Final
Slocums and Little Rivers Embayment System Total Maximum Daily Loads For Total Nitrogen (CN 315.1)

COMMONWEALTH OF MASSACHUSETTS
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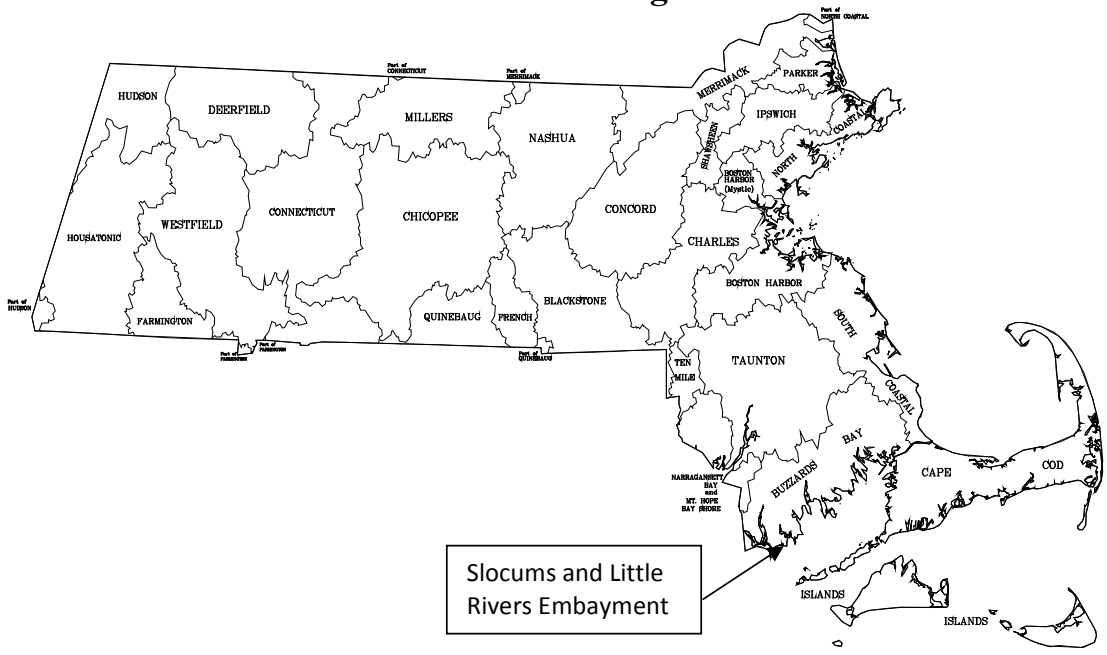


Key Feature: Total Nitrogen TMDL for Slocums and Little Rivers

Location: EPA Region 1

Land Type: New England Coastal

303d Listing: Slocums River (MA95-34) is impaired and in Category 5 of the 2014 Integrated Report for Total Nitrogen, Bioestuarine Assessments and Pathogens. Little River (MA95-66) is in Category 5 for Total Nitrogen but was not found to be impaired for nutrients during the course of the MEP study. Paskamansett River (MA95-11) is in Category 3, "No Uses Assessed."

Data Sources: University of Massachusetts – Dartmouth/School for Marine Science and Technology; US Geological Survey; Applied Coastal Research and Engineering, Inc.; Southeast Regional Planning & Economic Development District, Town of Dartmouth

Data Mechanism: Massachusetts Surface Water Quality Standards, Ambient Data, and Linked Watershed Model

Monitoring Plan: Buzzards Bay Coalition's Baywatcher Monitoring Program**,** Town of Dartmouth monitoring program with technical assistance from SMAST

Control Measures: Sewering, Storm Water Management, Attenuation by Impoundments and Wetlands, Fertilizer Use By-laws, Agricultural BMPs

Executive Summary

Problem Statement

Excessive nitrogen (N) originating from a range of sources has added to the impairment of the environmental quality of the Slocums and Little Rivers Embayment System. In general, excessive N in these waters is indicated by:

- Loss of eelgrass beds, which are critical habitats for macroinvertebrates and fish
- Undesirable increases in macro algae, which are much less beneficial than eelgrass
- Periodic extreme decreases in dissolved oxygen concentrations that threaten aquatic life
- Reductions in the diversity of benthic animal populations
- Periodic algae blooms

With proper management of N inputs these trends can be reversed. Without proper management more severe problems might develop, including:

- Periodic fish kills
- Unpleasant odors and scum
- Benthic communities reduced to the most stress-tolerant species, or in the worst cases, near loss of the benthic animal communities

The water and habitat quality of the Little and Barney's Joy Rivers are presently considered to be "healthy", and no reductions of N loading are called for. However, this document serves to notify the Town of Dartmouth that the target N loading rates to these two systems are protective and should be maintained as closely as possible in order to prevent future impairments.

Coastal communities rely on clean, productive, and aesthetically pleasing marine and estuarine waters for tourism, recreational swimming, fishing, and boating, as well as for commercial fin fishing and shellfishing. Failure to reduce and control N loadings could result in complete replacement of eelgrass by macro-algae, a higher frequency of extreme decreases in dissolved oxygen concentrations and fish kills, widespread occurrence of unpleasant odors and visible scum, and a complete loss of benthic macroinvertebrates throughout most of the embayment. As a result of these environmental impacts, commercial and recreational uses of Slocums and Little Rivers Embayment System coastal waters will be greatly reduced.

Sources of Nitrogen

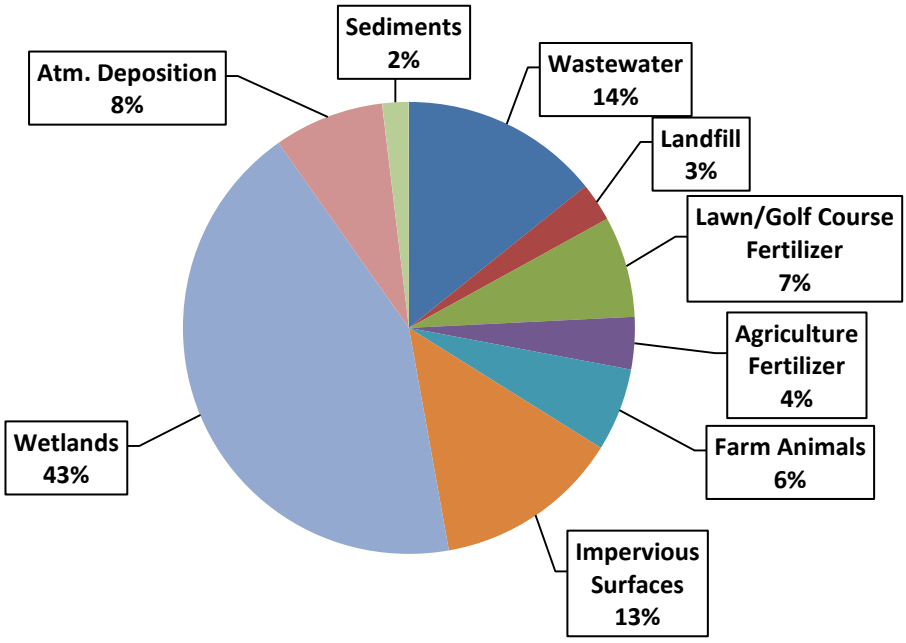
Nitrogen enters the waters of coastal embayments from the following sources:

- The watershed
    - Natural background
    - Septic Systems
    - Runoff
    - Fertilizers
    - Wastewater treatment facilities
    - Landfills

        - Agricultural activities
- Atmospheric deposition
- Nutrient-rich bottom sediments in the embayments

Figure ES-A below illustrates the percent contributions of all of the sources of N into the Slocums and Little Rivers Embayment System. Values are based on unattenuated loads from Table IV-6 from the Massachusetts Estuaries Project (MEP) Technical Report. As evident, the uncontrollable loads from atmospheric deposition, sediments and wetlands account for over half of the total load to this system. Most of the present *controllable* load is divided approximately equally between septic systems and runoff. Fertilizer sources (agriculture, lawn and golf courses combined) are a close second.

Figure ES-A: Percent Contributions of All Nitrogen Sources (Controllable and Uncontrollable) to Slocums and Little Rivers Embayment System



Target Threshold N Concentrations and Loadings

The N loadings (the quantity of N) to this embayment system ranged from 7.54 kg/day in Barneys Joy River (North and South) to 120 kg/day in Paskamansett River and Destruction Brook, with a total present load for the entire system of 154.78 kg/day. (These loadings are taken from Table ES-1 of the MEP Technical Report.) The resultant concentrations of N in this embayment ranged from 1.52 mg/L to 0.26 mg/L (range of average yearly means collected from 12 stations during 2000-2006 as reported in Table VI-1 of the MEP Technical Report).

In order to restore and protect this embayment system, N loadings, and subsequently the concentrations of N in the water, must be reduced to levels below those that cause the observed environmental impacts. This N concentration will be referred to as the *target threshold N concentration*. It is the goal of the TMDL to reach this target threshold N concentration, as it has been determined for each impaired waterbody segment. The Massachusetts Estuaries Project (MEP) has determined that by achieving N concentrations of 0.36 mg/L near sentinel station SRT-12 in the Slocums River and staying below a N concentration of 0.50 mg/L near sentinel station SRT-15 in the Little River (see Figure 5), eelgrass and benthic macroinvertebrate habitat quality will be restored in the Slocums River system and water and benthic habitat quality will be protected in the Little River system.

The mechanism for achieving the target threshold N concentrations is to reduce the N loadings to various portions of the Slocums River embayment system and maintain N loadings to the Little River. Based on the MEP sampling and modeling analyses and their Technical Report, the MassDEP has determined that in order to meet the target threshold N concentration a Total Maximum Daily Load (TMDL) of 144.35 kg total N/day will be needed for all water bodies in the Slocums and Little Rivers embayment system. Specifically, this calls for a reduction of 23.8% of the watershed N load within the Slocums River watershed and an 11.3% reduction of the watershed N load within the Paskamansett River and Destruction Brook watersheds. The water and habitat quality of the Little and Barney's Joy Rivers are presently considered to be "healthy" and no reductions of N loading are called for within their watersheds.

This document presents the TMDLs for this water body system and provides guidance to the watershed communities of Dartmouth and New Bedford on possible ways to reduce the N loadings to within the recommended TMDL and protect the waters for this embayment system.

Implementation

The primary goal of TMDL implementation will be lowering the concentrations of N. This can be achieved by reducing septic system loadings in the Slocums River by 76% and in the Paskamansett River/Destruction Brook subwatersheds by 80%, however, there are a variety of loading reduction scenarios that could achieve the target threshold N concentration. Local officials can explore other loading reduction scenarios through additional modeling as part of their Comprehensive Wastewater Management Plan (CWMP). Implementing best management practices (BMPs) to reduce N loadings from fertilizers, agriculture and runoff from impervious cover where possible will also help to lower the total N load to these systems. The recommended method of TMDL implementation will likely be a combination of reducing the loadings from any and all sources of N in the watershed. The appropriateness of any of the alternatives will depend on local conditions and will have to be determined on a case-by-case basis using an adaptive management approach. Methodologies for reducing N loading from septic systems, stormwater runoff and fertilizers are provided in detail in the "MEP Embayment Restoration and Guidance for Implementation Strategies", available on the MassDEP website: (https://www.mass.gov/media/1158461).

Since approximately 25% of the upper watershed of the Slocums River embayment is located in New Bedford (https://www.epa.gov/npdes-permits/regulated-ms4-massachusetts-communities)

the development of any implementation plan should keep in mind that Dartmouth and New Bedford should coordinate efforts to maximize the reduction in N loading. MassDEP recognizes that the Dartmouth has taken numerous steps to reduce nitrogen loads to the watershed since the start of the data collection period (2000-2006). Some of the Town's actions are provided in the Implementation section of the TMDL report. Growth within the communities of Dartmouth and New Bedford that would exacerbate the problems associated with N loadings, should be guided by considerations of water quality-associated impacts.

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Introduction

Section 303(d) of the Federal Clean Water Act requires each state (1) to identify waters that are not meeting water quality standards and (2) to establish Total Maximum Daily Loads (TMDLs) for such waters for the pollutants of concern. The TMDL allocation establishes the maximum loadings (of pollutants of concern) from all contributing sources that a water body may receive and still meet and maintain its water quality standards and designated uses, including compliance with numeric and narrative standards. The TMDL development process may be described in four steps, as follows:

1. Determination and documentation of whether or not a water body is presently meeting its water quality standards and designated uses.

2. Assessment of present water quality conditions in the water body, including estimation of present loadings of pollutants of concern from both point sources (discernible, confined, and concrete sources such as pipes) and non-point sources (diffuse sources that carry pollutants to surface waters through runoff or groundwater).

3. Determination of the loading capacity of the water body. EPA regulations define the loading capacity as the greatest amount of loading that a water body can receive without violating water quality standards. If the water body is not presently meeting its designated uses, then the loading capacity will represent a reduction relative to present loadings.

4. Specification of load allocations, based on the loading capacity determination, for non-point sources and point sources that will ensure that the water body will not violate water quality standards.

After public comment and final approval by the EPA, the TMDL will serve as a guide for future implementation activities. The MassDEP will work with the watershed towns of Dartmouth and New Bedford to develop specific implementation strategies to reduce N loadings, and will assist in developing a monitoring plan for assessing the success of the nutrient reduction strategies.

In the Slocums and Little Rivers embayment system the pollutant of concern for this TMDL (based on observations of eutrophication) is the nutrient nitrogen. Nitrogen is the limiting nutrient in coastal and marine waters, which means that as its concentration is increased so does plant productivity. This leads to nuisance populations of macro-algae and increased concentrations of phytoplankton and epiphyton which impairs the healthy ecology of the affected water bodies.

The TMDL for total N for the Slocums and Little Rivers Embayment System is based primarily on data collected, compiled and analyzed by University of Massachusetts Dartmouth's School of Marine Science and Technology (SMAST), the Southeast Regional Planning & Economic Development District and the Town of Dartmouth as part of the Massachusetts Estuaries Project (MEP). The data were collected over a study period from 2000 through 2006. This study period will be referred to as the "present conditions" in the TMDL since it contains the most recent data available. The accompanying MEP Technical Report (Howes *et al.* 2012*)* can be found at

https://www.mass.gov/guides/the-massachusetts-estuaries-project-and-reports#south-coast-buzzards-bay-mep-reports. The MEP Technical Report presents the results of the analyses of this coastal embayment system using the MEP Linked Watershed-Embayment N Management Model (Linked Model). The analyses were performed to assist the watershed communities with decisions on current and future wastewater planning, wetland restoration, anadromous fish runs, shellfisheries, open-space and harbor maintenance programs. A critical element of this approach is the assessment of water quality monitoring data, historical changes in eelgrass distribution, time-series water column oxygen measurements and benthic community structure that were conducted on this embayment. These assessments served as the basis for generating a N loading threshold for use as a goal for watershed N management. The TMDL is based on the site specific N threshold generated for this embayment. Thus, the MEP offers a science-based management approach to support the wastewater management planning and decision-making process in the watershed communities of Dartmouth and New Bedford.

