



CAPE COD  
COMMISSION

---

## Memorandum

To: Elaine Wijnja, DHCD DLTA Liaison  
From: Patty Daley, Deputy Director, Cape Cod Commission  
Date: January 10, 2019  
Re: Town of Brewster, District Local Technical Assistance Grant

The Town of Brewster was awarded \$25,000 of DLTA funding to support the Town of Brewster in developing a framework for municipal management of alternative septic systems for nitrogen treatment to meet nitrogen reduction goals for the Pleasant Bay **watershed. Both the management framework and the town's proposed** pilot program to evaluate the effectiveness of innovative nitrogen treatment leach field systems will provide valuable information for the town and the Cape Cod region as a whole.

Since this project was funded, the Town of Brewster became one of four communities in the Commonwealth to receive a Watershed Permit from the Massachusetts Department of Environmental Protection. This project directly assists the town in meeting its obligations under the Watershed Permit and will lead to the improvement of water quality in Pleasant Bay.

Project deliverables include:

1. A Draft General Bylaw for the Regulation of Sewage Disposal Systems to Protect Water Quality in Pleasant Bay;
2. A Memorandum Regarding the Implementation of an Onsite Septic System Treatment Program for the Pleasant Bay Watershed;
3. A Memorandum Regarding the Evaluation of the Number of Homes in the Pleasant Bay Watershed that will Require an Advanced Septic System to Meet the Nitrogen Reduction Goals for the Watershed; and,
4. A One Page Summary of Implementation Issues.

Project deliverables will be made available to all Cape Cod towns with nitrogen TMDL waterbodies.

Funding for this project is provided by the Department of Housing and Community **Development's District Local Technical Assistance program** through the Cape Cod Commission.

**DRAFT**  
**Town of Brewster, MA**  
**General Bylaw (for Town Meeting approval)**

**Regulation of Sewage Disposal Systems to Protect Water Quality in Pleasant Bay**

*This is a preliminary draft of the proposed bylaw developed for discussion purposes. Reader's notes are provided in specific sections to identify issues that need further evaluation and discussion.*

**1. Purpose and Authority**

- 1.1 This chapter is adopted to comply with the Town of Brewster's obligations pursuant to the Pleasant Bay Watershed Permit, issued by The Massachusetts Department of Environmental Protection (MassDEP) on August 3, 2018 (the "Permit"). The Town has concluded that it is necessary to reduce nitrogen in effluent from on site wastewater disposal systems in order to comply with the Town's obligations under the Permit. These requirements supplement and are in addition to those found in the *State Environmental Code Title 5* (310 CMR 15.00) ("Title 5").
- 1.2 The Brewster Board of Health is authorized to enforce this chapter and to adopt implementing regulations pursuant to M.G.L. Chapter 111, Section 31 and 127A, as amended to supplement its existing regulations.

*The Board of Health will be asked to develop implementing regulations to oversee the upgrade of septic systems in the Pleasant Bay watershed, providing details on the performance of the systems that are installed, the operation and maintenance requirements and monitoring schedules. These regulations can be updated over time based on lessons learned or to incorporate new technologies for nitrogen treatment.*

**2. Applicability**

This regulation shall apply to all existing and proposed subsurface sewage disposal systems located in Subwatershed \_\_\_\_\_, as shown on Map entitled \_\_\_\_\_ (the "Map") below. A copy of the Map is on file at the Brewster Board of Health Office at 2198 Main Street, Brewster, Massachusetts

*Further work is needed to determine the number and location of properties that will be required to update their septic system. This will depend primarily on the level of nitrogen treatment that can be provided by the advanced systems that will be used.*

**3. Definitions**

**Enhanced nitrogen removal system:** An alternative or innovative septic system that is approved by MassDEP for general, pilot or provisional use.

