generally require low maintenance and little or no fertilizers or pesticides. Other species may be proposed. It is Planning Board policy to encourage the use of native species to optimize planting survival and minimize the application of chemicals, which may pollute groundwater.

General Bylaws
No relevant regulations, fertilizers and pesticides only mentioned under "farming."

Board of Health
Sewage Disposal Regulations
Part 2 - Disposal Works Regulations

1.206 In order to effectively prevent nitrogen overloading of the aquifer by multi-family dwellings in the water resource protection districts, no fertilizer shall be used on site at a rate exceeding 3 pounds (nitrogen) per 1,000 square feet of lot area per year and the total area of land under cultivation shall not exceed 8 percent of the total lot area.

Conservation Commission
Wetlands Protection Regulations
Section 1.04 (3) of the wetlands regulations requires a 50-foot no disturb zone, and 1.04 (4) sets forth requirements for vegetated buffer strips.

1.04 RESOURCE PROTECTION AREAS

1. PREAMBLE

This section designates and defines protective buffer areas adjacent to a resource; i.e. the "buffer zone", the "no-disturb zone" and the "vegetated buffer strip", and provides guidance as to their respective purposes and uses. The overall intent of this section is to limit the potential adverse impact of any activity close to a protected resource on that resource. No invasive plants listed by the Natural Resource Conservation Service shall be allowed to be introduced within Commission jurisdiction. (...)

Adverse impacts to protected resources can occur during construction, from the project as full developed, or both. Such impacts may include, but are not limited to, erosion, siltation, loss of groundwater recharge capability, contamination of waterbodies by surface runoff carrying heavy metals (such as lead, cadmium, copper, and/or zinc), hydrocarbons (such as gasoline and motor oil), pesticides and herbicides, pathogens (both bacteria and viruses), and sediments. Nutrient loading of waterbodies can occur from overuse of fertilizers as well as septic effluent traveling through groundwater.

3. NO-DISTURB ZONE

The no-disturb zone is the area within fifty(50) feet landward of the boundary of any fresh water wetland, bank, beach, dune, flat, marsh, wet meadow, bog, swamp, or any estuary, creek, stream, pond or lake. Except for those being built on the footprint of an existing structure, and those deemed necessary to protect the resource, no new structures will be permitted in the no-disturb zone. Other kinds of proposed activities in this zone will be closely scrutinized and regulated with very few activities permitted. These activities can have no adverse impact on environmental interests.

4. VEGETATED BUFFER STRIP

A vegetated buffer strip within the buffer zone between the development activity and the protected resource may be deemed necessary, where none presently exists, to mitigate past, present or possible future activity impacts in the buffer zone. In the event that the Commission requires the establishment of a vegetated buffer strip of a given dimension as a condition to the approval of an activity, such strip shall consist of native or naturalized plant material listed in appendix.

1.06 LAWNS

Turf lawns may be a significant source of nutrients to wetlands, coastal embayments, and other bodies of water through surface runoff and leaching to the groundwater. Excessive nutrient loading of water bodies may lead to eutrophication. Eutrophication includes nuisance algal blooms, oxygen depletion, fish kills and foul odors.

Lawn fertilization is of concern because of possible overuse and the effects from a single house lot is extremely difficult to quantify.

To minimize potential contamination, the Conservation Commission may require that turf lawns be minimized or even eliminated from landscaping plans; particularly in lots adjoining surface water bodies and wetland resource areas. However, so as to reduce erosion and nutrient loading by sheet runoff, no new lawn may be planted immediately

adjacent to a wetland resource area. The commission may prohibit turf lawns in the buffer zone. Buffer zones of native, non-invasive plants may be required to reduce surface runoff.

Additional factors the Commission will consider:

- *A vegetated strip should be established between the lawn areas and the resource area. The buffer strip should contain a mix of native, non-invasive species or those recommended by the Conservation Administrator to provide both shallow and well developed root systems as well as a mix of canopy types and heights to enhance the wildlife habitat.*
- *A minimum of 6" of loam should underlie the lawn to minimize movement of phosphorus and nitrogen through the soil.*
- *A low-impact/minimum fertilizer plan shall be presented. Example:*
  - *Fertilizer application should be "split"; spring & fall*
  - *No more than one pound of nitrogen per 1,000 square feet for each application, 2 lbs/1,000 SF total/year*
  - *Use slow release fertilizer*
- *Mow lawn to a height=/> 2½ inches to promote a deeper root system to absorb nitrogen.*
- *Leave clippings on lawn.*
- *Irrigation should be minimized.*
- *Use of pesticides should be minimized.*

Following the above discussions, the Commission may determine that a turf area will be detrimental to adjoining wetlands and require the use of native plant species and non-turf grasses and groundcovers in the landscaping plan instead of lawn area. A useful list of low maintenance trees, shrubs, and herbaceous plants beneficial to wildlife is set forth in these regulations in the Appendix.

Planning Board

Rules and Regulations Governing Subdivisions and Special Permits Including Site Plan Review
(See Town Code, Chapter 400 already discussed above)

Zoning Bylaws

Section XVII - Six Ponds Special District

6.0 CLEARING AND GRADING

No person may clear any portion of a lot for construction without first obtaining a foundation permit or a building permit from the Building Department. No person shall undertake land clearing/grading activities exceeding an area of 30,000 square feet without first obtaining a special permit from the Planning Board. While the clearing/grading of an area less than 30,000 square feet does not require a special permit, compliance with the measures contained in 6.2.1 through 6.2.8 is encouraged for all development within the district.

***6.2** Granting of a special permit by the Planning Board for clearing/grading shall be based on the applicant's ability to prepare and execute a plan that meets the review*

standard listed below. The applicant shall demonstrate that the following measures are employed in the development of the site:

***6.2.8** The site shall be revegetated immediately after grading.*

1. Proper revegetation techniques shall be employed using native plant species, proper seedbed preparation, appropriate fertilizer and mulching to protect germinating plants. Revegetation shall occur on cleared sites within 7 (seven) calendar days of final grading and shall occur during the planting season appropriate to the selected plant species.

2. A minimum of 4 inches of topsoil shall be placed on all disturbed surfaces that are proposed to be planted.

3. Finished grades shall be no higher than the trunk flare(s) of trees to be retained.

3.5 ORLEANS

Based on our review of the Town of Orleans' bylaws regulations (listed below), the Town limits the use of fertilizer in specific resource areas under its wetlands protection regulations. Fertilization can be restricted to actively growing grasses, using slow release or controlled release nitrogen source, and limited to one lb/1,000 sq. ft. of total nitrogen per application.

Town Code

See relevant sections below under Board of Health, Conservation Commission, and Zoning.

Board of Health

Nutrient Management Regulations

Regulation adopted July 1, 2009, designed to address nitrogen and phosphorous loading. Except for general references to fertilizers, these regulations mostly address nutrients from wastewater.

Chapter 185

No relevant regulation based on the key word search.

Section 2 Preamble

Excess nitrogen has been identified as the major contributing factor in the declining health of the marine water environment. Excess phosphorus, and to some degree excess nitrogen, are the major contributing factors in the declining health of the freshwater environments. Ninety-nine percent of sewage disposal systems in town do little to remove nitrogen or phosphorus. A few systems are in place that partially remove nitrogen for the property they serve. In Orleans, this translates to an immediate concern over the level of nitrogen entering local groundwater and its subsequent effect on marine estuaries. Phosphorus has similar effects on freshwater resources(...)

Locally controllable sources of nitrogen are primarily from septic system effluent and to a lesser extent from lawn fertilizer.

Conservation Commission

Wetlands Bylaw - Chapter 160

No relevant regulation based on the key word search.

Wetlands Regulations - Chapter 196A

ARTICLE III - Specific Resource Areas Regulated

§ 196A-7. Buffer zone and buffer strip.

B. Presumption

Where a proposed activity involves the altering of a buffer zone, the Commission shall presume that such area is significant to the interests specified in the Orleans Bylaw – Chapter 160. This presumption is rebuttable upon clear and convincing evidence that the buffer zone does not play a role in the protection of said interests. No work will be permitted in the buffer zone which has a significant adverse impact upon the interests (wetland values) protected by the Act or the Orleans Bylaw. In buffer zones adjacent to an ACEC and in the Town Cove/Nauset estuary, the no adverse impact standard will apply.

C. Guidelines for work in the buffer zone

(1) Buffer strip: Where work results in eroded or bare ground, the area must be revegetated as soon as practicable or mulched immediately. Where there is new construction or reconstruction, a buffer strip will be required landward of the resource area. It shall consist of natural indigenous vegetation and shall be a minimum of twenty-five (25) feet in width depending on factors below. The Commission may also require that a buffer strip be created where none presently exists to mitigate past buffer alterations. No work will be permitted in the buffer strip except limited vegetation removal or reduction and work necessary to maintain the buffer strip as described under elements of buffer strip.

(2) Between twenty-five (25) and fifty (50) feet landward of the resource area, only activities that protect or enhance the wetland interests and values protected under the Act and the Orleans Bylaw will be permitted. It is the Commission's intent to maintain a fifty-foot buffer strip. In determining the feasibility of such a width, the Commission may consider the prior use of the specific area as well as other factors such as the topography, size and configuration of the lot and the impact of a setback of the applicant's ability to obtain substantially the view sought or the desired location of the proposed structure. For new construction, in no instance should the "limit of work" area extend into the fifty-foot area. Notwithstanding the previous statements, landscaping which includes selective vegetation removal and replacement, and selective pruning, and vista cutting, may be permitted at the discretion of the Commission upon clear and convincing evidence that the wetland values noted above will be protected.

(3) Between fifty (50) and one hundred (100) feet landward of the resource area, alterations, including construction, will only be permitted where such work can be conditioned by the Commission to fully satisfy the required standards of protection to the wetlands interests identified in the Act and the Orleans Bylaw.

D. Buffer Strip

(1) Goal: The goal of the Commission is to maintain a strip of dense, vegetative cover between the development activity and the resource area to be protected, consisting of indigenous plant materials suitable for the maintenance of wildlife, both flora and fauna.

(2) Function: A buffer strip serves to provide wildlife habitat, improve water recharge, reduce pollution and erosion and to maintain the natural appearance of our fresh and saltwater shorelines.

(3) Size of buffer strip:

(a) Such a strip shall be a minimum of twenty-five (25) feet in width running along the resource area boundary, unless such width is unreasonable in view of the lot size, placement of an existing structure or such other factors as the Commission may consider.

(4) The elements of the buffer strip should reflect the indigenous vegetation suitable to the site.

(d) Where new plantings are permitted in the order of conditions, slow release fertilizer may be required.

F. Lawns:

(1) Preamble. Lawn fertilization can be a major source of excess nutrients that leach into groundwater or are washed off into roads that lead to water bodies causing eutrophication, unwanted algal blooms, oxygen depletion, fish kills and foul odors. The extent of such eutrophication will depend upon the amount of nutrients added and the flushing capacity of the receiving waters. Insecticides and herbicides used to maintain lawns also contaminate our waters.

(2) Requirements. Grasses with their fibrous root system tend to be excellent stabilizing plants especially on steep slopes. The same factors that affect trees and shrubs also influence the health of grasses.

(a) For any lawns that are to be planted within 100 feet of a resource area, a minimum of 4-6 inches of loam is required prior to planting. This will improve conditions for the lawn and also reduce chances of nutrient leaching through the soil.

(b) Only hardy species of grass that require little or no fertilizer and those that can tolerate drier conditions are allowed such as a mixture of fescues, rye grasses, etc.

(3) Fertilization.

(a) Fertilization may be allowed only when grasses are actively growing using slow release or controlled release nitrogen source of 25% or more as a component of the total nitrogen analysis. It is further suggested that no more than one (1) pound of total nitrogen per 1,000 square feet (sq. ft.) be applied at any one time to reduce potential leaching from the site of application.

(b) A split application, (spring and fall) is also preferable as opposed to one application of the entire amount.

(c) Liming at a rate of 100 pounds per 1,000 square feet is a general recommendation rate for Cape Cod but a soil test will indicate the proper amount required.