Description of Water Bodies and Priority Ranking

The Slocums and Little Rivers Embayment System is located on the western shore of Buzzards Bay (See Figures 1 and 2). About 74.6% of the watershed of the Slocums River including the estuary portion is located within the Town of Dartmouth. The remaining approximately 25% of the northern portion of the watershed lies in the City of New Bedford. A very small percentage (<0.5%) lies also in the Towns of Westport and Freetown. The Slocums River is a tidal embayment with a number of streams, which flow into it. The mouth of the Slocums River embayment is defined by bedrock outcrops on the east at Potomska Point and by outcrops on the west in Lloyd State Park. The principal stream is the Paskamansett River (also spelled Paskamanset), which discharges into the northern headwaters and accounts for >80% of the surface water inflows. Other streams that discharge to the embayment include, in order of diminishing freshwater contribution: Destruction Brook; Barney's Joy River North and Barney's Joy River South/Giles Creek entering the estuary on the southwestern shore; and several relatively small, seasonal streams along both shores of the embayment.

The Town of Dartmouth has public water supply wells near the Paskamansett River. With a relatively large watershed and consequent substantial fresh surface water inputs, the Slocums River estuary has a variable salinity gradient that is strongly influenced by both short-term and seasonal rainfall patterns. Of the 23,771 acre watershed, more than 80% is north of the tidal reach of the estuary.

For the Slocums River and Little River Estuary System, the MEP project used 2009 land use data from the Town of Westport and the City of New Bedford, and 2010 data from the Town of Dartmouth. All land use data was provided by Buzzards Bay National Estuary Program (BBNEP) with subsequent review by the Town of Dartmouth staff. The predominant land use based on area in the Slocums River Estuary System watershed is public service/government, which accounts for 39% of the overall watershed area. Residential land area is the second highest percentage (30%). In the Little River system watershed, public service/government land uses (37%) and residential land uses (35%) are roughly equal. (See Figure IV-3 MEP Tech Report, Howes *et al.* 2012.)

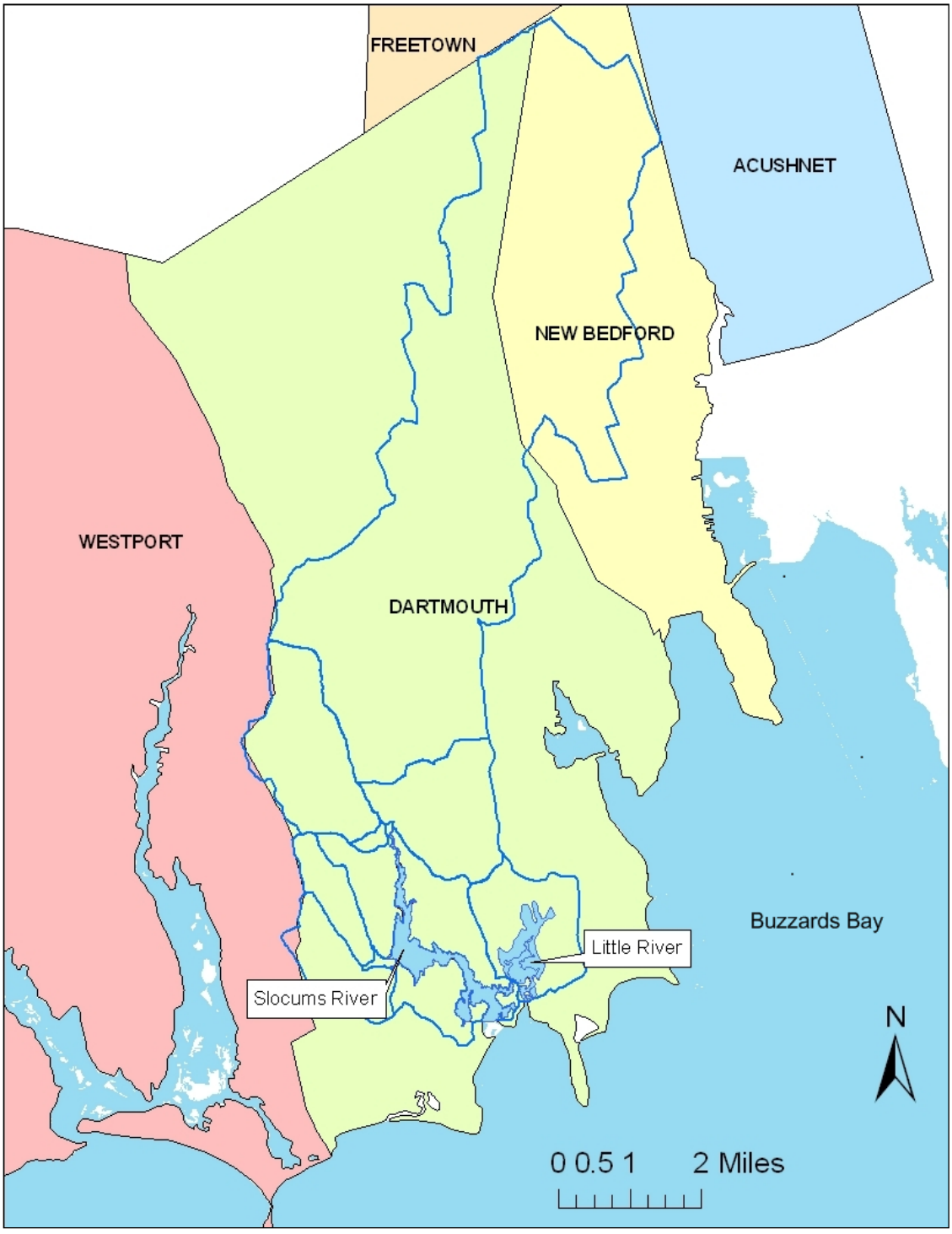

Figure 1 Watershed of the Slocums and Little Rivers Embayment System

There are a projected 2,009 additional residences at buildout in the Slocums River watershed. Buildout within the Slocum River watershed are projected to increase the unattenuated nitrogen loading rate by 15%. Buildout in the Little River watershed is predicted to increase the unattenuated nitrogen loading rate by 23%. (See Tables IV-6 and IV-7 of MEP Tech Report, Howes *et al.* 2012).

The Little River watershed and estuary is contained entirely within the Town of Dartmouth. The Little River embayment has a small watershed relative to its size, with 16.5 acres of land for each acre of estuary. Surface water inflow to the estuary is from two short intermittent streams that drain the low uplands to the northwest, while groundwater discharge is primarily to the extensive northern and eastern saltmarsh areas. The mouth of Little River is defined and controlled on the west by the bedrock outcrop of Potomska Point and on the east by both buried and partially exposed bedrock. There is a small amount of freshwater inflow, due to the small watershed relative to the surface area of estuary, and the relative "open" tidal exchange. The Little River shows little dilution of the salinity from the incoming Buzzards Bay waters and lower nutrient levels compared to the adjacent Slocums River waters. Currently, tidal exchange and thus potentially water quality of the Little River Estuary is linked in part to that of the Slocums River.

This embayment system constitutes an important component of the area's natural and cultural resources. The nature of enclosed embayments in populous regions brings two opposing elements to bear: 1) as protected marine shoreline, they are popular regions for boating, recreation, and land development; and 2) as enclosed bodies of water, they may not be readily flushed of the pollutants that they receive due to the proximity and density of development near and along their shores. In particular, the Slocums River embayment is at risk of further eutrophication from high nutrient loads in the groundwater and runoff from their watersheds. The Slocums River is already listed as waters requiring a TMDL (Category 5) in the MA 2014 Integrated List of Waters, as summarized in Table 1.

A complete description of this embayment system is presented in Chapters I and IV of the MEP Technical Report (Howes *et al*. 2012). A majority of the information presented here on this embayment system is drawn from this report. Chapters VI and VII of the MEP Technical Report provide assessment data that show that the Slocums River system is impaired because of elevated total nitrogen, low dissolved oxygen levels, elevated chlorophyll *a* levels, loss of eelgrass and degraded benthic fauna habitat. Please note that pathogens and other habitat alterations are listed in Table 1 for completeness. Further discussion of pathogens or other habitat alterations is beyond the scope of this TMDL.

The embayments addressed by this document have been determined to be "high priority" based on three significant factors: (1) the initiative that the Town of Dartmouth has taken to assess the conditions of the entire embayment system; (2) the commitment made by the town to restore the Slocums and preserve the Little River; and (3) the extent of impairment in the Slocums system and the need to prevent future impairments of the Little River. In particular, the Slocums River embayment is at risk of further degradation from increased N loads entering through groundwater and surface water from the increasingly developed watershed. In both marine and freshwater systems, an excess of nutrients results in degraded water quality, adverse impacts to

ecosystems and limits on the use of water resources. Observations are summarized in the Problem Assessment section below and detailed in Chapter VII, Assessment of Embayment Nutrient Related Ecological Health, of the MEP Technical Report.

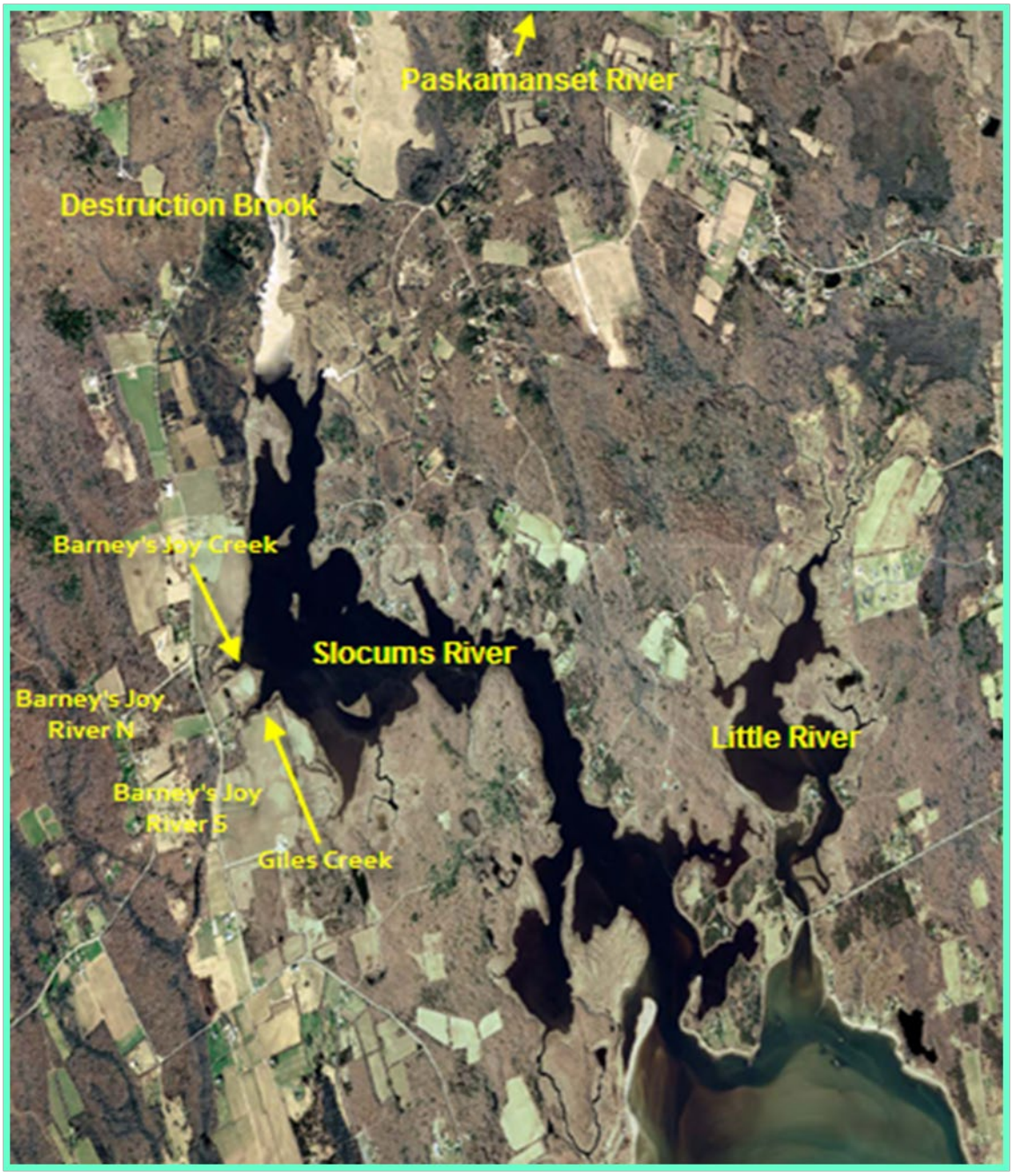

Figure 2: Slocums and Little River Embayment System

Table 1: Comparison of MassDEP and SMAST Impaired Parameters for Slocums and Little Rivers Embayment System

System Component	Water Body Segment	MassDEP Segment Description	Class	2014 Integrated List Category[1]	SMAST Impaired Parameter[2]	Size
Slocums River	MA95-34	Rock O'Dundee Road (confluence with Paskemanset River), Dartmouth to mouth at Buzzards Bay, Dartmouth.	SA (SFO, HQW)	5 (Estuarine Bioassessments, Nitrogen (Total), Fecal Coliform [CN 251.1; 5/15/2009])	Nitrogen (Total), Dissolved Oxygen, Chlorophyll a, Eelgrass loss, Benthic Fauna	0.672 (square miles)
Paskamansett River[3]	MA95-11	Headwaters, outlet Turners Pond, Dartmouth/New Bedford to confluence with Slocums River (Rock O'Dundee Road), Dartmouth.	B	3		10.543 (miles)
Destruction Brook[3,4]	MA95-90	Headwaters west of Fisher Road, Dartmouth to mouth at confluence with Slocums River, Dartmouth.	B	Not applicable		3 (miles)
Barneys Joy North[3,4]	MA95-91	Unnamed tributary to Slocums River, perennial portion east of Division Road, Dartmouth to confluence with saltwater portion east of Barneys Joy Road, Dartmouth (referred to as 'Barneys Joy North' in MEP Tech Report).	B	Not applicable		2.1 (miles)
Barneys Joy South[3,4]	MA95-92	Unnamed tributary to Slocums River, headwaters outlet wetland north of Horseneck Road, Dartmouth to confluence with saltwater portion east of Barneys Joy Road, Dartmouth (referred to as 'Barneys Joy South' in MEP Tech Report).	B	Not applicable		1.2 (miles)
Giles Creek[4]	MA95-89	From Demarest Lloyd Memorial State Park, Dartmouth to mouth at Slocums River, Dartmouth.	SA (SFO)	Not applicable	Not impaired for nutrients	0.06 (square miles)
Little River	MA95-66	Dartmouth	SA (SFO)	5 (Nitrogen (Total))	Not impaired for nutrients	0.18 (square miles)

1 MA 2014 Integrated List of Waters Water Body Listing
2 As determined by the MEP Slocums and Little Rivers embayment study and reported in the Technical Report
3 Freshwater, tributary to Slocums River
4 Proposed new segment for future Integrated List of Waters
SFO-Shellfishing Open, HQW-High Quality Water

Problem Assessment

The primary ecological threat to the Slocums and Little Rivers Embayment System is degradation resulting from nutrient enrichment. Water quality problems associated with development within the watersheds result primarily from septic systems, fertilizers, runoff and

agricultural activities. Nitrogen from these sources washes directly into the surface waterbodies or enters the groundwater system and eventually connects with the surface waterbodies.