**Person:** An individual, owner, firm, corporation, company, parent company, subsidiary, limited liability company, entity, trust, joint venture, partnership, legal representative, agent or other form of doing business or any other group of individuals or entities and includes the plural as well as the singular.

#### **4. Effluent Treatment Requirements for Septic Systems in Subwatershed \_\_\_\_\_.**

All existing septic systems and any proposed septic systems associated with new construction or expansion of existing development with Subwatershed \_\_\_\_\_ must be upgraded to comply with these requirements. Existing septic systems shall be upgraded at the time of any transfer in title of the property. All such upgrades, as well as construction of new septic system or expansion of all septic systems with Subwatershed \_\_\_\_\_ must incorporate an advanced nitrogen removal system approved for use by the MassDEP that will treat septic system effluent to a standard of \_\_\_\_\_ mg/L of total nitrogen or below. Compliance with the \_\_\_\_\_ mg/L standard must be measured in the effluent after treatment is conducted and before it is discharged into the ground below the leaching facility. All systems must be designed and installed with accessible monitoring ports.

#### **5. Monitoring Requirements**

Monitoring must be conducted according to the requirements for the innovative and advanced onsite treatment systems as approved by the Massachusetts Department of Environmental Protection (310 CMR 15.280) and the Board of Health. Monitoring for compliance with the Pleasant Bay Watershed Permit is also required according to requirements that will be established by the Board of Health. Monitoring will be conducted by \_\_\_\_\_ and all results shall be submitted to the Board of Health.

The Town reserves the right to take over monitoring for any or all systems installed pursuant to this chapter and to assess a fee to property owners to cover the costs of the same.

*Monitoring is required to prove that the advanced nitrogen treatment systems are meeting the required performance standards for compliance with the Pleasant Bay Watershed Permit. The Town needs to determine who will be responsible for taking samples, reporting results and paying for the ongoing testing.*

#### **6. Operation and Maintenance Requirements**

The property owner shall hire a person or firm who is approved by the system manufacturer and the Board of Health to operate the system and perform routine maintenance in accordance with the manufacturer's guidelines along with any additional requirements of MassDEP or the Board of Health. The property owner shall file documentation in the form of reports or receipts of routine maintenance or any repairs with the Board of Health.

The Town reserves the right to take over operations and maintenance for any or all systems installed pursuant to this chapter and to assess a fee to property owners to cover the costs of the same.

*The Town needs to decide if Town staff will conduct the system O&M, or if they will approve certified operators that will do the work on behalf of the property owner. There may also be options for regional coordination on system O&M that can be explored.*

## **7. Easements**

At the time of system approval by the Board of Health, a property owner must grant an easement to the Town in a form approved by Board of Health to conduct any required monitoring and/or operation and maintenance. All such easements shall be recorded against the property title at the Barnstable County Registry of Deeds or Land Court and shall be structured to allow Town staff and approved system operators to access the property.

## **8. Enforcement**

8.1 The Board of Health, its agents, officers and employees shall have the authority to enter upon privately owned land for the purpose of performing their duties for the administration and review of this regulation and may make or cause to be made such examination, operation and maintenance, surveys or sampling as the Board deems necessary.

8.2 The Board of Health shall have the authority to enforce these regulations by violation notices, administrative order and civil and criminal court actions.

8.3 Any person who shall violate any provision of this regulation for which a penalty is not otherwise provided shall be subject to a fine of not more than \$200. Each day or portion thereof during which a violation occurs or continues shall constitute a separate offense.

## **9. Severability**

Each section of these rules and regulations shall be construed as separate and to the end that if any section, item, sentence, clause or phrase shall be held invalid for any reason, the remainder of these rules and regulations shall continue in full force and effect.