Planning Board

Zoning Bylaws

No relevant regulation based on the key word search.

Subdivision Rules and Regulations - Chapter 192

ARTICLE II - Submission and Approval of Plans

§ 192-6. Definitive Plans

(2) Contents. Much of the information required can be obtained through the Orleans Planning Department or Conservation Commission. The scope of such analysis shall include the following information relative to impacts and their mitigation:

(e) For subdivisions containing two (2) or more lots with land within Groundwater Protection District 2, an analysis of the impact upon ground and surface water quality and level including estimated phosphate and nitrate loading on groundwater and surface water from septic tanks, lawn fertilizer and other activities within the development.

3.6 CAPE COD REGIONAL POLICY PLAN

http://www.capecodcommission.org/RPP/home.htm

Water Resources Goal - WR1: General Aquifer Protection

Minimum Performance Standards

WR1.1 Five-ppm Nitrogen Loading Standard: *All development and redevelopment shall not exceed a 5-parts per million (ppm) nitrogen loading standard for impact on groundwater unless a stricter standard applies in accordance with the water resources classification system below. Guidance on methodology to meet this standard can be found in Cape Cod Commission Nitrogen Loading Technical Bulletin 91-001, as amended.*

WR1.5 Turf and Landscape Management Plan*: Development and redevelopment shall adopt Best Management Practices such as a turf and landscape management plan that incorporates water conservation measures including the use of native and drought resistant plantings and the use of drip irrigation, and minimizes the amount of pesticides and chemical fertilizers.*

WR1.8 Alternatives to Chemical Fertilizers and Pesticides: *Development and redevelopment are encouraged to utilize alternatives to synthetic chemical fertilizers and pesticides in favor of organic and biological methods.*

Water Resources Goal - WR2: Drinking Water Quality and Quantity

The following Minimum Performance Standards apply to development and redevelopment in Wellhead Protection and Potential Water Supply Areas as shown on Water Resources Classification Map I.

WR2.1 Five-ppm Nitrogen Loading Standard: *The maximum nitrogen loading standard for impact on groundwater shall be 5 ppm for development and redevelopment unless a cumulative impact analysis indicates a more stringent loading standard is necessary.*

In addition to the above standards WR2.1 to WR2.4, for areas mapped as Potential Public Water Supply Areas, the following minimum performance standards shall apply. The Commission may determine that WR2.5 and WR2.6 do not apply provided that supporting information from the Town or Water District demonstrates to the Commission that the area will not be considered as potential water supply areas.

WR2.6 One-ppm Nitrogen Loading Standard: *The maximum nitrogen loading standard for impact on groundwater shall be 1 ppm for development. Guidance on methodology to meet this standard can be found in Cape Cod Commission Nitrogen Loading Technical Bulletin 91-001, as amended.*

4.0 FERTILIZER MANAGEMENT STRATEGIES USED IN OTHER LOCALES

HW conducted a review of fertilizer management strategies used by municipalities across the country that may be applicable for use in the Pleasant Bay watershed. These were obtained from an internet search based on the following keywords:

- Florida friendly landscaping;
- Florida friendly fertilizer;
- WaterStar;
- Greenscapes;
- Seattle greenscapes;
- Fertilizer campaign;
- Maine phosphorus manual;
- Fertilizer moratorium;
- Fertilizer/nutrient limit;
- Lawn removal;
- Lawn replacement;
- Buffer for fertilizer/nutrient management;
- Best management practices (BMPs) for fertilizer attenuation; and
- Golf course fertilizer management.

HW identified a series of programs and evaluated their applicability within the Pleasant Bay watershed towns. For example, other states such as Florida or Washington may have different soils and growing seasons from the Pleasant Bay watershed, but their fertilizer management strategies may still be adapted to Cape Cod conditions.

Sixteen programs are described below, divided into regulatory programs and standards, non-regulatory programs, and BMPs for fertilizer applications. Information about the Florida

Friendly Lawn program was also provided by Dr. Robert Duncanson and was included in the review.

4.1 REGULATORY PROGRAMS AND STANDARDS

A - Model Ordinance for the Protection of Water Quality and Quantity Using Florida-Friendly Landscapes

Source: http://www.dep.state.fl.us/WATER/nonpoint/docs/nonpoint/ffl-mo-ccr-1-09.pdf

The ordinance applies to all new, redeveloped, or rehabilitated landscapes for public agency projects and private development projects, including industrial, commercial, residential, and recreation projects, that involve new single-family and two-family homes. The focus of this ordinance is on preserving water quality and encouraging conservation of water resources.

The ordinance incorporates BMPs (as detailed in Florida-Friendly Best Management Practices for Protection of Water Resources by the Green Industries) in the following areas:

- Site planning and design;
- Soils;
- Land clearing standards and preservation of native vegetation;
- Appropriate plant selection, location, and arrangement;
- Practical use of turf;
- Efficient irrigation;
- Yard waste management, composting, and use of mulches;
- Fertilizer management;
- Pesticide management;
- Landscape maintenance; and
- Shoreline considerations.

Specific regulations regarding the use of fertilizer include:

- Fertilizer shall not be applied to turf or landscape plants unless a soil or tissue deficiency has been verified by an approved soil test;
- Fertilizer shall not be applied during the Prohibited Application Period (typically June 1 – September 30);
- Specified application practices, including the use of a spreader deflector shield shall be followed;
- Fertilizer shall not be applied to any impervious surface; and
- Fertilizer shall not be applied within ten feet, or three feet if a deflector shield, or drop spreader is used, of any pond, stream, water course, lake, canal, or wetland.

This model ordinance also includes provisions to require the training of all persons providing landscape maintenance services for hire.

Applicability for Pleasant Bay: The fertilizer management provisions directly reduce and restrict fertilizer application and require compliance with BMPs (as identified above). The turf area

provisions focus largely on irrigation practices. Finally, the shoreline management provisions require a voluntary six foot low-maintenance buffer zone. A similar low maintenance zone could be required in Pleasant Bay and potentially expanded.

B - Model Ordinance for Florida-Friendly Fertilizer Use on Urban Landscapes

Source: http://www.dep.state.fl.us/WATER/nonpoint/docs/nonpoint/ffl-mo-ccr-1-09.pdf

This model ordinance regulates the use of fertilizer by any applicator. Components addressed include:

- Timing of fertilizer application: fertilizer shall not be applied during the Prohibited Application Period, typically the rainy season, from June 1 – September 30 (a comparable period of Cape Cod would be October 1 – May 1) ;
- Fertilizer free zone: fertilizer shall not be applied within ten feet, or three feet if a deflector shield or drop spreader is used, of any pond, stream, water course, lake, canal, or wetland;
- Low maintenance zone: voluntary six-foot low-maintenance buffer zone for any water body;
- Fertilizer content and application rates: fertilizer shall not be applied to turf or landscape plants unless a soil or tissue deficiency has been verified by an approved soil test;
- Application practices: specified application practices, including the use of a spreader deflector shield, shall be followed; fertilizer shall not be applied to any impervious surface;
- Management of grass clippings and vegetative matter; and
- Training: commercial and institutional applicators operating within the county are required to complete training.

Examples:
Proposed Fertilizer and Landscape Management Rule, Environmental Protection Commission of Hillsborough County, Florida
Source: http://www.epchc.org/LandscapeManagement.htm

Proposed Fertilizer Use Ordinance, Wakulla County, Florida
Source: http://www.mywakulla.com/docs/agendas/December82009/Tab19Attachment3.pdf

Applicability for Pleasant Bay: This ordinance limits nitrogen fertilizer by setting standards for application and restricting the application period, as detailed above. Considerations for Pleasant Bay include: changing the voluntary low-maintenance zone to mandatory, increasing the size of the buffer, and including additional provisions that limit lawn/turf grass size.

C - Model Landscape Design Zoning Bylaw for the North and South Rivers Watershed Association

Source: Horsley Witten Group, Inc;
http://www.greenscapes.org/files/file/Bylaw/LandscapeBylaw.pdf

The focus of the standards and specifications within the model bylaw is on the health of soils, the preservation of natural landscapes, and the development of aesthetically pleasing landscaped areas that are environmentally sound. This bylaw limits lawn area in new residential development to 20% of the overall lot size or 8,000 sq. ft. This bylaw also uses the Special Permit process as the mechanism for review and approval.

This bylaw applies to:

- All land clearing, clear cutting, grading activities of an area greater than 40,000 sq. ft.;
- Any development that will result in the clearing and/or grading of more than 20,000 sq. ft.;
- Any development activity within a Zone II contributing area to the Town's public water supply that will result in the clearing and/or grading of more than 20,000 sq. ft.; and
- Any development within the jurisdiction of the Conservation Commission that will result in the clearing and/or grading of more than 20,000 sq. ft.

Applicability: The limit on residential lawn size would assist in reducing the need for fertilizer application. To achieve the required reduction in nitrogen, towns in Pleasant Bay could further restrict lawn size to 2,500 sq. ft. As this model bylaw uses the Special Permit process as a mechanism for review and approval, the Special Permit triggers in each town would need to be reviewed.

D - Fertilizer Application Model Bylaw, New Jersey Department of Environmental Protection

Source:
http://www.state.nj.us/dep/watershedmgt/DOCS/TMDL/Fertilizer%20Application%20Model%20Ordinance.pdf

The purpose of this model ordinance is to regulate the outdoor application of fertilizer to reduce the overall amount of excess nutrients entering waterways. The following is prohibited:

- Application of fertilizer when a runoff producing rainfall event is occurring or predicted;
- Application of fertilizer to an impervious surface;
- Application of fertilizer within the buffer (25 ft) of a water body; or
- Application of fertilizer more than 15 days prior to the start of or at any time after the end of the recognized growing season.

Applicability for Pleasant Bay: Similar fertilizer application practices could be considered by Pleasant Bay watershed communities.

E - Florida Yards and Neighborhoods Environmental Landscape Management Educational Program

Source: http://dep.state.fl.us/water/nonpoint/docs/nonpoint/fynxord.pdf

The Board of County Commissioners of Citrus County, FL established guidelines for managing existing and future turf and landscapes on County facilities. Regulations include:

- All appropriate maintenance operations staff will be trained and certified in the Florida Yards & Neighborhoods Environmental Landscape Management Course within one year of the approval of this regulation;
- Training and certification in the Florida Yards & Neighborhoods Environmental Landscape Management Course will be offered to commercial landscape contractors; and
- The Extension Office facility will serve as an educational example and demonstration site of building, landscape, and/or design principles related to natural resource conservation including water, energy, and landscapes.

Applicability for Pleasant Bay: This is an example of an educational program that certifies maintenance operations staff in an Environmental Landscape Management course. Additionally, the county is setting an example by managing their property using BMPs. Pleasant Bay communities could lead by example and manage their properties according to similar BMPs.

F - Restrictions on the Application and Sale of Lawn Fertilizer within the County of Westchester

Source:
http://environment.westchestergov.com/index.php?option=com_content&task=view&id=2580&Itemid=4621

The County of Westchester passed a law limiting the use of phosphorous-containing lawn fertilizers and imposes other common-sense restrictions on their application. Regulations include:

- Restricted use of lawn fertilizer containing more than 0% phosphorus; and
- Lawn fertilizer applications are not allowed between December 1 – April 1, within 20 feet of any surface water, or on impervious surfaces.

The bylaw also includes restrictions on the sale of fertilizer containing phosphorus, educational requirements for home improvement contractors, and public education components.

Applicability for Pleasant Bay: This bylaw addresses many of the same concerns that have been identified in the Pleasant Bay watershed. It could be adapted to focus on fertilizers containing nitrogen, as opposed to phosphorus. Each community within the watershed would have to pass the bylaw. There would be issues with enforcement and with the importation of nitrogen fertilizer from retail stores in other Towns. If considered, this may be best accomplished as a regional undertaking across Cape Cod.