The water quality problems affecting nutrient-enriched embayments generally include periodic decreases of dissolved oxygen, loss of eelgrass habitat, decreased diversity and quantity of benthic animals, and periodic algae blooms. In the most severe cases habitat degradation could lead to periodic fish kills, unpleasant odors and scums and near loss of the benthic community and/or presence of only the most stress-tolerant species of benthic animals.

Coastal communities rely on clean, productive and aesthetically pleasing marine and estuarine waters for tourism, recreational swimming, fishing and boating, as well as commercial fin fishing and shell fishing. The continued degradation of this coastal embayment, as described above, will significantly reduce the recreational and commercial value and use of these important environmental resources.

Figure 3 shows how the population of Dartmouth has grown from roughly 9,000 people in 1940 to over 34,000 people in 2010. Increases in N loading to estuaries are directly related to increasing development and population in the watershed. Dartmouth's population has increased 375% in the past 70 years and an increase in population contributes to a decrease in forests and increases in septic systems, runoff from impervious surfaces and fertilizer use.

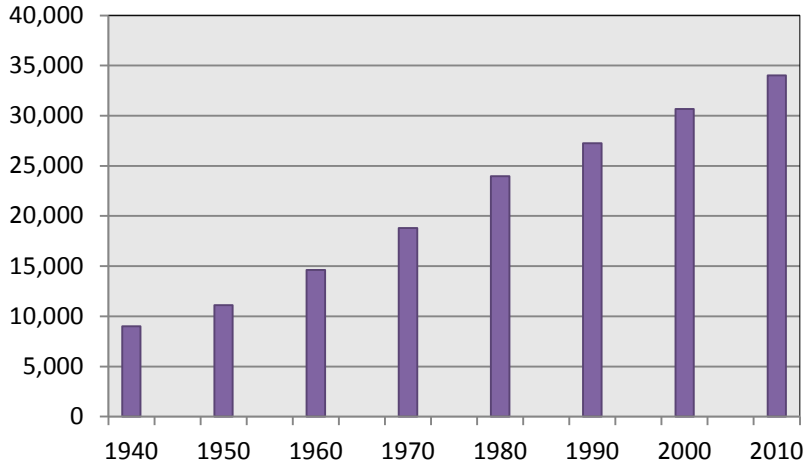

Figure 3: Resident Population for Dartmouth, 1940 through 2010

Habitat and water quality assessments were conducted on this embayment system based upon water quality monitoring data, changes in eelgrass distribution, time-series water column oxygen measurements and benthic community structure. The Slocums River system is a riverine estuary composed of an upper tidal river dominated by fringing wetlands, a large depositional basin in the middle of the system and a lower reach comprised of a main tidal channel and tributary coves, one of which is predominantly a salt marsh pond (Giles Creek). The Little River estuary is predominantly a salt marsh dominated tidal basin. Each of these functional components has different natural sensitivities to N enrichment and organic matter loading. Evaluation of eelgrass and infaunal habitat quality must consider the natural structure of each system and the system's ability to support eelgrass beds and various types of infaunal communities. At present, the

Slocums and Little Rivers Estuarine System is showing variations in N enrichment and habitat quality among its various component basins (Table 2).

In general, the Slocums River system is showing healthy to moderately impaired benthic habitat within the upper tidal reach. As a wetland dominated basin, impairment in the upper tidal reach is only moderate resulting mainly from the patches of drift macroalgal accumulation and surface macrophyte mats. However, the middle basin is significantly impaired habitat for infaunal animals (with periodic fish kills), as a result of spatially distributed and significant accumulations of drift macroalgae, moderate to high chlorophyll-*a* levels and periodic oxygen depletions. The lower basin is generally supporting high quality infaunal habitat except in regions of macroalgal accumulation (likely transported from the middle basin). However, the lower basin is significantly impaired relative to eelgrass habitat. The lower basin historically supported eelgrass as indicated by the 1951 analysis by MassDEP and field data from 1985 but eelgrass beds are no longer present within the system. Based upon all evidence the Slocums River is presently impaired by N loading from its watershed and restoration of this estuary should focus on the impaired infauna habitat within the middle basin and eelgrass habitat within the lower basin.

The Little River system is presently supporting high quality infaunal animal habitat and water quality conditions indicative of a salt marsh basin receiving watershed N inputs below its tolerance level. This system has infaunal communities consistent with a wetland dominated organic matter enriched estuarine sediment, with moderate to high numbers of individuals distributed among a diversity of species. The lower-most reach of this system is a tidal channel supporting the highest number of species within the entire Slocums and Little Rivers embayment system. The assessment of high quality infauna habitat is consistent with the generally low total N and chlorophyll-*a* levels, with oxygen depletion evident, but typical of salt marsh basins. Significantly, accumulations of drift macroalgae are not typical of this basin, with macroalgae present primarily as attached forms, e.g. *Codium, Enteromorpha*, and *Fucus*. There is no evidence that this estuarine river system ever supported eelgrass.

Pollutant of Concern, Sources, and Controllability

In the coastal embayments of the Town of Dartmouth, as in most marine and coastal waters, the limiting nutrient is N. Nitrogen concentrations beyond those expected naturally contribute to undesirable water quality and habitat conditions as described above in Table 1, through the promotion of excessive growth of plants and algae, including nuisance vegetation.

The embayments covered in this TMDL have had extensive data collected and analyzed through the Massachusetts Estuaries Program (MEP) and with the cooperation and assistance from Dartmouth, the USGS, and the Southeast Regional Economic and Development District. Data collection included both water quality and hydrodynamics as described in Chapters I, IV, V, VI and VII of the MEP Technical Report (Howes *et al*. 2012). These investigations revealed that loadings of N are much larger than would be under natural conditions.

Figure 4a and Figure 4b illustrate the controllable sources of nitrogen to the Slocums and Little Rivers estuaries respectively. The Slocums River watershed contributes over 97% of the total combined (Slocums and Little Rivers) controllable nitrogen load. In the Slocums River, most of

the load originates from on-site subsurface wastewater disposal systems (septic systems) and runoff from impervious surfaces (Figure 4a). Within the Slocums River watershed, the Paskamansett River and Destruction Brook subwatersheds are responsible for almost 93% of the nitrogen load.

The New Bedford Landfill is located within the Paskamansett River watershed east of Shawmut Avenue in New Bedford. Using the estimated total nitrogen concentrations, the digitized area of the capped solid waste (41 acres), and the Slocum River recharge rate, MEP staff developed an annual nitrogen load from the landfill of 2,128 kg. This total annual load is added to the watershed nitrogen load for the Paskamansett River subwatershed. The Dartmouth Landfill, also in the Slocums River watershed, was capped and a surface water drainage system was installed in 1996. Water quality data confirmed that the Dartmouth landfill is a negligible source of N.

Table 2: General Summary of Conditions Related to the Major Indicators of Habitat Impairment Observed in the Slocums and Little Rivers Embayment System

Embayment		Dissolved Oxygen Depletion	Eelgrass Loss	Chlorophyll *a*[1]	Benthic Fauna[2]	Macroalgae
Slocums River	Upper[3]	Salt marsh/Wetland Periodic depletions to <4 mg/L Very rare depletions to 3-2 mg/L **H**	**	High chlorophyll *a* levels generally >10-15 µg/L, frequently >20 µg/L (21% of time) **H-MI**[3]	Moderate numbers of individuals, moderate species, high diversity and Evenness **H**	Drift algae in sparse patches, patches of surface algal mat **H-MI**
	Middle	Depletions periodically to <4 mg/L Infrequent declines to <3.5 mg/L **MI-SI**	**	High chlorophyll *a* levels generally 4-15 µg/L, >15 µg/L (15% of time) **SI**	Low to moderate numbers of species and individuals, low to moderate diversity and Evenness **SI**	Moderate to high accumulations of drift algae, primarily Ulva **SI**
	Lower	Depletions periodically to <4 mg/L Infrequent declines to <3.5 mg/L **MI-SI**	Mapping indicates eelgrass lost from this system between 1951-1995 **SI**	Moderate to High chlorophyll *a* levels generally 5-10 µg/L Frequently >15 µg/L (8% of record) **MI-SI**	Tributary coves: moderately impaired habitat Main channel: high quality infaunal habitat, with high species diversity & evenness, high number of species & moderate number of individuals **H-MI**	Low accumulations of drift algae in tributary basins, little surface microphyte mat **H-MI**
Little River[3]		Salt marsh/Wetland Periodic depletions to <4 mg/L Very rare depletions to 3-2 mg/L **H**	**	Low to moderate chlorophyll *a* levels generally 2-8 µg/L, generally <6 µg/L **H**	Moderate to high number of individuals and species, with moderate to high diversity &evenness **H**	Diverse attached macroalgae community with some *Codium* and *Ruppia*, little drift algae **H**

[1]Algal blooms are consistent with chlorophyll *a* levels above 20 µg/l.

[2]Based on observations of the types of species, number of species, and number of individuals.
[3]Basin or estuarine reach supports fringing salt marsh and has a lower sensitivity to nitrogen enrichment and organic matter loading.
H - Healthy Habitat Conditions*
MI – Moderate Impairment*
SI – Significantly Impaired- considerably and appreciably changed from normal conditions*
SD – Severely Degraded – critically or harshly changed from normal conditions*
*- These terms are more fully described in MEP report "Site-Specific Nitrogen Thresholds for Southeastern Massachusetts Embayments: Critical Indicators" December 22, 2003 https://www.mass.gov/media/794926/
** - No evidence this basin is supportive of eelgrass.

In the Little River system septic systems are the major source of nitrogen. Although, freshwater wetlands are the largest single nitrogen source into both systems, this source is not considered controllable (Figure 4b).

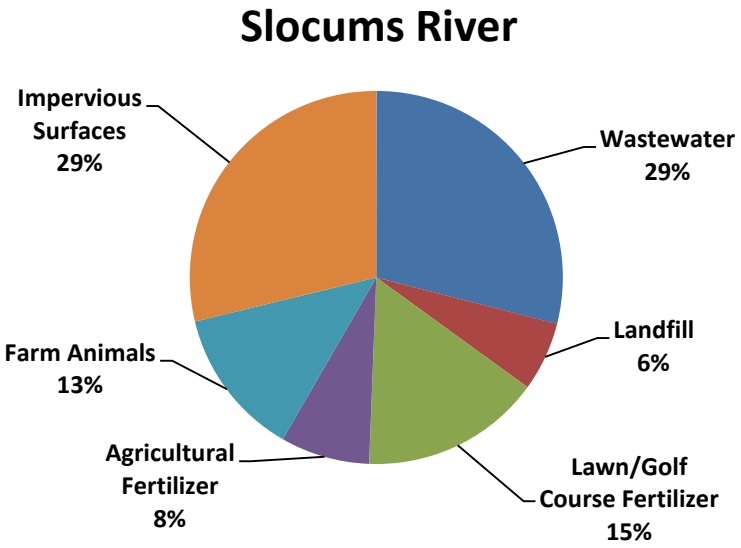

Figure 4a: Percent Contribution of Controllable Nitrogen Sources to the Slocums River System

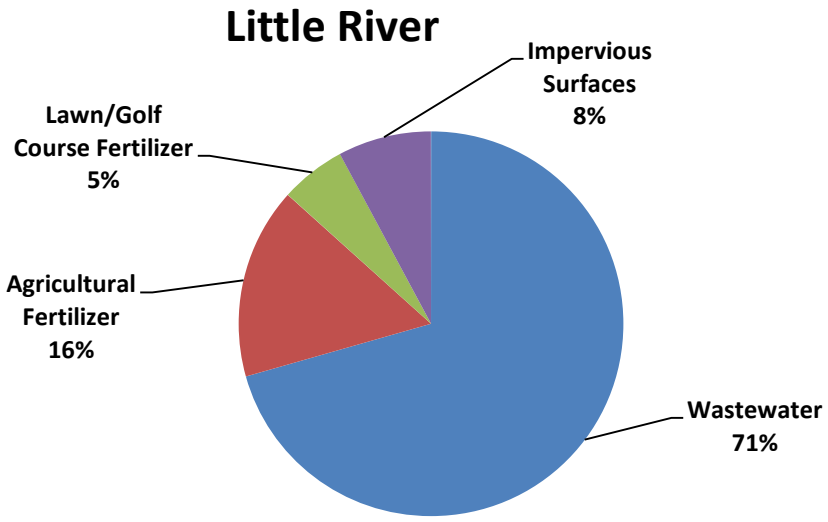

Figure 4b: Percent Contribution of Controllable Nitrogen Sources to the Little River System

The level of "controllability" of each source varies widely as seen below in Table 3. Cost/benefit analyses will have to be conducted on all possible N loading reduction methodologies in order to select the optimal control strategies, priorities and schedules.

Table 3: Sources of Nitrogen and their Controllability

Nitrogen Source	Degree of Controllability at Local Level	Reasoning
Agricultural fertilizer and animal wastes	Moderate	These nitrogen loadings can be controlled through appropriate agricultural Best Management Practices (BMPs).
Atmospheric deposition to the estuary surface	Low	It is only through region- and nation-wide air pollution control initiatives that significant reductions are feasible. Local control although helpful is not adequate.
Atmospheric deposition to natural surfaces (forests, fields, freshwater bodies) in the watershed	Low	Atmospheric deposition (loadings) to these areas cannot adequately be controlled locally. However, the N from these sources might be subjected to enhanced natural attenuation as it moves toward the estuary.
Fertilizer	Moderate	Lawn and golf course fertilizer and related N loadings can be reduced through BMPs, bylaws and public education.
Freshwater Wetlands	Low	Identified as a significant natural source of N in this system, which is characterized by extensive wetlands and swamps that border the river. Nitrogen is transformed in these wetlands but not attenuated due to the short hydraulic residence time in the associated river systems. It is not a controllable source.
Landfill	Low	Related N loadings can be controlled through appropriate BMP and management techniques.