## **10. Effective Date**

---



## MEMORANDUM

**To:** Chris Miller, Natural Resource Director  
Ryan Bennett, Town Planner

**From:** Mark Nelson, Jane Estey

**Date:** December 31, 2018

**Re:** Implementation of an Onsite Septic System Treatment Program for the Pleasant Bay Watershed

---

The Horsley Witten Group, Inc. (HW) has evaluated Brewster's requirements and options for the implementation of a program to install, operate and monitor advanced onsite septic systems for nitrogen removal within the Pleasant Bay watershed. The goal of this program is to remove the remaining nitrogen from sources within the watershed to meet the Total Maximum Daily Load for Brewster's portion of the Pleasant Bay Watershed.

This report has been prepared to identify the issues involved in establishing the program and to provide some initial recommendations on how to move forward. It is anticipated that the implementation process will be refined over the next year with significant input from the Select Board, the Board of Health and town residents. Funding for this project was provided by the Department of Housing and Community Development's District Local Technical Assistance program through the Cape Cod Commission.

### Background

Pleasant Bay is impacted by excessive nitrogen coming from sources within its watershed; that area which contributes groundwater to the Bay. Septic system discharges are the largest source of nitrogen in the watershed, followed by fertilizers, road runoff and agricultural sources. Approximately 25 percent of the Pleasant Bay watershed is located within Brewster, with the remaining watershed areas in Orleans, Harwich and Chatham (Pleasant Bay Alliance, May 2018).

The Massachusetts Department of Environmental Protection (MassDEP) has established a TMDL for the Bay (Mass DEP, May 2007) based on a model developed by the University of Massachusetts School for Marine Science & Technology (SMASST, May, 2006). Based on this information, Brewster has partnered with the other towns within the watershed to develop a Targeted Watershed Management Plan to restore Pleasant Bay. The plan is the foundation for the watershed permit between the four Pleasant Bay towns and the MassDEP issued in August, 2018 to manage the towns' actions to achieve TMDL compliance for Pleasant Bay over the next 20 years. The permit identifies the steps each town will take to meet the TMDL over the next 20 years and allows them to utilize non-traditional options for nitrogen removal, like the onsite systems proposed for Brewster.

Under the watershed permit, Brewster has agreed to remove 2,262 kg/year of nitrogen to meet its TMDL requirements. To date 56 percent of this load reduction has been achieved through

reductions in fertilizer use and through the recapture of nitrogen through the irrigation well at the town-owned Captains Golf Course (Table 1). The Town currently plans on removing the remaining load through the advanced onsite program.

### **Implementation Goals**

The goal of Brewster's advanced onsite treatment program is to upgrade enough onsite systems within the watershed to remove the remaining nitrogen needed to meet Brewster's TMDL requirement for Pleasant Bay. Approximately 980 kilograms of nitrogen need to be removed through the onsite program under current conditions. Additional nitrogen removal may be needed to accommodate future development within the watershed.

The planning for a successful advanced onsite system program requires consideration of several issues to ensure it is successful and will be in compliance with the TMDL and the watershed permit. They include:

- Development of a regulatory program to implement the advanced onsite system program;
- Selection of the appropriate nitrogen removal requirements for the proposed onsite systems to ensure the TMDL goal is met;
- Selection of the appropriate advanced onsite systems to incorporate in the program, or the selection of performance standards for the systems to be used, to allow for the inclusion of new technologies over time;
- Determining the number and location of properties where the use of an advanced system will be required;
- Development of an operation and maintenance program with clear oversight by the Town to ensure the systems that are installed and operated properly to meet their nitrogen reduction requirements; and
- Development of monitoring programs under the Town's supervision to confirm that the advanced systems are in compliance with the state's septic system regulations (Title 5, 310 CMR 15.00) and DEP's monitoring requirements to confirm TMDL compliance.

HW has conducted an initial analysis of these issues as discussed below and in the two attachments to this memo. An outline of the implementation plan also accompanies this memorandum.