4.2 NON-REGULATORY PROGRAMS AND STANDARDS

A - N-Balance - Nitrogen Offset Program, New Hampshire Coastal Protection Partnership

Source: http://www.nhcoast.org/index.php/welcome/overview/live-nitrogen-reduction-program/

This voluntary program was developed to encourage seacoast residents to offset their nitrogen footprint by purchasing N-Credits. Three levels of donations are recommended:

1) Average $25.00 = 10 lbs of nitrogen/year/person;

2) Elevated $30.00 = 12 lbs of nitrogen/year/person; and
3) High $40.00 = 16 lbs of nitrogen/year/person.

Applicability for Pleasant Bay: An offset program has the potential to be a source of revenue to support other programs, such as public education and outreach. An offset program could be used with other regulatory standards, providing an option to 'pay off' the impact of fertilizer use rather than comply with reductions in fertilizer application and/or lawn size.

B - New Castle Lawn Fertilizer Campaign, New Hampshire Coastal Protection Partnership

Source: http://www.nhcoast.org/index.php/welcome/overview/new-castle-nitrogen-reduction-program/

Residents are encouraged to pledge to reduce their nitrogen footprint and protect Great Bay by not using lawn fertilizer or using only brands that have the least impact on the Great Bay Estuary. The website provides fertilizer-free lawn care tips, information on how to select a lawn fertilizer, and recommended lawn fertilizers.

Applicability for Pleasant Bay: This public education and outreach campaign is supported by the revenue from the N-Balance – Nitrogen Offset Program. Public education is an important component of a nitrogen fertilizer reduction strategy.

C - Water Smart Landscapes Rebate Program, Southern Nevada Water Authority (SNWA)

Source: http://www.snwa.com/html/cons_wsl.html

This program is driven by the need of the SNWA to conserve water and avoid the cost of developing new supplies. Therefore, they are willing to invest significant money to reduce outdoor water use demand.

This program includes:

- Providing qualified home owners with a rebate of $1.50 per sq. ft. of grass removed and replaced with desert landscaping up to the first 5,000 sq. ft. of converted property, per year;
- Beyond the first 5,000 sq. ft., SNWA will provide a rebate of $1 per sq. ft. with a maximum award for any property in a fiscal year is $300,000;
- Converted area must be at least 50% living plant cover, have efficient irrigation, and surface treatment requirements; and
- Acceptance of a restrictive covenant and grant of conservation easement that requires the conversion to be sustained in perpetuity is required.

Applicability for Pleasant Bay: This program could be adapted to specifically reduce lawn size and address fertilizer use on lawns by requiring fertilizer BMPs. The use of a deed restriction on the converted lawn could be used to ensure lasting implementation and maintenance.

D - EPA GreenScapes

Source: http://www.epa.gov/oppfead1/Publications/catalog/greenscaping.pdf

This document identifies five principles for greenscaping:

- Healthy soil;
- Plant selection;
- Smart watering;
- Pest management; and
- Natural lawn care.

It is based on King County, WA's Solid Waste Division's Natural Lawn Care Campaign, which details practices under each principle:
(http://your.kingcounty.gov/solidwaste/naturalyardcare/documents/Five_easy_steps.pdf)

Applicability: EPA GreenScapes publications could be distributed in schools, at nurseries, and lawn care stores to encourage natural lawn care practices.

E - Greenscapes Massachusetts Coalition

Source: http://greenscapes.org/index.html

The Greenscapes Massachusetts Coalition initially supported by the Massachusetts Bays National Estuary Program and the North and South Rivers Watershed Association, developed a 'Greenscape Guide' that identifies practices that drastically reduce water usage including:

- Encouraging groundwater recharge;
- Protecting water supplies; and
- Reducing stormwater pollution.

Outreach materials are geared toward individual homeowners and include the Greenscapes Guide, which specifically addresses fertilizer alternatives. The Coalition also developed a Lawn-Care Checklist, which identifies seasonal activities for maintaining a healthy lawn. Participants of the program can receive a Greenscapes lawn sign to help raise awareness within the community. The Coalition also makes available a native grass seed mix, which requires little to no fertilizer and is developed specifically for the climate in Massachusetts.

Applicability for Pleasant Bay: The Pleasant Bay Watershed Alliance, or the municipalities within the watershed could directly join the Greenscapes Massachusetts Coalition, as have the North and South Rivers Watershed Association, the Salem Sound Coast Watch, Eight Towns and the Bay Committee of the Merrimack Valley Planning Commission, and the Connecticut River Cleanup Committee of the Pioneer Valley Planning Commission. The regional services offered by the organizations vary depending on community funding and interest, and include workshops and presentations, distribution of materials and displays, media relations, and consultations. The cost of the regional programs is shared by the organizations and the municipalities that they serve.

F - Massachusetts Horticulture Society's Master Gardener Program

Source: http://www.masshort.org/Master-Gardener-Program

The Massachusetts Horticulture Society's (MassHort) Master Gardener Program trains community volunteers to provide horticultural information and resources to the gardening public through their outreach work, answering gardening questions for callers to the HelpLine, running informational booths at community events, giving garden lectures through the Master Gardener Speakers' Bureau, and acting as docents at MassHort events and sites. Master Gardeners also help facilitate the execution of educational programs sponsored by MassHort.

Applicability for Pleasant Bay: The Master Gardener Program is a good example of a successful education and outreach program supported by community volunteers. Resources could potentially be leveraged for an education and outreach campaign for the specific needs of Pleasant Bay communities.

4.3 BEST MANAGEMENT PRACTICES

A - Northeast Organic Farming Association (NOFA) Standards for Organic Lawn Care

Source:
http://www.organiclandcare.net/sites/default/files/upload/NOFA_Standards_4th_ed_2009.pdf

The program works to educate land care professionals and the public about the meaning of "organic" and the benefits of this option for care of the land around their own homes, neighborhoods, and communities.

In specific regard to the use of nitrogen fertilizer, the Standards require the following:

- No more than three lbs of soluble nitrogen per 1,000 sq. ft. per year;
- No more than one lb of soluble nitrogen per 1,000 sq. ft. per application;
- Rates of nitrogen application must be further reduced after two years of organic management;
- Blood meal, vegetable meal, fish hydrolyzate, emulsion, or meal may be used;
- Prohibiting the application of nitrogen fertilizer to lawns when grass is not growing actively (generally between October 15 and April 1 in Massachusetts) enough to use it rapidly;
- Prohibiting fertilizers containing nitrogen or phosphorus to remain on sidewalks or pavement; and
- The use of chilean nitrate, leather meal or its byproducts; sewage sludge; or synthetically-derived nitrates, urea, or ammonia is prohibited.

Applicability for Pleasant Bay: The fertilizer loading rate recommended by NOFA is the same as that used in the MEP nitrogen loading modeling process and should be reduced if their recommendations are to be shared with Pleasant Bay watershed residents.

B - Florida-Friendly Best Management Practices for Protection of Water Resources by the Green Industries

Source: http://www.dep.state.fl.us/water/nonpoint/docs/nonpoint/BMP_Book_final.pdf

The goals of the BMPs are to reduce nonpoint source pollution and promote the efficient use of water by reducing the off-site transport of sediment, nutrients, and pesticides through surface water or groundwater using:

- Appropriate site design and plant selection;
- Appropriate rates and methods of applying fertilizer and irrigation; and
- Integrated Pest Management (IPM) to minimize pests and apply chemicals only when appropriate.

This document discusses BMPs specific to nitrogen fertilizer including proper handling of fertilizer, turf fertilization management, untreated buffer zones near bodies of water, fertilizer storage and loading, soil testing, and tissue testing.

It is recommended that water-soluble fertilizers be applied at a rate of no more than 0.5 lbs N/1,000 sq. ft.

Applicability to Pleasant Bay: Such a document can be referenced in a bylaw to ensure proper handling and use of fertilizers. BMPs may have to be altered to fit the specific characteristics of Pleasant Bay.

C - Best Management Practices for Nutrient Management of Turf in New Jersey, Rutgers Cooperative Extension and Research

Source: http://www.turf.rutgers.edu/outreach/bmpnutrientmanagement.pdf

This series of BMPs addresses nutrient management of turf including:

- Turfgrass species selection;
- Planting practices to prevent nutrient loss in sedimentation erosion;
- Nutrient management practices to prevent over or unwarranted applications of nutrients; and
- Nutrient application rates.

Applicability to Pleasant Bay: Such a document can be referenced in a bylaw to ensure proper handling and use of fertilizers. BMPs may have to be altered to fit the specific characteristics of Pleasant Bay.

D - Golf Courses Nitrogen Management Challenge, Peconic Estuary Program and EPA Region 2

Source: http://www.epa.gov/owow_keep/tmdl/tmdlsatwork/peconic.html

Using a computer model to understand the links between nitrogen loading, water temperatures, plant growth, bottom sediments, water depths, and dissolved oxygen levels, EPA and the Peconic

Estuary Program developed a practical load reduction strategy to meet the Peconic Bay nitrogen TMDL. Among other nitrogen sources, this strategy targets fertilizer applications to golf courses, municipal properties, and residences. The strategy will include the following activities, relevant to the Pleasant Bay watershed:

- Work cooperatively with 34 golf courses to reduce nitrogen loads to groundwater through improved management practices; and
- Manage the use of fertilizers by conducting the following activities:
    - Enact a county law banning the application of nitrogen-based fertilizers on turf grass between November 1 and April 1,
    - Prohibit fertilizer use on county property at any time (except county golf courses, ballfields, the County farm, and newly seeded/sodded areas - in all these instances BMPs must also be followed);
    - Require licensed "home improvement contractors" (which includes landscapers) to complete a turf management course;
    - Mandate informational signs and brochures at retail establishments that sell fertilizers, as well as calling for an annual report on fertilizer sales; and
    - Establish a public education effort.

Changes in golf course fertilizer management will be implemented by encouraging golf courses to accept the "Nitrogen Management Challenge," a partnership between each golf course, EPA, the United States Golf Association (USGA), Cornell University, local government, and concerned citizens with the goal of reducing nitrogen fertilizer loads to surface and ground water: (http://www.epa.gov/region02/p2/nitrogen_management/). The goal of this program is to implement BMPs for the following activities:

- Course design;
- Turf maintenance;
- Cleaning of turf maintenance equipment; and
- Proper management of compost.

As of September 2004, 30 of the 34 (more than 88%) public and private golf courses on the east end of Long Island (http://www.peconicestuary.org/News.Golf.html) had accepted the challenge to voluntarily better manage their fertilizer use and limit the amount of nitrogen that enters groundwater.

Applicability for Pleasant Bay: This program could be adapted to golf courses within Pleasant Bay, and modified to encourage pro-active actions to reduce fertilizer use.

5.0 RECOMMENDED FERTILIZER MANAGEMENT STRATEGIES

The identification and analysis of fertilizer management strategies has followed a phased process. HW initially identified 17 strategies that were presented for consideration by the Pleasant Bay Alliance Watershed Work Group. These strategies are summarized in Appendix C, and were the focus of a detailed discussion at a May 26, 2010 Work Group meeting. The outcome of this discussion was a request for HW to further develop the following six strategies:

1. Management strategies to minimize fertilizer applications on municipal properties, athletic fields and parks;
2. Strategies to minimize, to the extent feasible, fertilizer applications on golf courses, as they represent 8.3% of the total controllable nitrogen load to Pleasant Bay;
3. Enforcement of 50-foot no disturb buffers around wetland resource areas, and restoration or enhancement of wetland buffers on existing properties where possible;
4. Outreach and education techniques for year-round residents, second home owners, and landscape professionals to encourage improved fertilizer practices;
5. Training for turf grass managers to encourage fertilizer and landscaping practices to minimize the use of nitrogen; and
6. Regulations to reduce the size of lawns created through future development within the watershed, as fertilizer applications from existing residential development constitutes 6.8% of the controllable load to the Bay. It is also recommended that local regulations specifying topsoil requirements, fertilizer application rates and use of native species be standardized and made consistent with the same best management practices used for outreach to homeowners and lawn care professionals.