Septic system	High	Sources of N can be controlled by a variety of case-specific methods including: sewering and treatment at centralized or decentralized locations, transporting and treating septage at treatment facilities with N removal technology either in or out of the watershed, or installing N-reducing on-site wastewater treatment systems.
Sediment	Low	N loadings are not feasibly controlled on a large scale by such measures as dredging. However, the concentrations of N in sediments, and thus the loadings from the sediments, will decline over time if sources in the watershed are removed, or reduced to the target levels discussed later in this document. In addition, increased dissolved oxygen will help keep N from fluxing.
Stormwater runoff from impervious surfaces	Moderate	This nitrogen source can be controlled by BMPs, bylaws and stormwater infrastructure improvements and public education. Stormwater NPDES permit requirements help control stormwater related N loadings in designated communities.
Wastewater treatment facility (WWTF)	High	Wastewater treatment facilities as point sources of pollution are permitted under the National Pollution Discharge Elimination System. Treated wastewater effluent discharged to groundwater disposal systems are permitted by MassDEP. There is a high degree of regulatory certainty that within the limits of technology, nutrient sources at these facilities can be controlled. The Dartmouth WWTF discharges to Buzzards Bay, not to Slocums and Little Rivers watershed.

Overview of the Applicable Water Quality Standards

The water quality classification of the saltwater portions of the Slocums and Little Rivers Embayment System is SA, and the freshwater portions of the system are classified as B. The transition to freshwater from marine is surface water not subject to tidal action or subject to mixing of fresh and ocean waters. Water quality standards of particular interest to the issues of cultural eutrophication are dissolved oxygen, nutrients, aesthetics, excess plant biomass and nuisance vegetation. The Massachusetts water quality standards (314 CMR 4.00) contain numeric criteria for dissolved oxygen but have only narrative standards that relate to the other variables. The narrative standards for nutrients (nitrogen and phosphorus) for waters of the Commonwealth are such that "all surface waters shall be free of nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed site specific criteria developed in a TMDL or otherwise, established by the department" (MassDEP 2007).

Thus, the assessment of eutrophication is based on site-specific information within a general framework that emphasizes impairment of uses and preservation of a balanced indigenous flora and fauna. This approach is recommended by the U.S. Environmental Protection Agency in their draft Nutrient Criteria Technical Guidance Manual for Estuarine and Coastal Marine Waters (EPA-822-B-01-003, Oct 2001). The Guidance Manual notes that lakes, reservoirs, streams and rivers may be subdivided by classes, allowing reference conditions for each class and facilitating cost-effective criteria development for nutrient management. However, individual estuarine and coastal marine waters tend to have unique characteristics and development of individual water body criteria is typically required.

More details on the applicable standards can be found in Appendix A. This brief summary does not supersede or replace 314 CMR 4.0 Massachusetts Water Quality Standards, the official and legal standards. A complete version of 314 CMR 4.0 Massachusetts Water Quality Standards is available online at http://www.mass.gov/eea/agencies/massdep/water/regulations/314-cmr-4-00-mass-surface-water-quality-standards.html

Methodology - Linking Water Quality and Pollutant Sources

Extensive data collection and analyses have been described in detail in the MEP Technical Report. Those data were used by SMAST to assess the loading capacity of each sub-embayment. Physical (Chapter V), chemical and biological (Chapters IV, VII, and VIII) data were collected and evaluated. The primary water quality objective was represented by conditions that:

1) Restore the natural distribution of eelgrass because it provides valuable habitat for shellfish and finfish;
2) Prevent algal blooms;
3) Restore and preserve benthic communities;
4) Maintain dissolved oxygen concentrations that are protective of the estuarine communities.

The details of the data collection, modeling and evaluation are presented and discussed in Chapters IV, V, VI, VII and VIII of the MEP Technical Report. The main aspects of the data evaluation and modeling approach are summarized below.

The core of the Massachusetts Estuaries Project analytical method is the Linked Watershed-Embayment Management Modeling Approach. It fully links watershed inputs with embayment circulation and N characteristics, and is characterized as follows:

- Requires site specific measurements within the watershed and each sub-embayment;
- Uses realistic "best-estimates" of N loads from each land-use (as opposed to loads with built-in "safety factors" like Title 5 design loads);
- Spatially distributes the watershed N loading to the embayment;
- Accounts for N attenuation during transport to the embayment;
- Includes a 2D or 3D embayment circulation model depending on embayment structure;
- Accounts for basin structure, tidal variations, and dispersion within the embayment;
- Includes N regenerated within the embayment;
- Is validated by both independent hydrodynamic, N concentration, and ecological data;
- Is calibrated and validated with field data prior to generation of "what if" scenarios.

The Linked Model has been applied previously to watershed N management in over 60 embayments thus far throughout Southeastern Massachusetts. In these applications it became clear that the model can be calibrated and validated and has use as a management tool for evaluating watershed N management options.

The Linked Model, when properly calibrated and validated for a given embayment becomes a N management-planning tool as described in the model overview below. The model can assess solutions for the protection or restoration of nutrient-related water quality and allows testing of management scenarios to support cost/benefit evaluations. In addition, once a model is fully functional it can be refined for changes in land-use or embayment characteristics at minimal cost. Also, since the Linked Model uses a holistic approach that incorporates the entire watershed, embayment and tidal source waters, it can be used to evaluate all projects as they relate directly or indirectly to water quality conditions within its geographic boundaries. It should be noted that this approach includes high-order, watershed and sub-watershed scale modeling necessary to develop critical nitrogen targets for each major sub-embayment. The models, data and assumptions used in this process are specifically intended for the purposes stated in the MEP Technical Report, upon which this TMDL is based. As such, the Linked Model process does not contain the type of data or level and scale of analysis necessary to predict the fate and transport of nitrogen through groundwater from specific sources. In addition, any determinations related to direct and immediate hydrologic connection to surface waters are beyond the scope of the MEP's Linked Model process.

The Linked Model provides a quantitative approach for determining an embayment's (1) N sensitivity, (2) N threshold loading levels (TMDL) and (3) response to changes in loading rate. The approach is fully field validated and unlike many approaches, accounts for nutrient sources, attenuation and recycling and variations in tidal hydrodynamics (Figure I-2 of the MEP Technical Report). This methodology integrates a variety of field data and models, specifically:

• Monitoring - multi-year embayment nutrient sampling

• Hydrodynamics -
  - Embayment bathymetry (depth contours throughout the embayment)
  - Site-specific tidal record (timing and height of tides)
  - Water velocity records (in complex systems only)
  - Hydrodynamic model

• Watershed Nitrogen Loading
  - Watershed delineation
  - Stream flow (Q) and N load
  - Land-use analysis (GIS)
  - Watershed N model

• Embayment TMDL - Synthesis
  - Linked Watershed-Embayment Nitrogen Model
  - Salinity surveys (for linked model validation)
  - Rate of N recycling within embayment
  - Dissolved oxygen record
  - Macrophyte survey
  - Infaunal survey

Application of the Linked Watershed-Embayment Model

The approach developed by the MEP for applying the linked model to specific embayments, for the purpose of developing target N loading rates, includes:

1) Selecting one or two stations or sampling locations within the embayment system located close to the inland-most reach or reaches which typically has the poorest water quality within the system. These are called "sentinel" stations;

2) Using site-specific information and a minimum of three years of sub-embayment-specific data to select target threshold N concentrations for each sub-embayment. This is done by refining the draft target threshold N concentrations that were developed as the initial step of the MEP process. The target threshold N concentrations that were selected generally occur in higher quality waters near the mouth of the embayment system;

3) Running the calibrated water quality model using different watershed N loading rates to determine the loading rate that will achieve the target threshold N concentration at the sentinel station. Differences between the modeled N load required to achieve the target threshold N concentration and the present watershed N load represent N management goals for restoration and protection of the embayment system as a whole.

Previous sampling and data analyses and the modeling activities described above resulted in four major outputs that were critical to the development of the TMDL. Two outputs are related to N **concentration:**

1. The present N concentrations in the sub-embayments
2. Site-specific target threshold N concentrations

And, two outputs are related to N **loadings:**

1. The present N loads to the sub-embayments
2. Load reductions necessary to meet the site specific target N concentrations

In summary: meeting the water quality standards by reducing the N concentration (and thus the N load) at the sentinel station(s), the water quality goals will be met throughout the entire system.

A brief overview of each of the outputs follows:

Nitrogen concentrations in the embayment

a) Observed "present" conditions:
Table 4 presents the average concentrations of N measured in this embayment from six years of data collected at up to 12 stations during the period 2000 through 2006. The overall means and standard deviations of the averages are presented in Appendix A (reprinted from Table VI-1 of the accompanying MEP Technical Report). Water quality sampling stations are shown in Figure 5 below.

b) Modeled site-specific target threshold N concentrations:
The target threshold N level for an embayment represents the average water column concentration of N that will support the habitat quality and dissolved oxygen concentrations being sought. The water column N level is ultimately controlled by the integration of the watershed N load, the N concentration in the inflowing tidal waters (boundary condition), and dilution and flushing via tidal flows. The water column N concentration is modified by the extent of sediment uptake and/or regeneration, by direct atmospheric deposition and phytoplankton uptake.

A major component of TMDL development is the determination of the maximum concentrations of N (based on field data) that can occur without causing unacceptable impacts to the aquatic environment. Prior to conducting the analytical and modeling activities described above, SMAST selected appropriate nutrient-related environmental indicators and tested the qualitative and quantitative relationship between those indicators and N concentrations. The Linked Model was then used to determine site-specific target threshold N concentrations by using the specific physical, chemical and biological characteristics of each sub-embayment.

Target threshold N levels were developed to restore or, in the case of the Little River estuary, maintain SA waters or high habitat quality. In these embayments, high habitat quality was

defined as healthy eelgrass beds (in the Slocums River only), diverse benthic animal communities and dissolved oxygen levels that would support Class SA waters. The findings of the analytical and modeling investigations to determine this target threshold nitrogen concentration for the embayment system are discussed below.

Table 4: Observed Present Nitrogen Concentrations and Sentinel Station Threshold Nitrogen Target Concentrations for the Slocums and Little Rivers System

Sub-embayment	Observed Nitrogen Concentration [1] (mg/L)	Sentinel Station Target Threshold Nitrogen Concentration (mg/L)
Upper Slocums River	0.64	
Mid Slocums River	0.40 –0.62[2]	
Lower Slocums River	0.39	0.36 (Near station SRT-12)
Paskamansett River	0.93[3]	
Destruction Brook	1.50[3]	
Barney's Joy River (North & South)	0.61[3]	
Little River	0.40	0.50 [4] (Near station SRT-15)

[1] Calculated as the average of the separate yearly means of 2000-2006 data. Overall means and standard deviations of the average are presented in Appendix B.

[2] Listed as a range since it was sampled at several stations (see Appendix B)

[3] MEP stream gage data as reported in Table IV-8 of the MEP Technical Report.

[4] The target threshold N level is higher than the present conditions because Little River is not impaired and is functioning as a salt marsh so it is capable of receiving a higher nitrogen load

In the Slocums River system the loss of eelgrass classifies the lower tidal reach as "significantly impaired" although it presently supports healthy to moderately healthy infaunal communities. The target nitrogen concentration (tidally averaged N) for restoration of eelgrass at the sentinel location at Station SRT-12 (Figure 5) within the lower reach of the Slocums River was determined to be 0.36 mg/L N (Table 4).

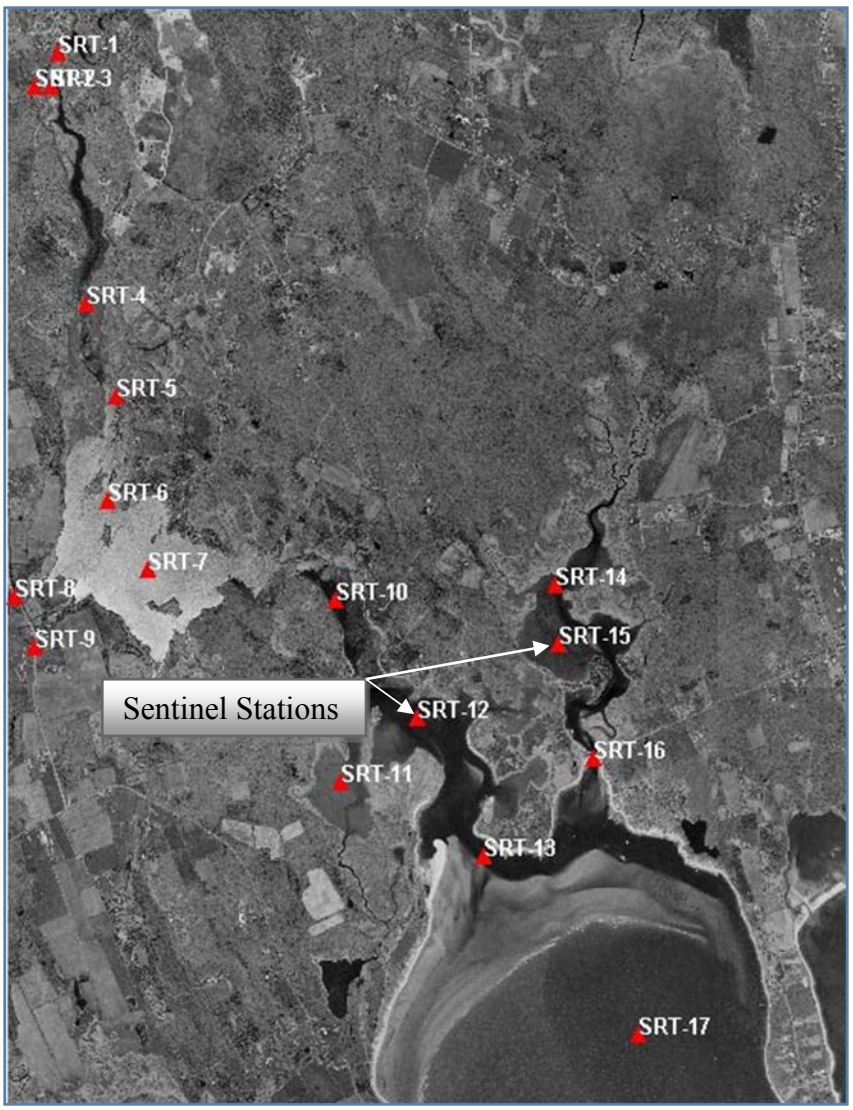

Figure 5: Water Quality Sampling Stations in the Slocums and Little Rivers Estuaries.