### **Regulatory Approach**

A regulation requiring the use of advanced onsite systems in the Pleasant Bay watershed will be needed to implement the program. There are two regulatory mechanisms that could be used; the adoption of a general bylaw or the adoption of a Board of Health regulation. HW recommends a combination of both. A general bylaw will require the use of the advanced onsite systems in the watershed with the appropriate number and treatment capability to meet Brewster's portion of the TMDL. The general bylaw will also mandate that the Board of Health develop regulations that provide the details of how the program will be implemented and administered over time with authority for enforcement with the Board of Health.

A general bylaw must be adopted by a simple majority at Town Meeting. Using this approach, the Town is given the opportunity to review and approve the proposed program and make an affirmative vote to adopt it. Board of Health regulations are adopted by a simple majority of the Board. This process doesn't provide for the same level of involvement for Town residents. However, having the Board adopt the implementation regulations allows opportunities to change or update the requirements over time, without the need to return for a Town Meeting vote. This will be helpful if new technologies are identified, or if there are other changes that warrant updates to the regulations.

This hybrid approach provides the benefits of both approaches; input from all Town residents in the approval of the bylaw, and flexibility to implement the program and adapt to changing circumstances through the proposed Board of Health regulations. The general bylaw could incorporate provisions for how the program will be financed, if the Town agrees to fund a portion of the costs (see the Financing section below).

A draft General Bylaw is attached to this memo in preliminary form. Additional detail will need to be added as the decisions on how the program will be implemented are made.

### **Advanced System Selection and Treatment Requirements**

Information on the advanced systems that Brewster might consider for use is currently being developed by the Pleasant Bay Alliance through the Southeast New England Program (SNEP) grant it received to help implement the Pleasant Bay watershed permit. This analysis will review the available technologies to rank them based on performance, reliability, and cost for installation and annual operation and maintenance.

There are two approaches for selecting which systems should be used in Brewster. Specific technologies could be approved for use, or a specific nitrogen removal concentration could be established and systems that are proven to meet this requirement could be chosen by the property owner with approval by the Board of Health.

The factors that need to be considered in selecting an approach include:

- The nitrogen removal capability of the systems selected for use in the program. The nitrogen reduction provided by an advanced system directly impacts how many systems must be upgraded. Fewer systems must be upgraded to meet the TMDL if the systems provide a higher level of nitrogen treatment. Further discussion on the number of systems requiring treatment is provided in the next section.
- The reliability of the chosen systems over the long term. The Town is responsible for ensuring that the TMDL nitrogen reduction goals are met and will need to have oversight of system performance. If the Town chooses to only allow the use of one or more systems, there may be issues if the systems do not provide the expected level of nitrogen treatment. If systems are operated and maintained properly, then the owners of the systems would likely not be liable for not meeting a nitrogen compliance goal as they installed the system the Town required them to install. One way to manage this concern might be to obtain a performance guarantee from the system manufacturer that states they will guarantee compliance with the nitrogen reduction levels set by the Town. In

addition, if the Town decides to select specific systems for use, there will likely need to be a proposal process to properly establish which systems will be used and what price will be provided.

- The cost for system installation, operation and maintenance. The cost for a system that provides a higher level of treatment may be more, and this could play into how many properties will be required to upgrade their system. There will be tradeoffs between cost and performance that the Town will need to consider as the program moves forward.
- The market for nitrogen reducing septic technologies is advancing and there will be changes over time. Therefore, selecting specific technologies may limit the Town from utilizing new technologies that may perform better or offer a cheaper alternative in the future. Establishing a set nitrogen reduction limit would avoid these types of complications.

### **Number of Properties Requiring and Advanced Onsite System**

The level of nitrogen treatment provided by an advanced onsite system and the location of a property in the watershed both factor into how many systems must participate in the program. Some properties are in areas where there is significant attenuation of nitrogen before it reaches Pleasant Bay via groundwater. This occurs in areas where nitrogen in groundwater flows to a pond and then back into groundwater before it discharges to the Bay. This process removes approximately 50% of the nitrogen contained in the groundwater that enters a pond. In some areas in Brewster groundwater flows through multiple ponds before entering the Bay. It may not be worthwhile to install nitrogen treatment systems in areas where this attenuation is taking place.