A discussion of each of these strategies follows, including specifics on the pros and cons of each option, how the strategy could be implemented, the potential cost, and the ability to sustain the strategy over time. In addition, the extent of nitrogen reduction from the strategy, and the ability to quantify this reduction to the point where it could be used to achieve compliance with a TMDL is discussed.

During the development of these strategies, HW met with Brian Dudley of the Massachusetts DEP to discuss DEP's opinion on how specific approaches to fertilizer management could help reduce nitrogen loading to reach the TMDLs for Pleasant Bay. According to DEP's initial guidance, the strategies must show a direct, verifiable reduction in nitrogen loading for credit to be given towards a TMDL. Examples that could be verified include the reduction in existing lawn area on a property, a restriction in new lawn sizes, or quantifiable changes in fertilizers practices at municipal fields or golf courses.

DEP also remains open to discussing how fertilizer reductions achieved through education and outreach could be achieved and quantified. We discussed the concept of a pilot outreach program to evaluate the extent of change in homeowner practices over time. The strategies discussed below take these issues into consideration.

5.1 MUNICIPAL FERTILIZER MANAGEMENT

The Pleasant Bay municipalities will be looking to residents and golf courses to reduce their fertilizer use, and should set an example by addressing their own nitrogen fertilizer management practices. Although the Pleasant Bay municipalities currently only apply nitrogen fertilizer in limited quantities to a select number of properties, including their athletic fields, practices can change. We recommend that the Alliance work with the municipalities to develop best management practices, possibly including adoption of a policy or bylaw, to limit the amount of fertilizer applied to town properties over the long term. This would ensure that higher nitrogen

fertilizer rates are not applied in the future and would set an example for other Cape Cod communities, as well as for residents and golf courses.

The best management practices policy or bylaw could accommodate different application rates on specific property types (e.g., Town Hall lawn vs. athletic field), and could specify which properties are fertilized (i.e., all others cannot be fertilized). A meeting with all parties involved, including representatives of the Pleasant Bay Alliance and relevant town departments (e.g., Parks and Recreation, Public Works) could explore appropriate application rates for various property uses and other measures that would provide the basis for the best management practices.

Implementation: Best management practices, including a policy to identify different application rates on specific property types and which properties are fertilized, would need to be adopted by the appropriate department in each municipality in the watershed or be incorporated into each municipality's comprehensive plan. Alternatively, a general bylaw could be adopted by each municipality in the watershed. To do this successfully, it would be necessary to build support and consensus for the bylaw by holding a meeting of municipal officials and towns' landscape maintenance personnel.

Maintenance over Time: Once the best management practices policy or bylaw is developed and adopted by each municipality, limited to no resources would be required for long-term maintenance. There may be a need for implementation oversight, to ensure that municipalities adhere to the practices' requirements.

Level of Nitrogen Reduction: Adopting a municipal fertilizer management policy or bylaw would however guarantee that nitrogen loads do not increase over time. These properties are not included in the current MEP model, and therefore nitrogen load reduction would be difficult to assess using the MEP model.

Based on an analysis of aerial photography and MassGIS land use within the Pleasant Bay watershed, HW determined that the watershed includes approximately 15.4 acres of athletic fields. Assuming that nitrogen is applied to these fields at a rate of 3 lbs/1,000 sq. ft., with a 20% leaching rate, this nitrogen input represents approximately 400 lbs, or 180 kg across the watershed. This estimate does not include other fertilized properties such as "high-visibility" properties for each municipality. If towns reduce nitrogen fertilizer applications to these fields to 1.5 lbs/1,000 sq. ft./year, this would represent an annual reduction of approximately 200 lbs of nitrogen input to the watershed.

5.2 GOLF COURSE FERTILIZER MANAGEMENT

Golf course fertilization represents 8.3% of the controllable nitrogen load in the Pleasant Bay watershed and is therefore an item worth evaluating. Based on the data presented in Section 2, there may be opportunities to reduce golf course nitrogen loads while still maintaining healthy turf for golfers. In particular the opportunity to reduce fertilizer loadings on roughs can be explored. This could significantly reduce the overall nitrogen load associated with the golf courses. Reductions in fertilizer load can be achieved through reducing the application rates for

fertilizers, or reducing the areas currently fertilized. Golf courses are located in Brewster, Chatham, and Harwich.

HW recommends a coordinated process between the Pleasant Bay Alliance and the golf courses. An agreement should be developed and signed onto by each golf course and their respective Town to set reduction targets, but allow the flexibility in implementation to reach the target over a five-year rolling period. Alternatively, each town, where a golf course exists, could develop a general bylaw to specify the fertilization practices appropriate for each course. The target for fertilization reduction should be detailed in each agreement or bylaw. It should also require that annual reports be filed by each golf course to their respective towns describing their fertilizer applications for the year to show compliance with the agreement or bylaw. The adoption of an agreement or general bylaw identifies the activities that will be undertaken by course operators and will help prove to DEP that these changes are long-term in nature.

The specifics of the agreement or bylaw should be determined in consultation with the golf course superintendents, or other representatives, to ensure the adopted practices allow continued, healthy use of the golf course. Some golf courses, such as Captain's Golf Course, have already implemented strategies to reduce fertilizer loads. The consultations will therefore document recent changes in fertilizer practices that have already taken place and that will support the adoption of the identified changes. A stakeholder committee with representatives from the golf courses, the Alliance and member towns should be established to facilitate this discussion, with the goal of reaching consensus on appropriate loading allowances, prior to adoption of the bylaws. This committee could also remain in operation over time to evaluate the effectiveness of the agreements or bylaws and make recommendations for any adjustments that may be needed based on the operation of the golf courses.

Implementation: Similar to the process for passing a municipal fertilizer best management practices bylaw or policy, it is recommended that there is a consensus building process prior to the agreement or bylaw being drafted to determine the specific fertilizer practices and limits. It is recommended that a golf course fertilizer reduction of 40% be achieved in the watershed by taking the rolling average of fertilizer application over a five year period. Though consultation with golf course managers and the Alliance and the towns, the level of reduction required for each golf course could be determined. This allows golf course managers flexibility in achieving the required reductions on a year-to-year basis and reductions can be made through any combination of a reduction in area fertilized or a reduction in fertilizer application on roughs, greens, tees, and/or fairways.

Maintenance over Time: Ongoing compliance with the agreement or bylaw would require the submission of annual reports by each golf course to their respective towns to document that they have only applied fertilizers in concert with the agreement or bylaw. This is standard practice at many existing golf courses on Cape Cod and throughout Massachusetts to document compliance of nitrogen loading to DEP for a course's groundwater discharge permit. Annual reporting is also used to document compliance with Cape Cod Commission Development of Regional Impact permits for a number of golf courses on Cape Cod. An annual meeting of golf course superintendants and other members of the stakeholder group should be held to provide an opportunity for updates and training.

Level of Nitrogen Reduction: The proposed level of nitrogen reduction to be achieved with this strategy should be developed with the golf course superintendents through the stakeholder process described above. If, for discussion purposes, a fertilizer application rate of one lb/1,000 sq. ft. on rough areas is selected, it appears that a 40% reduction may potentially be achieved by limiting fertilizer applications on golf course roughs only. This is documented in Table 4. The MEP model assumed that the Captains Golf Course applies four lbs N/1,000 sq. ft. of rough area. The model also assumed that the Cape Cod National and Eastward Ho! courses use two lbs N/1,000 sq. ft. of rough area. In each case the amount of rough area fertilized is similar to that for fairways, greens and tees combined.

Table 4. Golf course nitrogen load reduction potential from rough areas

Golf course	Rough Area (1,000 sq. ft.)	Modeled		Proposed		Reduction
		Rate (lbs/1,000 sq. ft.)	Load (lbs)	Rate (lbs/1,000 sq. ft.)	Load (lbs)	Load (lbs)
Cape Cod National	2,373	2	4,746	1	2,373	2,373
Eastward Ho! CC	1,490	2	2,980	1	1,490	1,490
Captains Golf Course	3,902	4.5	17,559	1	3,902	13,657
Chatham Seaside Links	765	2	1,530	1	765	765
Total						**18,285**
Total (leached)						**3,657**

If the loading rate is reduced to one lb N/1,000 sq. ft. of rough, the 40% reduction is achieved. This may need to be adjusted after the stakeholder process is completed, but if possible, this would mean the overall nitrogen load from golf courses would be reduced from 8.3% of the controllable load to Pleasant Bay to 4.8%. This is a significant reduction just from managing golf course rough, without changing the fertilizer practices on the main golf playing surfaces. Again, this change could be done through reducing the fertilizer applications to all rough areas, or reducing the size of the rough area that receives fertilizer.

To provide flexibility to golf course managers, each golf course could identify the appropriate level and location (e.g., type of turf, size of fertilized area) of fertilizer reduction, that meets an overall reduction of 40% across all golf courses. This could be implemented on a rolling average across five years.

This approach allows golf course managers flexibility in achieving the required reductions on a five-year basis and reductions can be made through any combination of a reduction in area fertilized or a reduction in fertilizer application on roughs, greens, tees, and/or fairways. It should be noted that some golf courses have already reduced their fertilizer use since the MEP model was developed. For example, Captains Golf Course has already achieved a 38% reduction in fertilizer load application in 2009 as compared to the MEP model by switching to slow-release fertilizer products. This reduction represents an overall reduction of 24% of golf course fertilizer application.

5.3 "NO DISTURB" BUFFER TO WETLAND RESOURCE AREAS

Fertilizers applied immediately adjacent to a wetland resource area (i.e., surface water body or wetlands) are at risk of leaching into the water body. One way to limit this is to require a buffer around resource areas where only activities to protect or enhance the resource are allowed. All four watershed towns have some type of 50-foot no-disturb buffer requirement in their regulations. For example, the Orleans Wetland Regulations state the following:

- A 25 ft. buffer strip must be planted with indigenous vegetation;
- Within 25 – 50 ft. landward of the resource area, only activities that protect or enhance the resource are allowed; and
- Within 50 – 100 ft. landward of the resource area activities, such as construction, may be conditioned by the Conservation Commission.

The buffer requirements apply to newly developed properties, but are harder to enforce when an applicant's pre-existing development has little or no buffer. In such cases, Conservation Commission's are encouraged to negotiate creation or enhancement of buffers, or other mitigation alternatives such as removal of lawn area. HW recommends that town Conservation Commissions continue to strictly enforce the fifty foot no disturb provisions in undisturbed areas and also work with property owners seeking orders of condition on existing developed properties to enhance or restore buffers, especially removing maintained lawns within 50 feet of a wetland resource area.

Implementation: It is recommended that at least a 50 ft. no-disturb buffer be required adjacent to resource areas. Information about the importance and function of buffers could be provided to Conservation Commission members and property owners to augment efforts to create or restore buffers on pre-existing developed properties.

Maintenance over Time: Conservation Commissions would need to review applications on an as needed basis.

Level of Nitrogen Reduction: Although the level of nitrogen reduction from requiring a 50 ft. no-disturb buffer cannot be calculated, this measure will provide overall water quality improvements.

5.4 PUBLIC EDUCATION AND OUTREACH

Fertilizers applied to residential lawns comprise 6.8% of the controllable nitrogen load to Pleasant Bay, and are an important opportunity to limit nitrogen that would otherwise migrate to the estuary. One primary way to encourage changed practices among residents is through a comprehensive outreach and education program to promote the proper management of lawns and landscaped areas. The program can be developed to target individual year-round homeowners, seasonal homeowners, homeowner associations, and landscapers who provide services to homeowners. The focus of an outreach campaign should be educating watershed residents and

landscape professionals about the impacts of nitrogen fertilizer on water resources, encouraging natural landscapes and limited fertilizer use, and sharing successes through community events.