Since there is no eelgrass within this estuary the MEP study determined the target threshold nitrogen concentration upon comparison to other local embayments of similar depths and structure. A well-studied eelgrass bed within the lower Oyster River in Chatham has been stable at a tidally averaged water column N of 0.37 mg/L N, while eelgrass was lost within the Lower Centerville River at a tidally averaged N of 0.395 mg/L N and also within Waquoit Bay at 0.39 mg/L N. Although the nitrogen management target is restoration of eelgrass habitat, benthic infaunal habitat quality must also be supported as a secondary condition. Therefore, in addition to the primary target nitrogen threshold at the sentinel station, secondary criteria for infaunal habitat restoration was established by the MEP study to ensure that all impaired regions are restored if the threshold at the sentinel station is achieved. The infaunal check station is the long-term average TN of stations SRT-6 and SRT-7 located within the presently significantly impaired middle basin. The tidally averaged target threshold nitrogen level required at this station to restore the infaunal animal habitat throughout the Slocums River system is <0.5 mg/L N based on comparison with other nearby, similar estuaries where levels <0.5 mg/L N were

found to be supportive of healthy infaunal habitat. Watershed nitrogen management to achieve this "check" nitrogen level will ensure restoration of infaunal habitats within the down-gradient reach as well. The secondary criteria should also be met when the target threshold is met at the sentinel station. Based on this, eelgrass is the primary nitrogen management goal for the lower Slocums River system and infaunal habitat quality the management target for the upper reaches.

The Little River does not support eelgrass nor is there any evidence that it ever had. The absence of eelgrass in similar saltmarsh dominated basins is typical throughout Southeastern Massachusetts. As a result, management of the Little River estuary should focus on maintaining the current high level of infaunal habitat quality. Since the Little River system is presently supporting high quality habitat and low total nitrogen levels and is predominately a salt marsh basin, its nitrogen threshold level is higher than the present condition of watershed nitrogen loading. A conservative estimate of the target threshold nitrogen level for this system of 0.5 mg/L N at the sentinel location (Station SRT-15, shown in Figure 5) is based on comparison to other nearby estuaries where levels <0.5 mg/L N were found to be supportive of healthy infaunal habitat (Table 2). However the goal should be to maintain the existing quality and prevent further degradation.

The findings of the analytical and modeling investigations for this embayment system are discussed and explained below.

Nitrogen loadings to the embayment

a) Present Loading rates:

In the Slocums and Little Rivers embayment systems overall the highest N loading from controllable sources is from on-site wastewater treatment systems (30 kg/day N) with runoff from impervious surfaces a close second (28 kg/day N). Agricultural activities, including farm animals contributed about 20 kg/day N and fertilizers from lawns and golf courses combined accounted for about 15 kg/day of N. The N load from the landfill in the Paskamansett subwatershed contributed about 6 kg/day. Nitrogen rich sediments in this system are a minor contribution. However, reducing the N load to the estuary will also reduce N in the sediments since the magnitude of the benthic contribution is related to the watershed load.

The total attenuated N loading from all sources is 154.78 kg/day across Slocums and Little Rivers embayments. A further breakdown of N loading, by source, is presented in Table 5. The data on which Table 5 is based can be found in Table ES-1 of the MEP Technical Report.

As previously indicated, the present N loadings to the Slocums River embayment system must be reduced in order to restore the impaired conditions and to avoid further nutrient-related adverse environmental impacts. The critical final step in the development of the TMDL is modeling and analysis to determine the loadings required that will achieve the target threshold N concentrations.

b) Nitrogen loads necessary for meeting the site-specific target threshold N concentrations:

The nitrogen thresholds developed by SMAST (Section VIII.2 in the MEP Technical Report) and summarized above were used to determine the amount of total nitrogen mass loading reduction required for restoration of eelgrass and infaunal habitats in the Slocums River system and protection of infaunal habitat in the Little River estuary. Tidally averaged total nitrogen thresholds were used to adjust the calibrated water quality model (Section VI in the MEP Technical Report). Watershed nitrogen loads were sequentially lowered using reductions in septic effluent discharges only until the nitrogen levels reached the threshold level at the sentinel station chosen for Slocums River (SRT-12). It is important to note that load reductions can be produced by reduction of any or all sources of N and/or by increasing the natural attenuation of nitrogen within the freshwater systems to the embayment. The load reductions presented here represent only one of a suite of potential reduction approaches that need to be evaluated by the community.

Table 5: Present Attenuated Nitrogen Loadings to the Slocums and Little Rivers System

Sub-Embayment	Present Non-Wastewater Watershed Load[1] (kg N/day)	Present Septic System Load (kg N/day)	Present Atmospheric Deposition[2] (kg N/day)	Present Benthic Input (kg N/day)[3]	Total nitrogen load from all sources [4] (kg N/day)
Slocums River	5.19	2.37	6.16	-4.87	8.85
Paskamansett River & Destruction Brook	103.12	16.88	--	--	120.0
Barney's Joy River (North & South)	6.40	1.13	--	--	7.53
Little River	6.38	1.76	1.36	8.90	18.4
System Total	121.09	22.15	7.52	4.03	154.78

[1]Includes fertilizers, runoff, landfill, farm animals, and atmospheric deposition to lakes, wetlands and natural surfaces.
[2] Atmospheric deposition to the estuarine surface only.
[3] Nitrogen loading from sediments.
[4] Composed of fertilizer, agriculture, runoff, landfill, wastewater, atmospheric deposition, and benthic nitrogen input.

Table 6 presents the present and target threshold watershed N loading to the Slocums and Little Rivers systems and the percent reduction of N necessary to meet the target threshold N concentration at the sentinel station (SRT-12) (from Table ES-2 of the MEP Technical Report). The water and habitat quality of the Little River and Barney's Joy River are presently considered to be "healthy" and no reductions of N loading are called for. However, this document serves to notify the Town of Dartmouth that the current N loading rates to these two systems are protective and should be maintained as closely as possible in order to prevent future impairments.

It is very important to note that load reductions can be produced through a variety of strategies, including: reduction of any or all sources of N; increasing the natural attenuation of N within the freshwater systems; and/or modifying the tidal flushing through inlet reconfiguration (where appropriate). This scenario presented here establishes the general degree and spatial pattern of reduction that will be required for restoration of the N impaired portions of the Slocums River Estuarine System. The watershed communities should take any reasonable actions to reduce the controllable N sources.

Table 6: Present Watershed Nitrogen Loading Rates, Calculated Loading Rates that are Necessary to Achieve Target Threshold Nitrogen Concentrations, and the Percent Reductions of the Existing Loads Necessary to Achieve the Target Threshold Loadings.

Sub-embayment	Present Total Watershed Load[1] (kg N/day)	Target Threshold WatershedLoad[2] (kg N/day)	Percent Watershed Load Reductions Needed to Achieve Target
Slocums River	7.56	5.76	- 23.8%
Paskamansett River & Destruction Brook	120.0	106.5	- 11.3%
Barney's Joy River (North & South)	7.53	7.53	0%
Little River	8.14	8.14	0%
System Total	143.24	127.93	- 10.7%

[1] Composed of fertilizer, runoff, landfill, farm animals, atmospheric deposition to lakes and natural surfaces and septic system loadings.
[2] Target threshold watershed load is the N load from the watershed (including natural background) needed to meet the target threshold N concentrations identified in Table 4, above.

Table 7 (from Table VIII-2 of the MEP Technical Report) presents a more specific load reducing scenario that would be necessary to achieve the target threshold N concentration at the sentinel station in the Slocums River (SRT-12) based solely on reducing the septic loads from the Slocums, Paskamansett River and Destruction Brook watersheds. However, as previously noted, there are a variety of loading reduction scenarios that could achieve the target threshold N concentrations. Local officials can explore other loading reduction scenarios through additional modeling as part of their Comprehensive Wastewater Management Plan (CWMP). It must be demonstrated however, that any alternative implementation strategies will be protective of the entire embayment system. To this end, additional linked model runs can be performed by the MEP to assist the planning efforts of the town in achieving target N loads that will result in the desired target threshold N concentration.

Table 7: Summary of the Present Septic System Loads, and the Loading Reductions Necessary to Achieve the TMDL by Reducing Septic System Loads Only

Sub-embayment	Present Septic Load (kg/day)	Threshold Septic Load (kg/day)	Threshold Septic Load % Change
Slocums River[1]	2.37	0.570	-76%
Little River[1]	1.76	1.76	0
Surface Water Sources:			
Paskamansett River and Destruction Brook	16.88	3.375	-80%
Barneys Joy River (North and South)	1.13	1.13	0
System Total	22.15	6.84	- 69%

[1]Total estuarine reach which receives septic N inputs through direct groundwater discharge and from surface water (stream) inflows.

Total Maximum Daily Loads

As described in EPA guidance, a total maximum daily load (TMDL) identifies the loading capacity of a water body for a particular pollutant. EPA regulations define loading capacity as the greatest amount of loading that a water body can receive without violating water quality standards. A TMDL is established to protect and/or restore the estuarine ecosystem, including eelgrass, the leading indicator of ecological health, thus meeting water quality goals for aquatic life support. Because there are no "numerical" water quality standards for N, the TMDLs for the Slocums and Little Rivers Embayment System are aimed at establishing the loads that would correspond to specific N concentrations determined to be protective of the water quality and ecosystems.

The TMDL development process includes detailed analyses and mathematical modeling of land use, nutrient loads, water quality indicators, and hydrodynamic variables (including residence time) for each sub-embayment. The results of the mathematical model are correlated with estimates of impacts on water quality, including negative impacts on eelgrass (the primary indicator), as well as dissolved oxygen, chlorophyll-*a* and benthic infauna.

In general, the TMDL can generally be defined by the equation:

$$\boldsymbol{TMDL = BG + WLAs + LAs + MOS}$$

Where:

TMDL = loading capacity of receiving water
BG = natural background
WLAs = Waste Load Allocation is the portion allotted to point sources
LAs = Load Allocation portion is allotted to (cultural) non-point sources
MOS = margin of safety

Background Loading

Natural background N loading is included in the loading estimates, but is not quantified or presented separately. Background loading was calculated on the assumption that the entire watershed is forested with no anthropogenic sources of N. It is accounted for in this TMDL but not defined as a separate component. Readers are referred to Table ES-1 of the MEP Technical Report for estimated loading due to natural conditions.

Waste Load Allocations

Waste load allocations (WLA) identify the portion of the loading capacity allocated to existing and future point sources of wastewater. A TMDL may establish a specific WLA for an identified source or, as in the case of stormwater, may establish an aggregate WLA that applies to numerous sources. EPA interprets 40 CFR 130.2(h) to require that allocations for NPDES regulated discharges of storm water be included in the waste load component of the TMDL.

Consequently, there are areas of the Slocums and Little Rivers watershed in New Bedford and Dartmouth (as well as a small area of Freetown) that contain EPA designated "urbanized areas" and as such are required to obtain coverage under the NPDES Phase II General Permit for stormwater discharges from Small Municipal Separate Storm Sewer Systems (MS4s). In addition, there are directly connected impervious areas (DCIAs) throughout the entire watershed as identified by the EPA in: https://www.epa.gov/npdes-permits/regulated-ms4-massachusetts-communities that discharge stormwater directly to waterbodies via a conveyance system such as a swale, pipe or ditch. This TMDL treats stormwater discharge from all DCIA (even those outside of regulated urbanized areas) as part of a waste load allocation. Since there are no other point sources of nitrogen in the Slocums and Little Rivers watershed the DCIA stormwater load contribution is considered the total waste load allocation for the TMDL.

The Linked Model accounts for storm-water and groundwater loadings in one aggregate allocation as a non-point source – combining the assessments of waste water and storm-water (including stormwater that infiltrates into the soil and direct discharge pipes into water bodies) for the purpose of developing control strategies. Based on land use, the Linked Model accounts for loading from stormwater, but does not differentiate stormwater into a load and waste load allocation. In order to distinguish the point source or waste load allocation of stormwater originating from DCIAs from the nonpoint source stormwater contribution (LA or load allocation), the percent of the impervious area that was identified as DCIA was determined and multiplied by the impervious surface N load (in kg N/day) as reported by the MEP in Table IV-6 of the Technical Report.

Table 8 shows the existing WLA and LA from stormwater runoff from impervious surfaces in the watershed of the Slocums and Little Rivers system. Percentages of DCIA in the subwatersheds were determined from the town by impervious area statistics listed on the EPA NPDES Stormwater Regulated Communities website: https://www.epa.gov/npdes-permits/regulated-ms4-massachusetts-communities. The WLAs for stormwater nitrogen contribution (kg N/day) was determined using the DCIA for each subembayment divided by total impervious area in the subembayment, then multiplying the total impervious surfaces runoff N

load for the subwatershed (from Table IV-6 in the MEP Technical Report) per EPA (EPA, 2010) Methodology. The remaining impervious surfaces loads were assigned as the LA.

For example, the impervious surface N load in the Paskamansett and Destruction Brook subwatersheds is 27 kg N/day (from Table IV-6 in the MEP Technical Report). This load was multiplied by the percent DCIA in those subwatersheds (67%) as calculated from the EPA stormwater link, to get the stormwater WLA of 18.07. As evident in Table 7, the Paskamansett, Destruction Brook subwatershed contributes the majority (97%) of the stormwater N load to the entire system compared to the other subwatersheds and 67% of this load is attributed to point sources of stormwater from directly connected impervious areas (the WLA). (See Appendix C for impervious cover statistics for each subwatershed as well as example calculations for determining the stormwater nitrogen WLA.)

Table 8. Existing Stormwater WLA and LA as determined by Percentage of Directly Connected Impervious Area (DCIA) in the watershed of the Slocums and Little Rivers Watershed

Subwatershed	% DCIA[1]	Impervious Surface N Load[2] (kg N/day)	Stormwater WLA[3] kg N/day	Stormwater LA kg N/day
Slocums River	1%	0.52	0.005	0.51
Little River	1%	0.2	0.002	0.198
Paskamansett/ Destruction Bk.	67%	27	18.07	8.93
Barneys Joy River North	1%	0.08	0.001	0.079
Barneys Joy River South	1%	0.19	0.002	0.188
System Total		27.9	18.08	9.905

From https://www.epa.gov/npdes-permits/regulated-ms4-massachusetts-communities
[1] DCIA (Directly connected impervious area in acres) divided by Total Area (acres) X 100.
[2] from the MEP Technical Report, Table IV-6
[3] Percent DCIA multiplied by Impervious Surface N Load (e.g., Slocums River WLA = 0.01 x 0.52 = 0.005)

Load Allocations

Load allocations (LA) identify the portion of loading capacity allocated to existing and future nonpoint sources. In the case of the Slocums and Little Rivers embayment system the nonpoint source loadings are primarily from septic systems although nearly as much has been attributed to agricultural activities, fertilizers and stormwater runoff from impervious surfaces not previously accounted for as a point source coming from DCIA. Figure 6 shows a breakdown of the N contributions from each source and also shows the contributions from both the WLA and LA portions of the stormwater load into the Paskamansett and Destruction Brook subwatershed. Additional non-point N sources include the landfill, natural background, atmospheric deposition, and nutrient-rich sediments. Nitrogen from stormwater runoff attributed to impervious surfaces not directly connected to a waterbody was determined to be 9.9 kg/day for the entire watershed (see Table 8) which, when compared to the total impervious surfaces N

watershed load of 27.8, accounts for approximately 36% of the impervious surfaces N load for the entire watershed.