HW has analyzed how many properties may need to participate in the program based on the level of nitrogen reduction that is needed. This is summarized in the attached memo which shows that most of the homes in the subwatersheds where there is no attenuation will need to be upgraded to meet the TMDL goals. This analysis will be refined over time as additional information becomes available.

### **Operation and Maintenance (O&M)**

The performance of the advanced onsite systems is directly tied to the way they are operated and maintained. Based on conversations with MassDEP, the Town must have oversight of the O&M program to ensure systems are working sufficiently to meet the nitrogen reduction goals of the TMDL. These requirements should be incorporated into the General Bylaw and the Board of Health regulation. The details on the required O&M practices will depend on the systems selected for use. The Town could:

- Hire a certified wastewater operator that works for the Town and is responsible for operating all systems upgraded under this program. The value of this option may depend on how many properties are included in the program and whether there are too many or too few systems for a Town staff person to manage. The financing for this approach could be provided by property owners who pay the town for the O&M of their system.



- Establish a program to review and approve certified operators that contract with property owners to operate and maintain their systems. Under this approach, the Town would need a program to review the O&M work conducted by the approved operators and likely conduct some spot checks to verify systems are operating properly.
- Work with other communities and possibly Barnstable County to establish a regional approach to O&M management. It might be possible to have the County establish a certified operator program that works on behalf of the Town, and other communities on Cape Cod to provide O&M for advanced onsite systems.

Further discussions in Brewster, with Barnstable County and with neighboring Towns are needed to develop and adopt an appropriate O&M process that provides the proper oversight and control by the Town. However, the process is conducted, the Town will require access to each property to inspect and possibly manage the O&M of the systems. The draft General Bylaw incorporates language to address this issue.

### **Monitoring**

Monitoring of all systems that are upgrades will be needed to confirm compliance with the nitrogen reduction goals in the TMDL. HW has discussed the monitoring requirements under the TMDL with MassDEP. At a minimum each system will need to be tested annually with effluent samples analyzed for total nitrogen concentrations. Mass DEP recommends that 1/12<sup>th</sup> of the systems installed in the watershed be tested each month. In the first month a random selection of system representing 1/12<sup>th</sup> of the total would be tested. In month two a second round of systems would be tested. Over a year all the systems would be tested in this fashion. The nitrogen reduction documented in the monitoring plan will be compared to the TMDL goal to confirm the program is working. It is anticipated there will be some variability in the performance of the systems and it is anticipated that an average nitrogen reduction across all the systems will be used to compare to the TMDL goal. However, data showing a system isn't meeting its performance goal should also be flagged so an operator can inspect the system and bring it into compliance.

In addition, many systems will require additional testing based on the innovative and alternative system regulations in Title 5 (310 CMR 280). New technologies must be approved following these regulations and there are monitoring requirements established by MassDEP for these systems. Depending on the systems used in Brewster there will be a need to evaluate how to incorporate this testing into the TMDL monitoring discussed above.

The Town will be responsible for overseeing the monitoring of the advanced systems to ensure compliance with the TMDL and a program to oversee this work will need to be established. There may be opportunities for collaboration with the Barnstable County Department of Health and Environment in the collection, recording and evaluation of this data, options the Town should explore.

## **Annual Watershed Permit Reporting**

The implementation of the program will need to be documented in the annual reports that are required under the Pleasant Bay watershed permit. A framework for the annual report should be developed that includes:

- Updates on the adoption of, and any changes to, the regulatory program;
- Reporting on the number of systems installed and their locations in the watershed;
- A summary of the O&M activities during the reporting period; and
- A summary of the monitoring conducted, including calculations of the amount of nitrogen removed relative to the TMDL nitrogen reduction goal.