This message can be conveyed through a number of mechanisms. Potential components of an education and outreach campaign include:

- Branding a 'Cape Cod Lawn' to promoting specific lawn care practices that are unique to Cape Cod due to the fragile ecosystem. As part of the 'Cape Cod Lawn' campaign limited fertilizer use and proper application should be promoted as follows:
    - Reduce lawn area by replacing turf with native landscapes that do not require fertilization;
    - If fertilizer is needed, as determined by a professional soil test (University of Massachusetts soil lab: http://www.umass.edu/plsoils/soiltest/), limit fertilizer applications to a maximum of one lb N/1,000 sq. ft. of lawn area per year;
    - If fertilizer is needed, use an organic, slow-release, water-insoluble fertilizer at the recommended dose; do not spread the fertilizer if heavy rain is predicted; evenly distribute the fertilizer using a mechanical spreader at the lowest setting, going over the area two or three times; and sweep up fertilizer that accidentally lands on paved surfaces;
    - Leave, at minimum, a 50-foot unfertilized buffer to any pond, stream, wetland, or surface water body (perhaps 100 feet if there is a steep slope down to the water body); and
    - Fertilize only in late April/early May and late August/early September when the turf can best use the nutrients.
- Developing a venue though which homeowners can be recognized for achieving a 'Cape Cod Lawn.' This could be in the form of a lawn sign, garden tours, or highlighting homeowners' achievements in the local newspaper;
- Educating second homeowners and homeowner associations about the value of requesting landscaping services that follow specific fertilizer use and application practices described in the 'Cape Cod Lawns' checklist above;
- Working with garden clubs and other organizations, such as the Orleans Ponds Coalition, to organize trainings/workshops and garden tours featuring 'Cape Cod Lawns' and naturalized landscapes;
- Distributing 'Welcome to the Watershed' outreach materials to new and seasonal homeowners to encourage the 'Cape Cod Lawns' program and minimal or no fertilizer use;
- Establishing demonstration sites at local schools and municipal properties;
- Promoting 'Cape Cod Lawns' in local schools through a logo design competition and curricula development;
- Publishing a bi-annual newsletter or column in the local newspaper or in annual water bills to report on the program's progress and maintain public interest;
- Promoting the program at local events, such as farmer's markets, cultural fairs, etc. and in public venues, such as town halls and libraries;
- Providing educational resources on the Pleasant Bay Alliance website or through local access channels; and
- Promoting and encouraging the certification of professional landscapers by an appropriate organization such as the Pleasant Bay Alliance or the Cape Cod Cooperative

Extension Services and developing a venue through which certified professional landscapers can be identified and recognized.

Implementation Process: A meeting was held with the Pleasant Bay Alliance and other outreach organizations to discuss potential education and outreach opportunities and strategies for implementation. It was recommended that the Pleasant Bay Alliance, lead the education and outreach campaign. The Orleans Pond Coalition, Friends of Pleasant Bay, the Harwich Garden Club, the Brewster Water Quality Advisory Committee were also identified as potential partnering organizations. There may also be value in partnering with organizations such as the Massachusetts Master Gardener Association and local garden clubs, which train volunteers to provide horticultural education and outreach to the community.

Maintenance over Time: Implementing an education and outreach program would require upfront time and monetary resources. Once materials are developed and the program is launched, it would require minimal financial resources to maintain the program over time. Additionally, an education and outreach campaign can help build general consensus and support for the bylaws recommended above.

Level of Nitrogen Reduction: It is difficult to calculate nitrogen reduction from changes in behavior. Based on the conversations with DEP described above, it would be worth considering a pilot program that could demonstrate the rate of compliance among homeowners and the amount of load reduction associated with identified changes in behavior. If nitrogen fertilizer applications to residential areas, particularly by lawn care professionals, were reduced by some residents from an average of three lbs/1,000 sq. ft. to a maximum of one lb/1,000 sq. ft. this could provide a quantifiable reduction in overall fertilizer loading. Table 6 quantifies the load reduction for this strategy when 1/3, 1/2, and 2/3 of lawns currently fertilized reduce fertilizer practices by approximately 2/3 (i.e., from three to one lb/1,000 sq. ft.). This shows that a 20% reduction in load may be achievable, but would need to be validated through a pilot.

Table 5. Residential lawn nitrogen load reduction potential

Population reducing fertilizer use to 1 lb/1,000 sq. ft.	Load reduction (lbs)	Load reduction (% of fertilizer applied to lawns	Load reduction (% of controllable load)
1/3 (33%)	1,563	22%	1.5%
1/2 (50%)	2,344	33%	2.3%
2/3 (67%)	3,126	44%	3.0%

5.5 TURFGRASS MANAGEMENT TRAINING

A number of municipal and golf course professionals consulted throughout this project stressed the value of local training in turfgrass management, highlighting opportunities and techniques to reduce nitrogen fertilizer applications while maintaining turfgrass health. It is recommended that the Pleasant Bay Alliance work with the Cape Cod Water Protection Collaborative and the Cape Cod Landscape Association to develop a Cape Cod based training workshop on an annual or bi-annual basis that would attract local landscape professionals, municipal property managers and golf course superintendents. Additionally, those that attend a training could advertise their

services as 'Bay Friendly' and the Alliance could encourage citizens to look for that designation when hiring landscaping professionals.

Implementation: The training should focus on successful turfgrass management strategies and should vary each time to promote continued attendance. A sampling of the topics to cover in an initial workshop includes:

- The concerns with nitrogen in fertilizers and how it impacts the health of coastal estuaries;
- Opportunities to reduce fertilizer use on lawns, gardens, and landscaped areas;
- Alternatives to traditional fertilizer practices:
    - Organic products;
    - Kelp;
    - Beneficial microorganisms;
    - Foliar applications of fertilizers;
    - Compost; and
    - Compost teas;
- Lawn alternatives; and
- Case studies on successful nitrogen reduction programs.

Having a local educational opportunity is important to promote attendance given the costs for overtime and travel expenses for people that have to travel to more distant locations. The workshop should be designed to provide continuing education credits from the Golf Course Superintendents Association, the Northeast Organic Farmers Association and/or the Massachusetts Certified Landscape Professionals as this promotes greater attendance. In addition, if funding could be found to support such training, it can reduce the cost for participants and boost interest in the course.

Maintenance over Time: Training courses could be held on an annual or biannual basis and could be updated with new information or new lawn care techniques as they are identified.

Level of Nitrogen Reduction: No specific reduction in nitrogen load can be attributed directly to this training. However, it will promote increased knowledge of these issues and will likely result in changes in lawn care practices for residential properties, town facilities and golf courses. As personnel changes over time, continuing the training on a regular basis would help support proper lawn care practices into the future.

5.6 LAWN SIZE LIMIT FOR NEW DEVELOPMENT

Restricting the size of new lawns will directly reduce the amount of fertilizer applied to the turf and could be readily quantified in the context of achieving compliance with the Pleasant Bay TMDLs. This can be done through the adoption of amendments to each town's zoning bylaw that limit the size of new lawns to less than 2,500 sq. ft. This would reduce the impact of lawn fertilizers associated with new construction by 50% or more, as most lawn areas are typically 5,000 sq. ft. or larger. Additionally, a sliding scale could be incorporated. For example, those parcels smaller than 1 acre are allowed a maximum of 2,500 sq. ft. of lawn area, while those

parcels larger than 1 acre are allowed an area proportional to 2,500 sq. ft. (i.e., an two acre parcel is allowed a maximum of 5,000 sq. ft. of lawn area).

The table in each bylaw that provides the dimensional restrictions for each zoning district could be amended to limit lawn size in a manner often used to regulate overall lot coverage. The towns could consider offering a slightly larger lawn for properties whose area is a minimum of twice the minimum lot size within their zoning district, with the lawn size prorated based on the size of the lot. To ensure enforcement and compliance over time, deed restrictions for all lawn replacement could be required. In addition, towns many consider developing a bylaw or guidance outlining other landscaping practices to employ other than lawn that do not require significant fertilization. If a healthy, non-lawn landscape is created, there is less impetus for homeowners to add lawn in the future.

Implementation: Revisions to the zoning bylaw limiting lawn size would need to be adopted by each municipality. For example, as demonstrated in Table 5, the Town of Harwich could add a column to Table 3, Height and Bulk Regulations of their Zoning Bylaws that states Maximum Lawn Size as 2,500 sq. ft per buildable acre for all residential districts. A definition of 'lawn' would also need to be added to the Definition section of Harwich's Zoning Bylaws.

Table 6. Proposed Table 3 Height and Bulk Regulations, Town of Harwich

District	**Maximum Permitted Height (feet)**	**Maximum Permitted Height (Stories)**	**Maximum Building Coverage of Lot (covered area as % of total lot area)**	**Maximum Site Coverage as % of Total Site Area**	***Proposed Maximum Lawn Size (sq. ft./ acre)***	**Minimum Residential Net Floor Area (sq. ft.)**
RR	30	2 1/2	15	25	*2,500*	none
RL	30	2 1/2	15	30	*2,500*	none
RM	30	2 1/2	20	35	*2,500*	none
RH-1	30	2 1/2	30	35	*2,500*	none
RH-2	30	2 1/2	30	35	*2,500*	none
RH-3	50	4	15	35	*2,500*	364 (See Article VI, Section 325-18K)

It is also recommended that local planning, health and conservation regulations specifying topsoil requirements, fertilizer application rates and use of native species should be standardized and made consistent with best management practices used for outreach to homeowners and lawn care professionals. This could be accomplished by developing a set of recommended guidelines and providing these to each town with a list of requested regulatory adjustments to consider and implement.

Maintenance over Time: Once a bylaw is developed and adopted by each municipality, minimal resources would be required for maintenance. Processing deed restrictions would have to occur on an as needed basis.

Level of Nitrogen Reduction: The level of nitrogen reduction can be readily calculated using the MEP nitrogen loading assumptions. It is estimated that an additional 2,665 lbs of nitrogen will be discharged to the watershed at buildout. If new lawns are reduced by 50%, the resulting loading is also reduced to 1,332 lbs per year. Requiring deed restrictions would ensure long term reductions.

5.7 TRANSLATING RECOMMENDATIONS INTO ACTION

The implementation of each of the four recommendations above will require time and investment. The following discussion is provided to walk through the steps needed to achieve adoption of the recommendations and to identify issues that require further consideration moving forward. This discussion separates the implementation process for the three regulatory recommendations from that of the education and outreach recommendation as the approaches are somewhat different.

Agreement/Bylaw Implementation

A series of steps is provided below to guide the adoption of policy, agreement or general bylaw or agreement for municipal and golf course fertilizer management in each community, along with a zoning bylaw for the minimization of future lawn sizes.

Initial outreach and stakeholder involvement: As mentioned above, further outreach is likely needed to gain support for the general bylaws or agreements, the proposed zoning amendments to reduce lawn sizes, and the continued enforcement of proposed wetlands protection regulations to ensure a buffer zone. This could include a presentation in each town, possibly at a Board of Selectmen's meeting to explain the need for, and the benefits of each. Outreach could also be conducted through the local committees involved in the implementation of their comprehensive wastewater management plans. For the golf course fertilization bylaw or agreement, ongoing consultation with golf course superintendents and managers is recommended to develop the final components of the bylaw and gain acceptance for its adoption. Support from the Cape Cod Water Protection Collaborative at public meetings would be helpful.

Identification of responsible parties to develop the bylaws: The agreements and/or bylawscould be drafted by the Town Planner in each municipality. However, the wording of each will be very similar, and there may be an economy of scale provided by having one person or group draft a model bylaw and/or agreement that can then be formatted to meet the requirements for each town. Separate models could be adopted for each general bylaw or agreement proposed, or one overall fertilizer management bylaw or agreement could be developed incorporating management of municipal fertilizers, golf course fertilizers, and possibly including requirements for landscape professional certification. Using the model bylaw or agreement approach would allow for greater coordination between the watershed towns, which could be beneficial. Please note that the content of the bylaw(s) or agreement is simple, so they should be straightforward to draft and present for review by the towns.

Evaluation of funding options: The cost of development may be reduced if a model agreement or bylaw is created to present to each town. A collaborative process may also make it easier to obtain a grant to support the work from one of the agencies discussed in Section 6. In addition, it

would be worth considering if each town could contribute to this effort using funds appropriated for wastewater management to comply with the Pleasant Bay TMDLs. These agreements will support compliance with each TMDL and could be considered in the same fashion as funds used for wastewater management that is also needed for TMDL compliance.