Locally controllable sources of N within the watershed are categorized as on-site subsurface wastewater disposal system wastes, runoff from impervious surface, fertilizers, agriculture, farm animals, and the landfill. Figure 6 below illustrates that septic systems and impervious surfaces are a significant portion of the controllable N load. Septic systems contribute 30 kg/day of N to the total estuary system while runoff from impervious surfaces contributes 27.9 kg N/day. The Paskamansett subwatershed is by far the largest contributor to the N loadings in every land use category. These figures emphasize the fact that both septic systems and impervious surface are areas where reduction could take place although reductions in fertilizers and contributions from agricultural activities (including farm animals) would also benefit the overall goal.

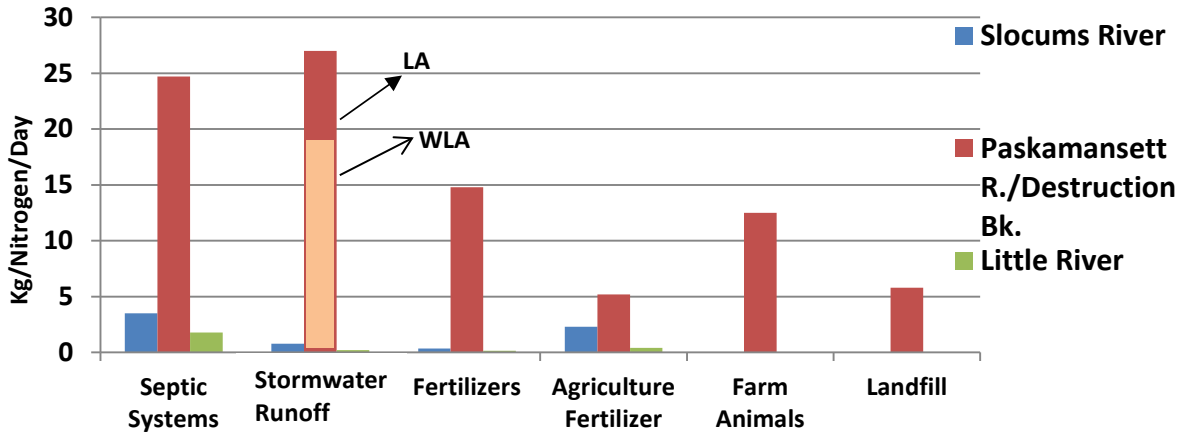

Figure 6: Slocums River, Paskamansett/Destruction Brook and Little River Subwatersheds Controllable N Sources

Benthic Flux and Atmospheric Deposition

The sediment loading rates incorporated into the TMDL are lower than the existing benthic input listed in Table 5 above because projected reductions of N loadings from the watershed will result in reductions of nutrient concentrations in the sediments and therefore, over time, reductions in loadings from the sediments will occur. Benthic flux of nitrogen from bottom sediments is a critical (but often overlooked) component of nitrogen loading to the shallow estuarine systems, therefore determination of the site specific magnitude of this component was also performed (see Section VI of the MEP Report). Benthic N flux is a function of N loading and particulate organic N (PON). Projected benthic fluxes are based upon projected PON concentrations and watershed N loads and are calculated by multiplying the present N flux by the ratio of projected PON to present PON using the following formulae:

Projected N flux = (present N flux) (PON projected / PON present)

When: $PON\ projected = (R_{load})\ (D_{PON})\ + PON_{present\ offshore}$

$When\ R_{load} =\ (projected\ N\ load)\ /\ (Present\ N\ load)$

And D_{PON} is the PON concentration above background determined by:

$D_{PON} = (PON_{present\ embayment} - PON_{present\ offshore})$

The benthic flux modeled for the Slocums and Little Rivers embayment system is reduced from existing conditions based on the load reduction and the observed PON concentrations within each sub-embayment relative to Buzzards Bay (boundary condition). The benthic flux input to each sub-embayment was reduced (toward zero) based on a future reduction of N in the watershed load.
The loadings from atmospheric sources incorporated into the TMDL however, are the same rates presently occurring because, as discussed above, local control of atmospheric loadings is not considered feasible.

Margin of Safety

Statutes and regulations require that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality [CWA para 303 (d)(20,(c) 40C.G.R. para 130.7(c)(1)]. The EPA's 1991 TMDL Guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. The MOS for the Slocums and Little Rivers Embayment System TMDL is implicit and the conservative assumptions in the analyses that account for the MOS are described below. An explicit MOS quantifies an allocation amount separate from other Load and Wasteload Allocations. An explicit MOS can incorporate reserve capacity for future unknowns, such as population growth or effects of climate change on water quality. An implicit MOS is not specifically quantified but consists of statements of the conservative assumptions used in the analysis. The MOS for the Slocums and Little Rivers Embayment System TMDL is implicit. MassDEP used conservative assumptions to develop numeric model applications that account for the MOS. These assumptions are described below, and they account for all sources of uncertainty, including the potential impacts of changes in climate.

While the general vulnerabilities of coastal areas to climate change can be identified, specific impacts and effects of changing estuarine conditions are not well known at this time (https://www.mass.gov/service-details/2011-massachusetts-climate-change-adaptation-report.). Because the science is not yet available, MassDEP is unable to analyze climate change impacts on streamflow, precipitation, and nutrient loading with any degree of certainty for TMDL development. In light of these uncertainties and informational gaps, MassDEP has opted to address all sources of uncertainty through an implicit MOS. MassDEP does not believe that an explicit MOS approach is appropriate under the circumstances or will provide a more protective or accurate MOS than the implicit MOS approach, as the available data simply does not lend itself to characterizing and estimating loadings to derive numeric allocations within confidence limits. Although the implicit MOS approach does not expressly set aside a specific portion of

the load to account for potential impacts of climate change, MassDEP has no basis to conclude that the conservative assumptions that were used to develop the numeric model applications are insufficient to account for the lack of knowledge regarding climate change.

Conservative assumptions that support an implicit MOS:

1. Use of conservative data in the linked model

The watershed N model provides conservative estimates of N loads to the embayment. Nitrogen transfer through direct groundwater discharge to estuarine waters is based upon studies indicating negligible aquifer attenuation and dilution, i.e. 100% of load enters embayment. This is a conservative estimate of loading because studies have also shown that in some areas less than 100% of the load enters the estuary. Nitrogen from the upper watershed regions, which travel through ponds or wetlands, almost always enter the embayment via stream flow, are directly measured (over 12-16 months) to determine attenuation. In these cases the land-use model has shown a slightly higher predicted N load than the measured discharges in the streams/rivers that have been assessed to date. Therefore, the watershed model as applied to the surface water watershed areas again presents a conservative estimate of N loads because the actual measured N in streams was lower than the modeled concentrations.

The hydrodynamic and water quality models have been assessed directly. In the many instances where the hydrodynamic model predictions of volumetric exchange (flushing) have also been directly measured by field measurements of instantaneous discharge, the agreement between modeled and observed values has been >95%. Field measurement of instantaneous discharge was performed using acoustic doppler current profilers (ADCP) at key locations within the embayment (with regards to the water quality model, it was possible to conduct a quantitative assessment of the model results as fitted to a baseline dataset - a least squares fit of the modeled versus observed data showed an R^2>0.95, indicating that the model accounted for 95% of the variation in the field data). Since the water quality model incorporates all of the outputs from the other models, this excellent fit indicates a high degree of certainty in the final result. The high level of accuracy of the model provides a high degree of confidence in the output; therefore, less of a margin of safety is required.

In the case of N attenuation by freshwater ponds, attenuation was derived from measured N concentrations, pond delineations and pond bathymetry. These attenuation factors were higher than that used in the land-use model. The reason was that the pond data were temporally limited and a more conservative value of 50% was more protective and defensible.

Similarly, the water column N validation dataset was also conservative. The model is validated to measured water column N. However, the model predicts average summer N concentrations. The very high or low measurements are marked as outliers. The effect is to make the N threshold more accurate and scientifically defensible. If a single measurement two times higher than the next highest data point in the series raises the average 0.05 mg N/L, this would allow for a higher “acceptable” load to the embayment. Marking the very high outlier is a way of preventing a single and rare bloom event from changing the N threshold for a system. This effectively strengthens the data set so that a higher margin of safety is not required.

Finally, the predicted reductions in benthic regeneration of N are most likely underestimates, i.e. conservative. The reduction is based solely on a reduced deposition of PON, due to lower primary production rates under the reduced N loading in these systems. As the N loading decreases and organic inputs are reduced, it is likely that rates of coupled remineralization-nitrification, denitrification and sediment oxidation will increase.

Benthic regeneration of N is dependent upon the amount of PON deposited to the sediments and the percentage that is regenerated to the water column versus being denitrified or buried. The regeneration rate projected under reduced N loading conditions was based upon two assumptions: (1) PON in the embayment in excess of that of inflowing tidal water (boundary condition) results from production supported by watershed N inputs and(2) presently enhanced production will decrease in proportion to the reduction in the sum of watershed N inputs and direct atmospheric N input. The latter condition would result in equal embayment versus boundary condition production and PON levels if watershed N loading and direct atmospheric deposition could be reduced to zero (an impossibility of course). This proportional reduction assumes that the proportion of remineralized N will be the same as under present conditions, which is almost certainly an underestimate. As a result, future N regeneration rates are overestimated which adds to the margin of safety.

Finally, the linked model accounted for all stormwater loadings and groundwater loadings in one aggregate allocation as a non-point source and this aggregate load is accounted for in the load allocation. The method of calculating the WLA in the TMDL for regulated stormwater was conservative as it did not disaggregate this load from the modeled stormwater LA, which contributes to the margin of safety.

Decreases in air deposition through continuing air pollution control efforts are unaccounted for this TMDL and provide another component of the margin of safety.

2. Conservative sentinel station/target threshold nitrogen concentration

Conservatism was used in the selection of the sentinel station and target threshold N concentration. The site was chosen that had stable eelgrass or benthic animal (infaunal) communities, and not those just starting to show impairment, which would have slightly higher N concentration. Meeting the target threshold N concentration at the sentinel station will result in reductions of N concentrations in the rest of the system.

3. Conservative approach

The target loads were based on tidally averaged N concentrations on the outgoing tide, which is the worst case condition because that is when the N concentrations are the highest. The N concentrations will be lower on the flood tides and therefore this approach is conservative.
In addition to the margin of safety within the context of setting the N threshold levels as described above, a programmatic margin of safety also derives from continued monitoring of this embayment to support adaptive management. This continuous monitoring effort provides the ongoing data to evaluate the improvements that occur over the multi-year implementation of the

N management plan. This will allow refinements to the plan to ensure that the desired level of restoration is achieved.

Seasonal Variation

Since the TMDLs for the waterbody segments are based on the most critical time period, i.e. the summer growing season, the TMDLs are protective for all seasons. The daily loads can be converted to annual loads by multiplying by 365 (the number of days in a year). Nutrient loads to the embayment are based on annual loads for two reasons. The first is that primary production in coastal waters can peak in both the late winter-early spring and in the late summer-early fall periods. Second, as a practical matter, the types of controls necessary to control the N load, the nutrient of primary concern, by their very nature do not lend themselves to intra-annual manipulation since the majority of the N is from non-point sources. Thus, the annual loads make sense since it is difficult to control non-point sources of N on a seasonal basis and N sources can take considerable time to migrate to impacted waters.

TMDL Values for the Slocums and Little Rivers Embayment System

As outlined above, the total maximum daily loadings of N that would provide for the restoration and protection of the embayment were calculated by considering all sources of N grouped by natural background, point sources and non-point sources. A more meaningful way of presenting the loadings data from an implementation perspective is presented in Table 8. This table is based on data from Table ES-2 in the MEP Technical Report.

In this table the N loadings from the atmosphere and sediments are listed separately from the target watershed threshold loads which are composed of natural background N along with locally controllable N from the on-site subsurface wastewater disposal systems, storm water runoff and fertilizer sources. Because directly connected impervious areas were determined to be a significant source of N to this system in the Paskamansett and Destruction Brook subwatershed, a WLA was calculated for stormwater and presented as part of the TMDL in Table 8. A description of how the stormwater WLA and LA were determined has been described in the previous section.

In the case of the Slocums and Little Rivers embayment system the TMDL was calculated by projecting reductions in locally controllable on-site subsurface wastewater disposal systems. The nitrogen septic load reductions within the Slocums River Estuary West and East sub-watersheds were reduced by 76% along with an approximate 80% reduction in nitrogen septic load for Paskamansett River and Destruction Brook. However, septic nitrogen loading represents only a moderate portion of the total watershed N load. Stormwater runoff from impervious surfaces, farm animals and lawn and golf course fertilizers have also been identified as sources of nitrogen to this system.

Table 9: The Total Maximum Daily Load (TMDL) for Slocums and Little Rivers Embayment System, Represented as the Sum of the Calculated Target Threshold Loads, Atmospheric Deposition and Sediment Load

Sub-embayment	Target Threshold Watershed Load [1] (kg N/day)			Atmospheric Deposition (kg N/day)	Load from Sediments[5] (kg N/day)	TMDL[6] (kg N/day)
	Natural Background[2]	WLA[3]	LA[4]			
Slocum's River	3.44	0.005	2.32	6.16	0	11.92
Little River	5.63	0.002	2.51	1.36	8.90	18.4
Paskamansett River & Destruction Brook[7]	60.61	18.07	27.82	-	-	106.5
Barney's Joy River (North & South)	4.95	0.003	2.59	-	-	7.54
System Total	74.63	18.08	35.24	7.52	8.9	144.35

[1] Target threshold watershed load is the load from the watershed needed to meet the embayment target threshold Nitrogen concentration identified in Table 4. It is comprised of natural background, the WLA and LA.
[2] Natural background N load from Table ES-1 of the MEP Technical Report.
[3] WLA (from Table 7) is the impervious surfaces runoff from DCIA.
[4] LA is the remaining Target Watershed Load.
[5] Projected sediment N loadings obtained by reducing the present loading rates (Table 5) proportional to proposed watershed load reductions and factoring in the existing and projected future concentrations of PON. Negative sediment loads were set to zero.
[6] Sum of target threshold watershed load, sediment load and atmospheric deposition load.
[7] The two freshwater streams enter the headwaters of Slocums River. Though nutrient load is combined here, separate TMDLs are assigned in Appendix D.