## **Financing**

As this program is developed there will also need to be discussions within Brewster on how it will be financed. HW described options for Town and individual property owner financing in a memo dated June 29, 2017 that provided a range of ways to pay for the program. Town involvement in the financing will allow access to State Revolving Fund loans available through the Pleasant Bay permit, as well as other locally generated funds. Town involvement also recognizes that residents beyond those property owners in the watershed benefit from the restoration of Pleasant Bay. An in-depth discussion of an equitable financing program should take place at the same time the implementation plan is developed and should involve extensive input from Town Boards and residents.

## **Next Steps**

The implementation plan will evolve as more information on potential advanced systems is available and as the Town Boards and residents get involved in the discussion. The following next steps are recommended based on the information gathered to date:

- Work with the Pleasant Bay Alliance to identify and evaluate advanced nitrogen reducing septic systems, focusing on their performance, reliability, and cost. The majority of this information will be developed by the Massachusetts Septic System Test Center for the Alliance through the SNEP grant mentioned above.
- Select an approach for choosing which systems will be used in Brewster. The Town could decide to require new systems to meet a specific performance standard or could select a suite of systems allowed for use under the program based on their performance and reliability.
- Determine an effective approach to oversee the operation and maintenance program for the selected systems to insure they are functioning properly. The Town could run this program themselves, contract out for the services needed or set specific requirements in the approval of each system. However it is done, the Town must have oversight of how the systems are maintained to insure they meet their performance goals.
- Finalize the monitoring program based on the specific requirements for the technologies chosen for use in the program.

- Incorporate a strong public participation program in the implementation planning. Regular meetings with the Select Board and Board of Health will be important as well as other outreach activities including public meetings and meetings focused on the property owners affected by the program.
- Continue discussions on how best to finance this program, evaluating public and private funding approaches. This evaluation should be concurrent with the rest of the implementation planning, especially as decisions on the technologies chosen and on the oversight of operation and maintenance will affect the overall project cost.

### **Pilot Program**

The Town should plan for a pilot program that starts during the implementation planning process to test out the options considered for the selection of systems, and the ongoing operation, maintenance and monitoring practices. Five to ten sites should be chosen for the installation of pilot systems, with the systems chosen based on the information provided through the Pleasant Bay Alliance SNEP grant analysis. The Town should solicit volunteers to allow the installation on their property. This will give valuable information on installation costs. It will also provide worthwhile experiences with operation and maintenance to guide how this process can best work moving forward. It will also be useful in evaluating the mechanisms for ongoing monitoring of the systems. The Town could begin with an installation at a Town property such as with an upgrade of the septic system at the Captains Golf Course.

### *References*

#### FINAL

Massachusetts Department of Environmental Protection, May, 2007. Pleasant Bay System Total Maximum Daily Loads For Total Nitrogen (Report # 96-TMDL-12, Control #244.0).

Pleasant Bay Alliance, May 2018. Pleasant Bay Targeted Watershed Management Plan  
<http://pleasantbay.org/programs-and-projects/watershed-planning/pleasant-bay-watershed-permit>

University of Massachusetts Dartmouth, School of Marine Science and Technology, May 2006. Massachusetts Estuaries Project, Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Pleasant Bay System, Orleans, Chatham, Brewster and Harwich, Massachusetts



## MEMO

**TO:** Ryan Bennett and Chris Miller

**FROM:** Mark Nelson, Geraldine Camilli

**RE:** Evaluation of the Number of Homes in the Pleasant Bay Watershed that will Require an Advanced Septic System to Meet the Nitrogen Reduction Goals for the Watershed.

**DATE:** December 31, 2018

---

The Horsley Witten Group, Inc. (HW) has evaluated how many septic systems within the Pleasant Bay watershed will need to be upgraded with an advanced, nitrogen reducing septic system to meet the Town's portion of the nitrogen reduction goal for Pleasant Bay. This was done as part of HW's initial assessment of the implementation steps needed to comply with the nitrogen reduction specified in the Pleasant Bay Watershed permit and as established by the Massachusetts Department of Environmental Protection (MassDEP) in the issuance of the Total Maximum Daily Load (TMDL) for the Bay.