Coordination of ordinance adoption: As explained above, general bylaws must be placed on the Town Meeting warrant at least 7 days prior to Town Meeting and then must receive a majority vote at Town Meeting to be adopted. A zoning bylaw amendment must be heard by the Planning Board, prior to being placed in the warrant and must receive a 2/3 majority vote at Town Meeting. Alternatively, if an agreement is used, the towns and relevant parties could draft a policy statement, which all sign and agree to abide by, and is endorsed by the Board of Selectmen.

Ongoing implementation: Once a bylaw or agreement is adopted, each town will need to ensure future compliance. The processes for compliance, such as regular reports from golf course operators, or from DPW staff for municipal facilities, could be included within the agreement or bylaw. Some initial outreach on the compliance requirements for the agreement should be considered, tailored to the appropriate audience. For example, a regular, annual meeting of golf course superintendents would be useful to evaluate the effectiveness of the proposed fertilizer reductions.

Outreach Implementation

The education and outreach recommendations discussed the proposed message to deliver and recommended that the Pleasant Bay Alliance be the lead organization coordinating this program. It is important for one person to coordinate the outreach message and program structure across the watershed and with other organizations, so all are provided with consistent information. Moving forward, this decision will need to be confirmed by representatives from each town, and a structure and financial plan put in place to allow it to move forward.

It is recommended that the outreach campaign targeted specifically on compliance with the "Cape Cod Lawn" checklist, be piloted in one of the sample sub-watersheds as identified in Appendix A. By piloting the program in a low density residential neighborhood, with no golf courses, or a high density residential neighborhood, the program can be tested and adapted to ensure it is as effective as possible. It is more challenging to identify funding options for this program. Unlike bylaw adoption, education and outreach requires more than a one-time source of funds, as efforts continue over time, requiring fiscal support each year.

Options for funding include support from the wastewater implementation funding that has or will be approved within each town. A small percentage of the operation and maintenance funding for wastewater programs could be allocated to fertilizer outreach to support compliance with TMDLs. This could potentially be supported through private donations and/or grants from programs similar to those identified in Section 6.

Ongoing coordination with the Cape Cod Water Protection Collaborative is encouraged to share lessons learned and evaluate which options considered here have value across Cape Cod. At the outset, a presentation of this study to the Collaborative members would foster a discussion on the

applicability of these recommendations in other communities. An evaluation of golf course fertilization practices, the proper management of municipal fields and restrictions on future lawn sizes all have value within other Cape watersheds. The outreach recommendations should also be useful, and there may be benefits to having a broader audience for some of the outreach programs.

Finally, coordination with the Collaborative and other outreach organizations allows this program to adapt to new ideas or outreach approaches quickly, supporting the goals of reducing nitrogen inputs to Pleasant Bay and improving water quality over time.

5.8 CUMULATIVE IMPACT OF RECOMMENDED STRATEGIES

Each strategy implemented individually could result in a reduction in nitrogen load from fertilizers. From a TMDL perspective, these strategies must have measurable impacts to the overall load to the Pleasant Bay watershed, and some may be easier to estimate than others. Table 7 summarizes the nitrogen load reduction estimates for each recommended strategy. One of the recommended strategies (lawn size limit for future development) targets future nitrogen loads. The other three recommended strategies have the combined potential to reduce controllable nitrogen loads by approximately 5.2%.

Table 7. Nitrogen load reduction potential for the recommended strategies

Strategy[1]	Potential Reduction in N Fertilizer Load Leached		
	(lbs/year)	(% of current fertilizer load)	(% of current controllable load)
Municipal fertilizer management	200	1.2%	0.2%
Golf course fertilizer management	3,650	22.8%	3.5%
Public education and outreach	1,563	9.7%	1.5%
Total (existing)	**5,410**	**33.8%**	**5.2%**
Lawn size limit for new development	1,333	8.3%[2]	1.3%[2]

[1] *Does not include strategies for which nitrogen loading estimates cannot be calculated*
[2] *These percentages were calculated based on current loads, because future loads are unknown for the watershed. This strategy addresses future development.*

As discussed earlier, while the MEP model does not estimate nitrogen fertilizer loads from municipal properties, implementation of the municipal fertilizer management strategy would guarantee that nitrogen loads do not increase over time. HW's GIS-based analysis estimated that municipalities apply approximately 2,000 lbs of nitrogen fertilizer across the watershed to ball fields only. This estimate represents approximately 400 lbs, or 180 kg of nitrogen leached across the watershed, but does not include other fertilized properties such as "high-visibility" properties for each municipality. If towns reduce nitrogen fertilizer applications to these fields to 1.5 lbs/1,000 sq. ft./year, this would represent an annual reduction of only 200 lbs of nitrogen input

to the watershed. The greater benefit of this recommendation would be a cap to future fertilization of municipal properties, should current practices change.

For golf courses, a 40% reduction in nitrogen load can be achieved for this source if the loadings to rough areas are limited to one lb N/1,000 sq. ft. If possible, this would mean the overall nitrogen load from golf courses would be reduced from 8.3% of the controllable load to Pleasant Bay to 4.8%. As mentioned above, each course could be given flexibility in how fertilizer reductions take place, provided, overall, that a 40% reduction is achieved.

While it is difficult to calculate nitrogen reduction from changes in home lawn fertilization behavior, HW estimates that if approximately one third of residents reduce their applications from an average of three lbs/1,000 sq. ft. to a maximum of one lb/1,000 sq. ft as a result of the education and outreach campaign, then nitrogen fertilizer applications to residential areas could be reduced by approximately 20%.

Nitrogen loads associated with future buildout are based on the MEP model's estimate of 2,468 additional residential properties, and assumptions on current fertilizer practices. This corresponds to a potential added nitrogen fertilizer application of 13,325 lbs/year, or 2,665 lbs leached per year. Successful implementation of a lawn size limit on new development could potentially reduce that future load by 1,332 lbs per year. Deed restrictions would be needed to ensure long term reductions.

6.0 POTENTIAL FUNDING OPPORTUNITIES

A series of potential opportunities to fund the implementation strategies have been identified through the research conducted as part of this project. Brief descriptions are provided below along with web links for further information.

6.1 NEW ENGLAND GRASSROOTS ENVIRONMENTAL FUND

Source: http://grassrootsfund.org/

The New England Grassroots Environmental Fund (NEGEF) provides grants ranging from $500 to $2,500 to organizations in New England that are conducting community-based environmental work, have less than two full-time staff or their equivalents, and have an operating budget of less than $100,000. The goal of the grant program is to support community work that will strengthen the role of local citizens in solving environmental problems or developing sound environmental policies. Qualifying community programs should identify a significant community need and clear plan for translating the need into action.

6.2 MASSACHUSETTS ENVIRONMENTAL TRUST

Source:
http://www.mass.gov/?pageID=eoeeaterminal&L=4&L0=Home&L1=Grants+%26+Technical+Assistance&L2=Grant+%26+Loan+Programs&L3=Massachusetts+Environmental+Trust+%28MET%29&sid=Eoeea&b=terminalcontent&f=eea_met_met_grant_programs&csid=Eoeea

The Massachusetts Environmental Trust provides grants to communities and non-profit organizations for projects that will restore, protect, and improve water and water-related resources of the Commonwealth. The Trust specifically seeks proposals that improve water quality or quantity, conserve aquatic or marine habitats and species, reduce runoff pollution, mitigate the effects of climate change on water resources, promote human health as it relates to water resources, and other efforts consistent with the Trust's mission. Grant size varies, but it typically ranges between $10,000 and $50,000 per year per award. Applications are accepted in the fall.

6.3 CLEAN WATER STATE REVOLVING FUND

Source: http://www.mass.gov/dep/water/wastewater/cwsrf.pdf

The Clean Water State Revolving Fund (CWSRF) solicits projects from municipalities and wastewater districts that focus on meaningful water quality and public health benefits, and address the needs of the communities and the watersheds. Grants are typically awarded for planning and construction of projects, however, grants are also awarded for non-structural projects that are consistent with DEP's Nonpoint Source Management Plan (http://projects.geosyntec.com/NPSManual/NPSManual.pdf). Projects that support the need to achieve or maintain compliance with applicable discharge permits or other water quality pollution control requirements are preferable. Solicitation for applications are announced each Summer/Fall.

7.0 CONCLUSIONS

Management of golf course fertilizer applications provides the best opportunity to reduce the fertilizer-based nitrogen load to Pleasant Bay. A reduction in fertilizers applied to golf course roughs (or equivalent fertilizer application reductions) could reduce the overall, controllable nitrogen load to the Bay by approximately 4%, a significant reduction for a non-point source use of nitrogen. Towns should also consider adoption of general bylaws to limit the fertilizers applied to municipal lands, including parks athletic fields, and landscaped areas around public buildings. While this is not a significant source of nitrogen to the Bay, it demonstrates that Town officials are willing to put into practice the strategies they are requesting of golf courses and homeowners.

Outreach and education is important and may be the best way to change the behavior of homeowners and the landscape professionals that take care of many lawns. However, the fertilizer load from existing homeowner lawns is less than that created by golf course fertilization. In addition, the extent to which outreach can change practices is limited, with an estimated 20% reduction anticipated from a successful outreach program. These numbers would need to be evaluated in a pilot program to further evaluate the effectiveness of outreach and education.

Finally, future loading from fertilization of lawns associated with new construction is a significant potential additional source to Pleasant Bay, comprising a 40% increase in residential

fertilizer loads over existing loads. Zoning bylaws should be revised in each town through amendments to the dimensional tables to limit new lawns to a maximum size of 2,500 sq. ft., thereby reducing this future load by 50%.

In summary, adoption of the five strategies targeting current nitrogen load could result in an overall nitrogen loading reduction of 5,410 lbs/year, which represents 5.2 % of the controllable nitrogen load within the watershed. In addition, the fourth strategy targeting residential lawns for future development would result in a reduction in future loadings of 1,332 lbs/year. While these reductions do not solve Pleasant Bay's water quality problems, they can assist in TMDL compliance efforts underway in each of the four watershed towns.

REFERENCES

Massachusetts Estuaries Project, Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Pleasant Bay System, Orleans, Chatham, Brewster and Harwich, Massachusetts - Final Report, May 2006

Massachusetts Estuaries Project, Linked Watershed-Embayment Model (MEP Model)

Brewster Bylaws and Regulations

http://www.town.brewster.ma.us/index.php?option=com_docman&task=cat_view&gid=85&Itemid=115

http://www.town.brewster.ma.us/index.php?option=com_content&view=category&id=27&Itemid=33

http://www.town.brewster.ma.us/images/stories/conregs.pdf

http://www.town.brewster.ma.us/index.php?option=com_docman&task=doc_download&gid=26&Itemid=115

http://www.town.brewster.ma.us/index.php?option=com_docman&task=cat_view&gid=85&Itemid=115

Chatham Bylaws and Regulations

http://www.ecode360.com/ecode3-back/getSimple.jsp?custId=CH2233&guid=10426251

http://chathamma.virtualtownhall.net/Public_Documents/ChathamMA_Health/Nitrogen Loading/Approved Nitrogen Loading Regulation 05-01-06.pdf

http://www.chatham-ma.gov/public_documents/chathamMA_conservation/Chapter 272.pdf

http://www.chatham-ma.gov/public_documents/chathamMA_conservation/WetlandsProtectionRegulations

http://chathamma.virtualtownhall.net/Public_Documents/ChathamMA_planning/Subdivision Regulations.pdf

http://chathamma.virtualtownhall.net/Public_documents/chathamma_CommDev/Zbylaw.pdf