In particular, stormwater runoff from impervious areas has been identified in the MEP Report as the most significant source of N in the Paskamansett/Destruction Brook subwatershed. As stated above, portions of Dartmouth, New Bedford and Freetown that contribute to this subwatershed are classified as Urban Areas (UAs) by the United States Census Bureau and are regulated under the NPDES Phase II permit programs. EPA's Phase II rule specifies that these communities must develop, implement, and enforce a storm water management program that is designed to reduce the discharge of pollutants to the maximum extent practicable, protect water quality, and satisfy the applicable water quality requirements of the Clean Water Act.

The NPDES permits which EPA has issued in Massachusetts to implement the Phase II Stormwater program do not establish numeric effluent limitations for stormwater discharges, rather, they establish narrative requirements, including best management practices, to meet the following six minimum control measures and to meet State Water Quality Standards.

1. public education and outreach particularly on the proper disposal of pet waste,
2. public participation/involvement,
3. illicit discharge detection and elimination,
4. construction site runoff control,
5. post construction runoff control, and
6. pollution prevention/good housekeeping.

As part of their applications for Phase II permit coverage, communities must identify the best management practices they will use to comply with each of these six minimum control measures and the measurable goals they have set for each measure. Therefore, compliance with the requirements of the Phase II stormwater permits in the communities of Dartmouth and New Bedford will contribute to the goal of reducing the nitrogen load as prescribed in this TMDL for the Paskamansett/Destruction Brook subwatershed.

Once again the goal of this TMDL is to achieve the identified target threshold N concentration at the identified sentinel station. The target load identified in this table represents one alternative-loading scenario to achieve that goal but other scenarios may be possible and acceptable as well. However, this scenario establishes the general degree and spatial pattern of reduction that will be required for restoration of this nitrogen impaired embayment.

Implementation Plans

EPA and MassDEP authorized most of the watershed communities of New Bedford and large portions of Dartmouth for coverage under the NPDES Phase II General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4s) in 2003. EPA and MassDEP reissued the MS4 permit in April 2016 and became effective on July 1, 2018.

This TMDL forms the basis for implementation plans to meet the Nitrogen loading capacity established for the Slocums and Little Rivers Embayment System. As MS4 permittees, Dartmouth and New Bedford will be required to identify in their respective Storm Water Management Plans (SWMPs) and Annual Reports those discharges that are subject to TMDL related requirements, as identified in part 2.2.1. of the renewal permit, and those that are subject to additional requirements to protect water quality, as identified in part 2.2.2. of the renewal permit. Because this TMDL will be subject to EPA review and approval after issuance of the renewal permit, Dartmouth and New Bedford are subject to the additional requirements to protect water quality in part 2.2.2. for purposes of implementing this TMDL, and they are each required to comply with the applicable provisions in Appendix H to address their respective nitrogen discharges to the maximum extent practicable, as required by CWA Section 402(p)(3)(B)(iii). Although EPA's Phase II MS4 regulations only require a small MS4 to implement its program in the urbanized area subject to permitting, EPA and MassDEP nonetheless encourage permittees, including Dartmouth and New Bedford, to update and implement their respective SWMPs jurisdiction-wide to further water quality improvements. The critical element of this TMDL process is achieving the sentinel station specific target threshold N concentrations presented in Table 4 that are necessary for the restoration and protection of water quality and eelgrass habitat within the Slocums and Little Rivers Embayment System. In order to achieve these target threshold N concentrations, N loading rates must be reduced throughout the Slocums embayment and preserved within the Little River embayment.

The water and habitat quality of the Little and Barney's Joy Rivers are presently considered to be "healthy" and no reductions of N loading are called for. Accordingly, the target N loading rates to these two systems are considered "pollution prevention" TMDLs. Pollution prevention

TMDLs on these waterbodies will encourage the maintenance and protection of existing water quality and help prevent further degradation to waterbodies that are downstream or linked. These pollution prevention TMDLs will serve as a guide to help ensure that the Little River and Barney's Joy Rivers do not become impaired for N. (Note that previously the Little River was listed on the MA 2014 Integrated List of Waters as impaired. The new data indicate that this water body is not currently impaired due to nitrogen. As such MassDEP will petition the EPA to remove this segment from the current list.)

As previously noted, there is a variety of loading reduction scenarios that could achieve the target threshold N concentrations. Dartmouth and New Bedford can explore other loading reduction scenarios through additional modeling as part of their Comprehensive Wastewater Management Plan (CWMP). It must be demonstrated however, that any alternative implementation strategies will be protective of the entire embayment system and that none of the embayment will be negatively impacted. To this end, additional linked model runs can be performed by the MEP at a nominal cost to assist the planning efforts of the town in achieving target N loads that will result in the desired target threshold N concentration.

Because a significant portion of the of controllable N load is from septic systems for private residences the CWMP should assess the most cost-effective options for achieving the target N watershed loads, including but not limited to, sewering and treatment for N control of sewage and septage at either centralized or de-centralized locations and denitrifying systems for all private residences. The CWMP should include a schedule of the selected strategies and estimated timelines for achieving the N targets. However, the MassDEP realizes that an adaptive management approach may be used to observe implementation results over time and allow for adjustments based on those results. If a community chooses to implement TMDL measures without a CWMP it must demonstrate that these measures will achieve the target threshold N concentration. (Note: Communities that choose to proceed without a CWMP will not be eligible for State Revolving Fund loans.)

As discussed above, the MEP Technical Report has predicted that the threshold N concentration can be met by the prescribed reductions in septic loads only. However, because stormwater runoff contributes such a large percentage of the N load to the Slocums River, MassDEP recommends that Dartmouth and New Bedford continue to work towards reducing stormwater runoff N loads to the Paskamansett and Destruction Brook subwatersheds through the implementation of their Stormwater Management Programs (SWMPs) under their NPDES Phase II Stormwater permits.

The NPDES permit does not, however, establish numeric effluent limitations for storm water discharges. Maximum extent practicable is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The maximum extent practicable standard is a narrative effluent limitation that is satisfied through implementation of Stormwater Management Programs and achievement of measurable goals. Non-point source discharges are generally characterized as sheet flow runoff and are not categorically regulated under the NPDES program and can be difficult to manage. However, some of the same principles for mitigating point source impacts may be applicable. Portions of the watershed in Dartmouth and New Bedford are not currently regulated under the Phase II program. It is recommended that

these municipalities consider expanding some or all of the six minimum control measures and other BMPs throughout their jurisdiction in order to minimize storm water contamination.

In addition to the Phase II Stormwater Permit program described above, the MassDEP issued a Stormwater Policy in1996 that established Stormwater Management Standards. In 2008 MassDEP revised the Stormwater Management Standards and the Massachusetts Stormwater Handbook to promote increased stormwater recharge, the treatment of more runoff from polluting land uses, low impact development (LID) techniques, pollution prevention, the removal of illicit discharges to stormwater management systems, and improved operation and maintenance of stormwater best management practices (BMPs). MassDEP applies the Stormwater Management Standards pursuant to its authority under the Wetlands Protection Act, M.G.L. c. 131, § 40, and the Massachusetts Clean Waters Act, M.G.L .c. 21, §§ 26-53. The revised Stormwater Management Standards have been incorporated in the Wetlands Protection Act Regulations, 310 CMR 10.05(6)(k) and the Water Quality Certification Regulations, 314 CMR 9.06(6)(a).The Massachusetts Stormwater Handbook can be found at: http://www.mass.gov/eea/agencies/massdep/water/regulations/massachusetts-stormwater-handbook.html

Also significant to implementation efforts are several groups that have been active in the protection of the Buzzards Bay watershed for many years. The Buzzards Bay National Estuary Program (NEP) joined the National Estuary Program in 1987. There are 28 NEPs around the country and they have become a model for watershed management and planning. The Buzzards Bay NEP acts as an advisory and planning unit of the Massachusetts Office of Coastal Zone Management. There are two not-for-profit active stewards of the Buzzards Bay, the Coalition for Buzzards Bay (CBB) and the Buzzards Bay Action Committee (BBAC). The CBB is a citizens group primarily focused on education and outreach and the BBAC, consisting of municipal officials, focusing on regulation and legislation issues. Today, both organizations are on the Buzzards Bay NEP's Steering Committee, where their mission is "To protect and restore water quality and living resources in Buzzards Bay and its surrounding watershed through the implementation of the Buzzards Bay Comprehensive Conservation and Management Plan" (CCMP) This document, originally published in 1991 was updated in October 2012 and the new draft is available for download at http://buzzardsbay.org/management-solutions/2013-ccmp/). This plan is a blueprint for the protection and restoration of water quality and living resources in Buzzards Bay and its watershed. The Buzzards Bay NEP provides funding and technical assistance to municipalities and citizens to implement the recommended actions contained in the CCMP. The CCMP includes the following action plans:

- Managing Nitrogen-Sensitive Embayment's
- Protecting and Enhancing Shellfish Resources
- Controlling Stormwater Runoff
- Managing Sanitary Wastes from Boats
- Managing On-Site Systems
- Preventing Oil Pollution
- Protecting Wetlands and Coastal Habitat
- Planning for a Shifting Shoreline
- Managing Sewage Treatment Facilities
- Reducing Toxic Pollution

- Managing Dredging and Dredged Material Disposal

Through implementation of the action plan to control stormwater in the CCMP the Buzzards Bay NEP produced a mapping document, *"Atlas of Stormwater Discharges in the Buzzards Bay Watershed"*. Data collected to produce the map sets remediation implementation priorities within the watershed. The storm water mapping effort is ongoing in areas not included in the original Atlas.(http://buzzardsbay.org/stormatlas.htm)

Dartmouth and New Bedford are urged to meet the target threshold N concentration by reducing N loadings from any and all sources, through whatever means are available and practical, including reductions in stormwater runoff and/or fertilizer use within the watershed through the establishment of local by-laws and/or the implementation of stormwater BMPs in addition to reductions in on-site subsurface wastewater disposal system loadings.

Based on land-use and the fact that most of the watershed is located within the Town of Dartmouth it appears that significant nitrogen management for the Slocums River restoration may be formulated and implemented through the Town of Dartmouth's actions. Although it is noted that much of the watershed area in New Bedford is presently serviced by the municipal wastewater system, cooperation with New Bedford on planning and management particularly with regard to management of stormwater from impervious surfaces, is still important to the long-term success of a restoration plan. The watershed of the Little River lies entirely within the Town of Dartmouth so management of this system is dependent on Dartmouth only.

The Town of Dartmouth has taken an active role in reducing the TN to the watershed since the start of the MEP project. Numerous sewer extensions within the Slocums and Little River Watersheds have been completed since the start of data collection in 2000. The Dartmouth Board of Health reports that 469 septic systems were abandoned and the residents tied in to the municipal system. An additional 399 substandard septic systems were upgraded to Title 5 where sewer was not available. Dartmouth passed comprehensive revisions to their Aquifer Protection Zoning By-law in 2005, which, in compliance with MassDEP Wellhead Protection requirements in the Drinking Water Regulations, requires onsite recharge of stormwater for residential and commercial properties with impervious areas greater than 15% or 2,500 square feet.

Dartmouth has required stormwater Best Management Practice (BMP) at three major commercial properties in the watershed since 2005 (North Dartmouth Mall, Faunce Corner Road, and Russell's Mills Road). Dartmouth, along with the Commonwealth of Massachusetts and local non-governmental organizations, has established permanent open space with the Slocums and Little Rivers watersheds. Dartmouth reports that approximately 8.6 square miles or 22% or the land area within the watershed is protected open space.

Massachusetts Department of Agricultural Resources, Plant Nutrient Application Requirements, 330 CMR 31.00, became effective December 2015. These regulations which require basic plant nutrient management plans for 10 or more acres and adherence to application and seasonal restrictions, will reduce the agricultural TN load entering the surface water and groundwater throughout Massachusetts, including Slocums and Little Rivers Estuarine System.

Climate Change:

MassDEP recognizes that long-term (25+ years) climate change impacts to southeastern Massachusetts, including the area of this TMDL, are possible based on known science. Massachusetts Executive Office of Energy and Environmental Affairs 2011Climate Change Adaptation Report: https://www.mass.gov/service-details/2011-massachusetts-climate-change-adaptation-report predicts that by 2100 the sea level could be from 1 to 6 feet higher than the current position and precipitation rates in the Northeast could increase by as much as 20 percent. However, the details of how climate change will affect sea level rise, precipitation, streamflow, sediment and nutrient loading in specific locations are generally unknown. The ongoing debate is not about whether climate change will occur, but the rate at and the extent to which it will occur and the adjustments needed to address its impacts. EPA's 2012 Climate Change Strategy https://www.mass.gov/doc/embayment-restoration-and-guidance-for-implementation-strategies states: "Despite increasing understanding of climate change, there still remain questions about the scope and timing of climate change impacts, especially at the local scale where most water-related decisions are made." For estuarine TMDLs in southeastern Massachusetts, MassDEP recognizes that this is particularly true, where water quality management decisions and implementation actions are generally made and conducted at the municipal level on a sub-watershed scale.

EPA's Climate Change Strategy identifies the types of research needed to support the goals and strategic actions to respond to climate change. EPA acknowledges that data are missing or not available for making water resource management decisions under changing climate conditions. In addition, EPA recognizes the limitation of current modeling in predicting the pace and magnitude of localized climate change impacts and recommends further exploration of the use of tools, such as atmospheric, precipitation and climate change models, to help states evaluate pollutant load impacts under a range of projected climatic shifts.

In 2013, EPA released a study entitled, "Watershed modeling to assess the sensitivity of streamflow, nutrient, and sediment loads to potential climate change and urban development in 20 U.S. watersheds." (National Center for Environmental Assessment, Washington D.C.; EPA/600/R-12/058F). The closest watershed to southeastern Massachusetts that was examined in this study is a New England coastal basin located between Southern Maine and Central Coastal Massachusetts. These watersheds do not encompass any of the watersheds in the Massachusetts Estuary Project (MEP) region, and it has vastly different watershed characteristics, including soils, geography, hydrology and land use – key components used in a modeling analysis. The initial "first order" conclusion of this study is that, in many locations, future conditions, including water quality, are likely to be different from past experience. However, most significantly, this study did not demonstrate that changes to TMDLs (the water quality restoration targets) would be necessary for the region. EPA's 2012 Climate Change Strategy also acknowledges that the Northeast, including New England, needs to develop standardized regional assumptions regarding future climate change impacts. EPA's 2013 modeling study does not provide the scientific methods and robust datasets needed to predict specific long-term climate change impacts in the MEP region to inform TMDL development.