### **Methodology**

Under the watershed permit, Brewster has agreed to remove 2,262 kg/year of nitrogen to meet its TMDL requirements. To date 56 percent of this load reduction has been achieved through reductions in fertilizer use and through the recapture of nitrogen through the irrigation well at the town-owned Captains Golf Course. The Town currently plans on removing the remaining load (979 kg/year) through the advanced onsite program.

### Septic system effluent concentration

The load from onsite septic systems within the watershed is based on an assumption in the University of Massachusetts School for Marine Science & Technology (SMAST) model that the nitrogen concentration in septic system effluent that reaches the embayment is 26.6 mg/L. Therefore, the load reduction provided by an advanced onsite system will be based on the difference between 26.6 mg/L and the effluent concentration provided by the advanced system, assuming the water use on the property does not change.

Each advanced onsite technology has its own capacity to reduce nitrogen and the Town is working with the other communities in the Pleasant Bay Watershed to evaluate technologies that may be appropriate for application in Brewster. At the same time, it is worthwhile to

evaluate how many homes may require an upgrade based on the treated effluent concentration that could be provided by an advanced system.

Using the original SMAST model, HW calculated the load reduction that could be provided by advanced systems meeting a series of nitrogen treatment goals. The following four scenarios were evaluated reflecting the expected range of nitrogen treatment that could be expected from advanced systems:

- Scenario 1: Nitrogen rate in the septic system effluent is reduced from the current rate to 19 mg/L.
- Scenario 2: Nitrogen rate in the septic system effluent is reduced from the current rate to 15 mg/L.
- Scenario 3: Nitrogen rate in the septic system effluent is reduced from the current rate to 12 mg/L.
- Scenario 4: Nitrogen rate in the septic system effluent is reduced from the current rate to 10 mg/L.

#### Parcel Locations

In conducting the evaluation, HW focused on the sub-watersheds to Pleasant Bay with parcels in Brewster where there is little to no attenuation of nitrogen in groundwater before it discharges to Pleasant Bay. This is because some Brewster properties are in areas where there is significant attenuation of nitrogen before it reaches Pleasant Bay. This occurs in areas where nitrogen from septic systems enters groundwater and then flows to a pond and then back into groundwater before it discharges to the Bay. This process removes approximately 50% of the nitrogen contained in the groundwater that enters a pond. In some areas in Brewster groundwater flows through multiple ponds before entering the Bay. It may not be worthwhile to install nitrogen treatment systems in areas where this attenuation is taking place.

As part of the original modeling conducted by SMAST to determine the nitrogen reduction goals for the Bay, the Pleasant Bay Watershed was divided into 18 major sub-watersheds (including one also called “Pleasant Bay”), and 95 smaller sub-watersheds. Eight of the major sub-watersheds, and 34 of the smaller sub-watersheds overlap with the Town of Brewster (i.e., they are located in whole or in part within town boundaries). The Pleasant Bay major sub-watershed is the largest in Brewster, contains the most properties with septic systems and has the least attenuation to account for. Therefore, these preliminary calculations focused solely on this major sub-watershed. In the future, as more details become available regarding advanced systems that might be used in Brewster, an evaluation of the other sub-watersheds can be conducted to determine if it is cost-effective to incorporate them into the program.

#### Estimate N Loads from Selected Parcels

In order to estimate the number of septic systems in each sub-watershed of interest, HW used GIS information to identify developed residential parcels in Brewster that overlap the sub-watersheds of interest. Some parcels overlap multiple sub-watersheds, so HW conducted the

analysis for parcels that are wholly located within the sub-watersheds of interest, and re-ran the analysis for parcels for which most of the area is located within these sub-watersheds.