Harwich Bylaws and Regulations

http://harwichma.virtualtownhall.net/Public_Documents/HarwichMA_Admin/GENERAL%20CODE%20-%20FINAL.pdf

http://harwichma.virtualtownhall.net/Public_Documents/HarwichMA_Admin/general%20by-laws.pdf

http://www.harwich-ma.gov/Public_Documents/HarwichMA_Health/BOHregs.pdf

http://www.harwich-ma.gov/Public_Documents/HarwichMA_Conservation/wetland%20regs%20updated%207-2008.pdf

http://harwichma.virtualtownhall.net/Public_Documents/HarwichMA_Planning/Rules-Regs/Rules_and_Regs-122308APPROVED-FINAL.pdf

http://harwichma.virtualtownhall.net/Public_Documents/HarwichMA_Planning/Zoning%20November%202009.pdf

Orleans Bylaws and Regulations

http://www.e-codes.generalcode.com/globalsearch.asp

http://www.town.orleans.ma.us/Pages/OrleansMA_Health/NutrientManagementRegulationsAdopted2008-11-18.pdf

http://www.e-codes.generalcode.com/codes/1150_A/Ch.%20160,%20Wetlands.pdf

http://www.e-codes.generalcode.com/codes/1150_A/Ch.%20196A,%20Wetlands%20Regulations.pdf

http://orleansma.virtualtownhall.net/Pages/OrleansMA_Planning/bylaws

http://www.e-codes.generalcode.com/codes/1150_A/Ch.%20192,%20Subdivision%20Rules%20and%20Regulations.pdf

Cape Cod Commission Regional Policy Plan

http://www.capecodcommission.org/RPP/home.htm

Fertilizer Management Strategies References

Florida-Friendly Landscapes: http://www.dep.state.fl.us/WATER/nonpoint/docs/nonpoint/ffl-mo-ccr-1-09.pdf

Fertilizer and Landscape Management Rule, Environmental Protection Commission of Hillsborough County, Florida: http://www.epchc.org/LandscapeManagement.htm

Proposed Fertilizer Use Ordinance, Wakulla County, Florida: http://www.mywakulla.com/docs/agendas/December82009/Tab19Attachment3.pdf

Model Landscape Design Zoning Bylaw for the North and South Rivers Watershed Association*:* http://www.greenscapes.org/files/file/Bylaw/LandscapeBylaw.pdf

Fertilizer Application Model Bylaw, New Jersey DEP: http://www.state.nj.us/dep/watershedmgt/DOCS/TMDL/Fertilizer%20Application%20Model%20Ordinance.pdf

Florida Yards and Neighborhoods Environmental Landscape Management Educational Program: http://dep.state.fl.us/water/nonpoint/docs/nonpoint/fynxord.pdf

Restrictions on the Application and Sale of Lawn Fertilizer within the County of Westchester: http://environment.westchestergov.com/index.php?option=com_content&task=view&id=2580&Itemid=4621

N-Balance - Nitrogen Offset Program, New Hampshire Coastal Protection Partnership: http://www.nhcoast.org/index.php/welcome/overview/live-nitrogen-reduction-program/

New Castle Lawn Fertilizer Campaign, New Hampshire Coastal Protection Partnership: http://www.nhcoast.org/index.php/welcome/overview/new-castle-nitrogen-reduction-program/

Water Smart Landscapes Rebate Program, Southern Nevada Water Authority (SNWA): http://www.snwa.com/html/cons_wsl.html

EPA GreenScapes: http://www.epa.gov/oppfead1/Publications/catalog/greenscaping.pdf

King County, WA's Solid Waste Division's Natural Lawn Care Campaign: http://your.kingcounty.gov/solidwaste/naturalyardcare/documents/Five_easy_steps.pdf

Greenscapes Massachusetts Coalition: http://greenscapes.org/index.html

Massachusetts Horticulture Society's Master Gardener Program: http://www.masshort.org/Master-Gardener-Program

Northeast Organic Farming Association (NOFA) Standards for Organic Lawn Care: http://www.organiclandcare.net/sites/default/files/upload/NOFA_Standards_4th_ed_2009.pdf

Florida-Friendly Best Management Practices for Protection of Water Resources by the Green Industries: http://www.dep.state.fl.us/water/nonpoint/docs/nonpoint/BMP_Book_final.pdf

Best Management Practices for Nutrient Management of Turf in New Jersey, Rutgers Cooperative Extension and Research: http://www.turf.rutgers.edu/outreach/bmpnutrientmanagement.pdf

Golf Courses Nitrogen Management Challenge, Peconic Estuary Program & EPA Region 2: http://www.epa.gov/owow_keep/tmdl/tmdlsatwork/peconic.html http://www.epa.gov/region02/p2/nitrogen_management/ http://www.peconicestuary.org/News.Golf.html

Funding Opportunities References

http://grassrootsfund.org/

http://www.mass.gov/?pageID=eoeeaterminal&L=4&L0=Home&L1=Grants+%26+Technical+Assistance&L2=Grant+%26+Loan+Programs&L3=Massachusetts+Environmental+Trust+%28MET%29&sid=Eoeea&b=terminalcontent&f=eea_met_met_grant_programs&csid=Eoeea

http://www.mass.gov/dep/water/wastewater/cwsrf.pdf

http://projects.geosyntec.com/NPSManual/NPSManual.pdf

Appendix A - Three sample sub-watersheds

HW selected and conducted a preliminary assessment of three sub-watersheds to Pleasant Bay for their different land use characteristics, including presence or absence of a golf course, and low or high density residential land uses. The goal was to develop subwatershed information that could potentially be used to evaluate specific management strategies, such as outreach and education.

Since the model assumes no fertilizer applications to commercial properties, HW tried to identify sub-watersheds with limited commercial area. These sub-watersheds' individual nitrogen loads and their residential buildout potential are described below. These watersheds can be used as potential pilot watersheds for implementation of some of the recommended strategies. The MEP report describes the buildout analysis as based on zoning districts, including overlay districts (e.g., water resource protection districts). Larger lots were subdivided by the minimum lot size to determine the total number of new lots and existing developed properties were reviewed for additional development potential (e.g., residential lots that are twice the minimum lot size, but have only one residence).

Low density residential, no golf course

The Pochet Neck Stream sub-watershed in Orleans (identified as sub-watershed #56 in the MEP model) was selected as an example of low-density residential watershed with over 80% of the watershed covered by 64 residential parcels totaling almost 56 acres. The model estimates the nitrogen input from fertilizer in this sub-watershed at 71 lbs/year, exclusively from residential properties. This represents approximately 9% of the total nitrogen load for the watershed, estimated at 831 lbs. The model also estimates the development potential at 18 residential lots, or an additional input of 19 lbs/year.

Higher density residential

The Ryder Cove sub-watershed in Chatham (identified as sub-watershed #85 in the MEP model) was selected as an example of higher-density residential watershed with over half the watershed covered by 76 residential parcels totaling approximately 43 acres. The Chatham Harbor watershed most likely includes higher density residential areas, but it also includes commercial areas, and a small golf course. The model estimates the nitrogen input from residential fertilizer in this sub-watershed at 82 lbs/year. This represents less than 8% of the total nitrogen load for the watershed, estimated at 1,069 lbs. The model also estimates the development potential at 13 residential lots, or an additional input of 14 lbs/year.

Predominantly golf course

The Tar Kiln Stream sub-watershed in Brewster (identified as sub-watershed #63 in the MEP model) was selected as an example of a watershed with predominantly golf course land use, with only 12 residential parcels covering approximately 12 acres, and accounting for 6% of the watershed. The model estimates the nitrogen input from fertilizers in this sub-watershed are the following: 9.7 lbs/year from residential properties, and 2,822 lbs/year from the Captain's golf course. This represents over 90% of the total nitrogen load for the watershed, estimated at 3,115 lbs. The model also estimates the development potential at nine residential lots, or an additional input of 9.7 lbs/year.

Appendix B - Golf course nitrogen application information

The information provided in this appendix is based on data provided by the Pleasant Bay Alliance in a report dated 4/25/2007, and updated based on HW's review of the MEP Model for Pleasant Bay. Please note that these numbers represent the nitrogen fertilizer applied to each golf course, but that the model then assumes a 20% leaching rate. When available, recent fertilizer application rates, as provided by golf course superintendents are reported in bold.

Captains Golf Course

Captain's Golf Course Nitrogen Application Summary								
Turf Type	Area (1,000 sf^2)*		Application Rate (lbs./1,000 sf^2/yr)			Amount of Nitrogen Applied (lbs/yr)*		
Rough	3,902	3049	4.5	4.25	**2 - 2.5**	17,559	12,958	**6,098 - 7,622**
Tee	127	305	5.5	3.5	**3.5 - 4**	699	1,068	**1,068 - 1,220**
Green	206	331	6	4.5	**3.5 - 4**	1,236	1,490	**1,158 - 1,324**
Fairway	1,597	2614	4.5	4.25	**2.5 - 3**	7,187	11,110	**6,535 - 7,842**

*Rounded Shaded figures provided by Captains Golf Course (grey shading from 2007 report, green and bold figures obtained from HW for 2009)

Eastward Ho!

Eastward Ho! Nitrogen Application Summary										
Turf Type	Area (1,000 sf^2)*		Application Rate (lbs./1,000 sf^2/yr)				Amount of Nitrogen Applied (lbs/yr)*			
Rough	1490	1306	2	3.2	3.1	**3.05**	2980	4179	4049	**3,983**
Tee	29	66	3	4.6	4.76	**4.56**	87	304	314	**301**
Green	70	133	3	3.1	2.95	**3.89**	210	412	392	**517**
Fairway	1,156	1,350	3	4.1	4.9	**3.9**	3,468	5535	6566	**5,265**

*Rounded Shaded figures provided from EH! Golf Course, blue '05, yellow '06, green '09

Cape Cod National

Cape Cod National Nitrogen Application Summary										
Turf Type	Area (1,000 sf^2)*		Application Rate (lbs./1,000 sf^2/yr)				Amount of Nitrogen Applied (lbs/yr)*			
Rough	2,373	1401	2	2	2	2	4,746	2802	2802	2802
Tee	118	118	2.25	3.5	2.5	2.7	266	413	295	319
Green	95	95	4.5	4.06	2.6	4.87	428	386	247	463
Fairway	960	1421	1.75	2.6	1.4	1.5	1,680	3695	1989	2132

Shaded figures from CCN green '04, blue '05, yellow '06

Appendix C - Preliminary List of Recommended Fertilizer Management Strategies

A series of potential fertilizer management options under consideration for Pleasant Bay are provided below. These are the same options presented and discussed at a meeting of the Pleasant Bay Alliance Watershed Work Group on May 26, 2010. Each option is described below along with its pros and cons. In addition, a preliminary estimate of the ability to quantify the nitrogen loading reduction of each option is provided, along with the potential effectiveness of each approach.

The benefits and challenges for each option were provided to spur input from the Work Group on which options seemed most applicable for Pleasant Bay. The five recommended fertilizer management strategies described in Section 5 of the report were derived from the discussions about these 17 preliminary options.

Regulatory Options

1. Develop a zoning or general bylaw to limit the size of new lawns to less than 2,500 sq. ft. This would limit fertilizer applications from new development to 50% or less than existing development.

   Pros: The impact of lawn fertilizers associated with new construction would be cut by 50% or more, as most lawn areas are typically 5,000 sq. ft. or more.

   Cons: There are enforcement questions related to ensuring the lawn is the proper size and does not grow in the future. This could be offset by the Deed Restriction discussed in item #5 below.

   Ability to Measure Load Reduction: The extent of nitrogen reduction from this option can be readily calculated using the MEP nitrogen loading assumptions.

   Effectiveness: Moderate to High

2. Require residents and businesses who want a larger lawn than that provided above to purchase a nitrogen loading offset credit for the fertilizer impacts associated with the larger lawn. This money could be used to promote fertilizer outreach programs and/or support wastewater planning processes within the watershed towns. This could also be a voluntary program, where people pay for their nitrogen use in a manner comparable to people purchasing a carbon offset for an airline trip. A similar program has been developed by the New Hampshire Coastal Protection Partnership through which residents can voluntarily purchase a nitrogen offset according to their perceived nitrogen footprint. Revenue helps support a fertilizer outreach program.

   Pros: Nitrogen loading offsets are becoming more common on Cape Cod in watersheds where loadings must be restricted. This approach could provide funding support for other outreach, education and lawn removal programs.

Cons: The offset described above does not result in a load reduction; it only develops revenue from those willing to pay for it.

Ability to Measure Load Reduction: Not applicable

Effectiveness: Low to Moderate

3. Develop a general bylaw for each applicable town limiting fertilizer applications on golf courses. The appropriate level of nitrogen reduction to set in such a bylaw requires careful consideration based on a review of current management practices at each course in the watershed. To be equitable, the loading allowance could be based on a watershed wide per-acre nitrogen loading rate that recognizes relevant TMDLs.

   Pros: Golf course turf represents a significant component of the overall nitrogen load in three of the Pleasant Bay sub-watersheds. Controlling these sources is worthwhile and supports efforts to control fertilizer loadings on municipal, residential and other commercial properties. Setting an allowable loading rate based on the appropriate TMDLs promotes equity throughout the watershed.

   Cons: Any fertilizer restrictions at the golf courses need to be determined in the context of the overall health of the golf course turf to insure its long term viability.

   Ability to Measure Load Reduction: Any reductions in loading to the golf courses can be readily quantified.

   Effectiveness: Moderate

4. Develop a bylaw limiting fertilizer applications on municipal properties including school grounds, athletic fields, cemeteries and other town-owned lawns and garden areas. It may be possible to eliminate fertilizer applications in some locations, with a reduced level of application possible for some athletic fields such as Cape Cod Baseball League fields. A similar bylaw was adopted by Citrus County, Florida.

   Pros: This option allows the town government to lead by example, reducing nitrogen fertilizers on municipally-owned lands and managing coastal water quality. This could also potentially result in budget savings for the town.

   Cons: None identified.

   Ability to Measure Load Reduction: The load reduction can be readily quantified through working with the appropriate personnel from each community.

   Effectiveness: High

5. Require a Deed Restriction for all lawn removal or future lawn installations (for new development) restricting the lawn size to that required. This would limit future lawns to a set

number, such as the 2,500 sq. ft. discussed in option 1 above, or limit redevelopment of lawns voluntarily reduced in size. A similar program was developed by the Southern Nevada Water Authority. Although the focus of the program is on water conservation, residents who receive a rebate for replacing turf with drought tolerant plants are required to accept a restrictive covenant or conservation easement to ensure the conversion is sustained in perpetuity.

Pros: Requiring a Deed Restriction places a greater level of emphasis on the importance of maintaining a lawn at a certain size and helps with the enforcement of lawn size restrictions.

Cons: Implementing lawn size restrictions adds a layer of enforcement that some may find cumbersome.

Ability to Measure Load Reduction: This approach adds to the certainty that any lawn size reductions or restrictions will be in place long term, adding to the ability to quantify a load reduction to the embayment.

Effectiveness: Moderate to High

6. Develop a general bylaw requiring specific fertilizer application practices for all properties within the watershed. These could include restrictions on the timing of fertilizer applications such that they can only be applied during the growing season. Restrictions on applications near wetland resource areas, and on or near impervious surfaces could be developed as well. There could also be restrictions on applications immediately in advance of a rain event. A model bylaw was developed by the Florida Department of Environmental Protection (FL DEP) for fertilizer use on urban landscapes which addresses application practices (including timing of application), establishes a fertilizer-free zone, requires a soil test prior to fertilizer application, and establishes a training program for commercial and institutional applicators.

   Pros: A general bylaw provides a mechanism to standardize lawn care practices throughout the watershed and promotes the importance of proper fertilization use. It raises the importance of the outreach and education process needed to reduce fertilizer impacts on water quality.

   Cons: Enforcement of specific fertilization practices is difficult and requires municipal staff resources from each community to be effective.

   Ability to Measure Load Reduction: A specific load reduction will be difficult to quantify. However, this approach, combined with other non-regulatory and outreach efforts could be used to justify credit for a percentage reduction in the overall loading to Pleasant Bay from fertilizers.

   Effectiveness: Low to Moderate

7. Develop a general bylaw to require certification and training of landscapers and lawn care providers and set up a series of best management standard that they must follow. The

certification could also include the design and construction standards for lawn removal and replacement. This approach is promoted by FL DEP in the model bylaw for the Protection of Water Quality and Quantity. All persons providing landscape maintenance services for hire are required to complete training in Florida-Friendly Landscape Practices.

Pros: Requiring training and best management practices from lawn care providers could increase awareness of the issues, and promote a reduction in fertilizer use.

Cons: There are questions about the enforcement of such a bylaw and the ability to fund the oversight of the training and certification. This could be discussed with the Barnstable County Extension Service.

Ability to Measure Load Reduction: A load reduction from changed lawn care practices can be estimated, with a contingency based on the level of buy-in and long term cooperation expected from the lawn care providers.

Effectiveness: Moderate

Non-Regulatory Options

8. Develop a "Lawn Sense" or "Bay Sense" program to promote the proper management of lawn areas. Property owners could join once they agree to adopt a series of lawn care practices that reduce nitrogen application. Different tiers of membership could be achieved. For example, someone who removes lawn area could achieve greater recognition.

   Pros: Such a program would work well with the other regulatory and outreach options discussed here. It also provides recognition to those homeowners and businesses that are improving their practices, potentially increasing the peer pressure on other property owners.

   Cons: There are questions on the long term viability of such a program that require further research and assessment to determine how it can be sustained. There are also issues with the cost of implementing the program.

   Ability to Measure Load Reduction: The nitrogen loading reductions can be readily quantified based on the expected changes in lawn care practices.

   Effectiveness: Moderate to High

9. Certify and/or promote nurseries and stores that promote Lawn Sense or Bay Sense products. Arrangements could be made with businesses and distributors to develop discounted prices for appropriate products. Funding opportunities to support this option are outlined under #13.

   Pros: A partnership with the firms providing lawn care products can support the other programs described here and further build on the acceptance of alternative lawn care practices as an acceptable component of a TMDL management plan

Cons: Time, effort, and funding are needed to coordinate the program.

Ability to Measure Load Reduction: A specific load reduction will be difficult to quantify. However, this approach, bundled with other non-regulatory and outreach efforts could be used to justify credit for a percentage reduction in the overall loading to Pleasant Bay from fertilizers.

Effectiveness: Low to Moderate

10. Explore a partnership with the Natural Resource Conservation Service or Barnstable County Extension Service to provide native species for lawn replacements. Further research and discussion is needed to determine if this would be worthwhile, but it may provide an alternative to partnering with private plant distributors.

    Pros: Having a reliable source for native species will promote the transformation of lawns to landscapes requiring less fertilizer. The economy of scale of initiating a program like this across Cape Cod could be explored.

    Cons: There may be concerns raised by for-profit nurseries and landscape firms that want to provide a similar service. This could be a fall back option if the for-profit outlets are not providing what is needed by homeowners.

    Ability to Measure Load Reduction: A specific load reduction will be difficult to quantify. However, this approach, combined with other non-regulatory and outreach efforts could be used to justify credit for a percentage reduction in the overall loading to Pleasant Bay from fertilizers.

    Effectiveness: Low to Moderate

11. Promote the removal of lawn area replaced by native landscape that does not require fertilization. Options to fund this are outlined below, under #13. A similar program was developed by the Southern Nevada Water Authority (SNWA). SNWA provides a rebate for grass removed and replaced with desert landscaping. Acceptance of a restrictive covenant or conservation easement is required. Although this program is aimed at water conservation, specific criteria could be established to address fertilizer use.

    Pros: Reducing lawn size is the most effective and measurable approach to reducing fertilizer loadings and should be easily accepted as part of a TMDL management plan.

    Cons: There are costs associated with the removal and replacement of lawn that must be considered. Properties within 100 feet of a wetland resource area will need approval from the local Conservation Commission.

    Ability to Measure Load Reduction: The load reduction from lawn replacement can be readily quantified.

Effectiveness: High

12. Develop a mechanism to pre-approve lawn removal/replacement projects located within the jurisdiction of the Conservation Commission. Having a general approval for lawn replacement projects subject to appropriate conditions on native plant selection, equipment access, and erosion and sedimentation controls would simplify the lawn removal process. The type of approval process will vary by town, and could potentially be incorporated into an administrative review category.

    Pros: Having a lawn replacement program pre-approved by the Conservation Commission, or having the approval process streamlined will greatly increase public involvement in replacing their lawn.

    Cons: Issues with the level of detail needed to gain Conservation Commission approval need to be investigated. For example, is a surveyed plan needed for approval? This can generate costs that may make homeowners reluctant to move forward.

    Ability to Measure Load Reduction: On its own, this option does not reduce fertilizer loads. It does provide support for the lawn replacement program for which load reductions can be readily quantified.

    Effectiveness: Moderate

13. Develop funding opportunities to support lawn removal and offset discounted prices for appropriate lawn care products. One option is the development of a low-interest loan program modeled on the Barnstable County septic system upgrade loan program. The possibility of using state revolving funds or a 319 non-point source pollution grant (or other grant services) could be explored to provide seed money.

    Pros: The cost of a lawn replacement may be more than a homeowner can fund at one time, but they may be interested if they can borrow the money in a simple manner and pay it off over time.

    Cons: There will be costs associated with the administration of the program, and initial seed money is needed to initiate the loan process.

    Ability to Measure Load Reduction: On its own, this option does not reduce fertilizer loadings. It does provide support for the lawn replacement program for which load reductions can be readily quantified.

    Effectiveness: Moderate

Outreach

14. Develop a focused outreach program to educate seasonal homeowners on the need to reduce fertilizer applications.

    Pros: As seasonal homeowners comprise a significant percentage of overall homes in the watershed, and many are located adjacent to the embayment or its tributary waters, it is important for them to recognize the importance of this issue. It will also help them realize the need to select a landscape contractor who is well versed in appropriate lawn care practices and who may be certified as discussed in item #7 above.

    Cons: There is a need to identify who would be involved in managing the outreach program.

    Ability to Measure Load Reduction: A specific load reduction will be difficult to quantify. However, this approach, combined with other non-regulatory and outreach efforts could be used to justify credit for a percentage reduction in the overall loading to Pleasant Bay from fertilizers.

    Effectiveness: Low to Moderate

15. Promote tours of model properties complying with Lawn Service practices to highlight how a healthy attractive landscape can be achieved while lowering or eliminating fertilizer applications.

    Pros: Many homeowners are reluctant to believe that they can maintain a healthy and attractive landscape by applying alternative lawn care approaches. Having an opportunity to hear success stories can promote others to change their practices.

    Cons: None identified.

    Ability to Measure Load Reduction: A specific load reduction will be difficult to quantify. However, this approach, combined with other non-regulatory and outreach efforts could be used to justify credit for a percentage reduction in the overall loading to Pleasant Bay from fertilizers.

    Effectiveness: Low

16. Consider an outreach and education program within the local schools. Children bring information and outreach materials home to their parents. If feasible within the curriculum, this can be an effective technique to change behavior.

    Pros: School curricula have proven effective in changing homeowner behavior, such as with recycling.

Cons: There are challenges in getting support from teachers on new curricula as they have significant time constraints on outside issues they can teach based on state standards and testing requirements.

Ability to Measure Load Reduction: No direct load reduction can be quantified as a result of this individual action.

Effectiveness: Moderate

17. Develop guidance materials for the public works officials managing the compost production facilities that exist in one or more of the Pleasant Bay towns. Many homeowners welcome the availability of compost from the municipality, but have questions about its quality. Guidance could be provided to ensure the compost is processed well and in a uniform fashion, such as through ensuring a high enough temperature is reached to kill off weed seed. This would increase the community's confidence in a product that can support the fertilizer reduction goals of this project.

    Pros: High-quality compost can replace or reduce the fertilizer demands for residential lawns and gardens.

    Cons: This may require funding and staff resources initially for training on proper compost management.

    Ability to Measure Load Reduction: No direct load reduction can be credited to this action. However, this approach, combined with other non-regulatory and outreach efforts could be used to justify credit for a percentage reduction in the overall loading to Pleasant Bay from fertilizers.

    Effectiveness: Low