The original SMAST model estimated wastewater load by small sub-watershed, rather than by Town, and relied on water use information for individual parcels. In order to evaluate Brewster's load, HW averaged the water use for each sub-watershed across all parcels, and assumed that water use in Brewster is on average the same as water use for all parcels within the sub-watershed. Using the original SMAST model, HW calculated the nitrogen load to Pleasant Bay for the properties described above under the four scenarios, and compared the results to the original model output using the effluent concentration of 26.56 mg/L. For each scenario, HW calculated an average nitrogen load reduction per property for all sub-watersheds. This average reduction was then used to convert a nitrogen reduction for each sub-watershed into a number of properties.

### Results

The table below shows the amount of nitrogen removed under the four nitrogen treatment scenarios that were evaluated. There are 319 residential properties either fully within the watershed or with more than 50% of their land area in the watershed. Septic effluent needs to be treated to 10 mg/L (Scenario #4) to fully remove the 979 kg/year needed to meet the TMDL goal. If effluent is treated to 12 mg/L (Scenario #3), the total nitrogen removed is very close the goal (960 kg/year versus 979 kg/year). Under this scenario an additional seven homes in other unattenuated watersheds would require an upgrade to meet the TMDL goal. If commercial or industrial properties are included in the analysis, it is likely the goal will be met under the 12 mg/L treatment scenario and this will be evaluated further in the near future.

This analysis will be updated as further information is available on the treatment capabilities of onsite technologies that may be considered by Brewster, and as SMAST runs new modeling scenarios for the watershed taking into account current and proposed efforts to remove nitrogen from the watershed.

### Nitrogen reductions provided by Onsite System Upgrades in the Pleasant Bay Subwatershed

Scenario	Nitrogen Reduction kg/year	TMDL Goal kg/year	Amt Over/Under TMDL Goal kg/year
#1: 19 mg/L	487	979	492
#2: 15 mg/L	752	979	227
#3: 12 mg/L	960	979	19
#4: 10 mg/L	1,096	979	-117

# Summary of Implementation Issues

## BREWSTER'S ADVANCED ONSITE SEPTIC SYSTEM PROGRAM



### Regulatory Approach

**Option 1:** General Bylaw approved by simple majority at Town Meeting.

**Option 2:** Adoption of Board of Health regulation.

*A combined approach is recommended with a General Bylaw laying out the parameters of the program and direction for the Board of Health to adopt implementing regulations and have enforcement authority.*

### Considerations in Selecting Onsite Technologies to Use in Brewster

**Option 1:** Select one or more specific technologies to use.

**Option 2:** Set a septic effluent nitrogen concentration limit that must be met by technologies used.

*Considerations in choosing an option include: the number of properties to upgrade, the expected performance and reliability of the proposed systems(s), and cost. Setting a performance goal allows the Town to readily allow the use of new technologies over time as improved technologies come into the market. Selecting specific technologies may provide the option for the manufacturer to provide a performance guarantee and would require a proposal process to choose which systems will be used.*

### Operation and Maintenance (O&M) Approaches

The Town will need to have oversight of the operation and maintenance of each system to ensure it is meeting its nitrogen reduction goal.

**Option 1:** Town hires an in-house certified operator and requires property owners to allow the Town to operate and maintain its system.

**Option 2:** The Town supports a regional O&M program perhaps led by Barnstable County.

**Option 3:** The Town approves certified operators and requires property owners to contract with them for O&M of their systems.

*Further discussions with Barnstable County and the Pleasant Bay towns is needed to select an option.*

### Performance Monitoring

Nitrogen reduction monitoring will require annual sampling of each system, with random locations chosen monthly for testing. Results of the testing will be compared to the effluent reduction goals for Pleasant Bay.

Additional monitoring may be required under the States onsite septic system regulations for innovative and alternative systems.