MassDEP believes that impacts of climate change should be addressed through TMDL implementation with an adaptive management approach in mind. Adjustments can be made as environmental conditions, pollutant sources, or other factors change over time. Massachusetts Coastal Zone Management (CZM) has developed a Storm Smart Coasts Program (2008) to help coastal communities address impacts and effects of erosion, storm surge and flooding which are increasing due to climate change. The program, www.mass.gov/czm/stormsmart offers technical information, planning strategies, legal and regulatory tools to communities to adapt to climate change impacts.

As more information and tools become available, there may be opportunities to make adjustments in TMDLs in the future to address predictable climate change impacts. When the science can support assumptions about the effects of climate change on the nitrogen loadings to Slocums and Little Rivers Embayment the TMDL can be reopened, if warranted.

The watershed communities of Dartmouth, New Bedford Westport, Acushnet and Freetown are urged to meet the target threshold N concentrations by reducing N loadings from any and all sources, through whatever means are available and practical, including reductions in on-site subsurface wastewater disposal system loadings as well as reductions in stormwater runoff and/or fertilizer use within the watershed through the establishment of local by-laws and/or the implementation of stormwater Best Management Practices (BMPs).

MassDEP's MEP Implementation Guidance report: https://www.mass.gov/doc/embayment-restoration-and-guidance-for-implementation-strategies provides N loading reduction strategies that are available to Dartmouth and New Bedford and that could be incorporated into the implementation plans. The following topics related to N reduction are discussed in the Guidance:

- Wastewater Treatment
    - On-Site Treatment and Disposal Systems
    - Cluster Systems with Enhanced Treatment
    - Community Treatment Plants
    - Municipal Treatment Plants and Sewers
- Tidal Flushing
    - Channel Dredging
    - Inlet Alteration
    - Culvert Design and Improvements
- Stormwater Control and Treatment *
    - Source Control and Pollution Prevention
    - Stormwater Treatment
- Attenuation via Wetlands and Ponds
- Water Conservation and Water Reuse
- Management Districts
- Land Use Planning and Controls
    - Smart Growth
    - Open Space Acquisition
    - Zoning and Related Tools

- Nutrient Trading

* Dartmouth and New Bedford are two of the 237 communities in Massachusetts covered by the Phase II storm water program requirements.

Monitoring Plan

MassDEP is of the opinion that there are two forms of monitoring that are useful to determine progress towards achieving compliance with the TMDL. MassDEP's position is that implementation will be conducted through an iterative process where adjustments maybe needed in the future. The two forms of monitoring include 1) tracking implementation progress as approved in the Dartmouth and New Bedford CWMP plans and 2) monitoring water quality and habitat conditions in the estuaries, including but not limited to, the sentinel stations identified in the MEP Technical Report.

The CWMP will evaluate various options to achieve the goals set out in the TMDL and the MEP Technical Report. It will also make a final recommendation based on existing or additional modeling runs, set out required activities, and identify a schedule to achieve the most cost effective solution that will result in compliance with the TMDL. Once approved by the Department tracking progress on the agreed upon plan will, in effect, also be tracking progress towards water quality improvements in conformance with the TMDL.

Relative to water quality, MassDEP believes that an ambient monitoring program much reduced from the data collection activities needed to properly assess conditions and to populate the model, will be important to determine actual compliance with water quality standards. Although the TMDL load values are not fixed, the target threshold N concentrations at the sentinel stations are fixed. Through discussions amongst the MEP it is generally agreed that existing monitoring programs which were designed to thoroughly assess conditions and populate water quality models can be substantially reduced for compliance monitoring purposes. Although more specific details need to be developed on a case-by-case basis MassDEP believes that about half the current effort (using the same data collection procedures) would be sufficient to monitor compliance over time and to observe trends in water quality changes. In addition, the benthic habitat and communities would require periodic monitoring on a frequency of about every 3-5 years. Finally, in addition to the above, existing monitoring conducted by MassDEP for eelgrass should continue into the future to observe any changes that may occur to eelgrass populations as a result of restoration efforts.

The MEP will continue working with the watershed communities to develop and refine monitoring plans that remain consistent with the goals of the TMDL. Through the adaptive management approach ongoing monitoring will be conducted and will indicate if water quality standards are being met. If this does not occur other management activities would have to be identified and considered to reach to goals outlined in this TMDL. It must be recognized however that development and implementation of a monitoring plan will take some time, but it is more important at this point to focus efforts on reducing existing watershed loads to achieve water quality goals.

Reasonable Assurances

When a TMDL is developed for waters impaired by both point and nonpoint sources, and a wasteload allocation (WLA) is based on an assumption that the nonpoint source load reductions will occur, EPA guidance requires states provide reasonable assurance that nonpoint control measures will achieve the expected load reductions necessary to meet the Water Quality Standards. EPA guidance also directs states to achieve TMDL allocations in waters only impaired by nonpoint sources, however reasonable assurances are not required. This TMDL treats stormwater discharge from all DCIA (even those outside of regulated urbanized areas) as part of a waste load allocation. Since there are no other point sources of nitrogen in the Slocums and Little Rivers watershed the DCIA stormwater load contribution is considered the total waste load allocation for the TMDL. In order to distinguish the point source or WLA of stormwater originating from DCIAs from the nonpoint source stormwater contribution (LA or load allocation), the percent of the impervious area that was identified as DCIA was determined and multiplied by the impervious surface N load (in kg N/day) as reported by the MEP in Table IV-6 of the Technical Report. This quantitative approach to stormwater allocations does not result in the alteration of the WLA under an assumption that LA will be met, and therefore this TMDL does not require reasonable assurance.

MassDEP possesses the statutory and regulatory authority, under the water quality standards and/or the State Clean Water Act (CWA), to implement and enforce the provisions of the TMDL through its many permitting programs including requirements for N loading reductions from on-site subsurface wastewater disposal systems. However, because most non-point source controls are voluntary, reasonable assurance is based on the commitment of the locality involved. Dartmouth and New Bedford have demonstrated this commitment through the comprehensive wastewater planning that they initiated well before the generation of the TMDL. The communities expect to use the information in this TMDL to generate support from their citizens to take the necessary steps to remedy existing problems related to N loading from on-site subsurface wastewater disposal systems, stormwater, and runoff (including fertilizers), and to prevent any future degradation of these valuable resources.

Moreover, reasonable assurances that the TMDL will be implemented include enforcement of regulations, availability of financial incentives and local, state and federal programs for pollution control. EPA's stormwater NPDES permit coverage will address discharges from municipally owned storm water drainage systems. Portions of Dartmouth and New Bedford, within the watershed of this estuarine system are regulated areas under the general stormwater permit. Enforcement of regulations controlling non-point discharges include local implementation of the Commonwealth's Wetlands Protection Act and Rivers Protection Act, Title 5 regulations for on-site subsurface wastewater disposal systems and other local regulations (such as the Town of Rehoboth's stable regulations).

Financial incentives include federal funds available under Sections 319, 604 and 104(b) programs of the CWA, which are provided as part of the Performance Partnership Agreement between MassDEP and EPA. Other potential funds and assistance are available through the Massachusetts Department of Agriculture's Enhancement Program and the United States Department of Agriculture's Natural Resources Conservation Services. Additional financial

incentives include income tax credits for Title 5 upgrades and low interest loans for Title 5 on-site subsurface wastewater disposal system upgrades available through municipalities participating in this portion of the state revolving fund program.

Statewide implementation of the stormwater management is being accomplished through a wide variety of federal, state, local, and non-profit programs and partnerships. It includes partnering with the Massachusetts Coastal Zone Management on the implementation of Section 6217 program. That program outlines both short and long term strategies to address urban areas and stormwater, marinas and recreational boating, agriculture, forestry, hydro modification, and wetland restoration and assessment. The CZM 6217 program also addresses TMDLs and nitrogen sensitive embayments and is crafted to reduce water quality impairments and restore segments not meeting state standards.

As the municipalities implement this TMDL the loading values (kg/day of N) will be used by MassDEP for guidance for permitting activities and should be used by local communities as a management tool.

Public Participation

A public meeting to present the results of and answer questions on this TMDL were held on September 20, 2018 at the Dartmouth Town Hall, Dartmouth, MA. Notice of the public meeting was issued through a press release, a notice was placed in the Massachusetts Environmental Policy Act (MEPA) Monitor, and an email was sent to town officials and volunteer groups. A copy of the draft TMDL was placed on the MassDEP website and a copy was available at the Dartmouth town hall.

Patti Kellogg, Brian Dudley and Barbara Kickham of MassDEP summarized the Massachusetts Estuaries Project and described the Draft Total Nitrogen TMDL Report findings. Public comments received at the public meeting and comments received in writing by October 30, 2018 were considered by the Department. This final version of the TMDL report includes both a summary of the public comments together with the Department's response to the comments and scanned images of the attendance sheets from the meetings (Appendix E).

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Appendix A: Overview of Applicable Water Quality Standards

Water quality standards of particular interest to the issues of cultural eutrophication are dissolved oxygen, nutrients, bottom pollutants or alterations, aesthetics, excess plant biomass, and nuisance vegetation. The Massachusetts water quality standards (314 CMR 4.0) contain numeric criteria for dissolved oxygen, but have only narrative standards that relate to the other variables. This brief summary does not supersede or replace 314 CMR 4.0 Massachusetts Water Quality Standards, the official and legal standards. A complete version of 314 CMR 4.0 Massachusetts Water Quality Standards is available online at http://www.mass.gov/eea/agencies/massdep/water/regulations/314-cmr-4-00-mass-surface-water-quality-standards.html

Applicable Narrative Standards

314 CMR 4.05(5)(a) states "Aesthetics – All surface waters shall be free from pollutants in concentrations that settle to form objectionable deposits; float as debris, scum, or other matter to form nuisances, produce objectionable odor, color, taste, or turbidity, or produce undesirable or nuisance species of aquatic life."

314 CMR 4.05(5)(b) states "Bottom Pollutants or Alterations. All surface waters shall be free from pollutants in concentrations or combinations or from alterations that adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, or adversely affect populations of non-mobile or sessile benthic organisms."

314 CMR 4.05(5)(c) states, "Nutrients –Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to 314 CMR 4.00. Any existing point source discharge containing nutrients in concentrations that would cause or contribute to cultural eutrophication, including the excessive growth of aquatic plants or algae, in any surface water shall be provided with the most appropriate treatment as determined by the Department, including, where necessary, highest and best practical treatment (HBPT) for POTWs and BAT for non POTWs, to remove such nutrients to ensure protection of existing and designated uses. Human activities that result in the nonpoint source discharge of nutrients to any surface water may be required to be provided with cost effective and reasonable best management practices for nonpoint source control."

Description of Coastal and Marine Classes and Numeric Dissolved Oxygen Standards

Excerpt from 314 CMR 4.05(4) (a):

(a) Class SA. These waters are designated as an excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, excellent habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. Where designated in the tables to 314 CMR 4.00 for shellfishing, these waters shall be suitable for shellfish

harvesting without depuration (Approved and Conditionally Approved Shellfish Areas). These waters shall have excellent aesthetic value.
1. Dissolved Oxygen. Shall not be less than 6.0 mg/l. Where natural background conditions are lower, DO shall not be less than natural background. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.

Excerpt from 314 CMR 4.05(3) (b):

(b) Class B. These waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06, they shall be suitable as a source of public water supply with appropriate treatment ("Treated Water Supply"). Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.

1. Dissolved Oxygen. Shall not be less than 6.0 mg/l in cold water fisheries and not less than 5.0 mg/l in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained

Waterbodies Not Specifically Designated in 314 CMR 4.06 or the tables to 314 CMR 4.00
Note many waterbodies do not have a specific water quality designation in 314 CMR 4.06 or the tables to 314 CMR 4.00**.** Coastal and Marine Classes of water are designated as Class SA and presumed High Quality Waters as described in 314 CMR 4.06 (4).

314 CMR 4.06(4):

(4) Other Waters. Unless otherwise designated in 314 CMR 4.06 or unless otherwise listed in the tables to 314 CMR 4.00, other waters are Class B, and presumed High Quality Waters for inland waters and Class SA, and presumed High Quality Waters for coastal and marine waters. Inland fisheries designations and coastal and marine shellfishing designations for unlisted waters shall be made on a case-by-case basis as necessary.

Applicable Antidegradation Provisions
Applicable antidegradation provisions are detailed in 314 CMR 4.04 from which an excerpt is provided:

Excerpt from 314 CMR 4.04:
4.04:Antidegradation Provisions

(1) Protection of Existing Uses. In all cases existing uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.

(2) Protection of High Quality Waters. High Quality waters are waters whose quality exceeds minimum levels necessary to support the national goal uses, low flow waters, and

other waters whose character cannot be adequately described or protected by traditional criteria. These waters shall be protected and maintained for their existing level of quality unless limited degradation by a new or increased discharge is authorized by the Department pursuant to 314 CMR 4.04(5). Limited degradation also may be allowed by the Department where it determines that a new or increased discharge is insignificant because it does not have the potential to impair any existing or designated water use and does not have the potential to cause any significant lowering of water quality.

(3) Protection of Outstanding Resource Waters. Certain waters are designated for protection under this provision in 314 CMR 4.06. These waters include Class A Public Water Supplies (314 CMR 4.06(1)(d)1.) and their tributaries, certain wetlands as specified in 314 CMR 4.06(2) and other waters as determined by the Department based on their outstanding socio-economic, recreational, ecological and/or aesthetic values. The quality of these waters shall be protected and maintained.

(a) Any person having an existing discharge to these waters shall cease said discharge and connect to a Publicly Owned Treatment Works (POTW) unless it is shown by said person that such a connection is not reasonably available or feasible. Existing discharges not connected to a POTW shall be provided with the highest and best practical method of waste treatment determined by the Department as necessary to protect and maintain the outstanding resource water.

(b) A new or increased discharge to an Outstanding Resource Water is prohibited unless:

1. the discharge is determined by the Department to be for the express purpose and intent of maintaining or enhancing the resource for its designated use and an authorization is granted as provided in 314 CMR 4.04(5). The Department's determination to allow a new or increased discharge shall be made in agreement with the federal, state, local or private entity recognized by the Department as having direct control of the water resource or governing water use; or

2. the discharge is dredged or fill material for qualifying activities in limited circumstances, after an alternatives analysis which considers the Outstanding Resource Water designation and further minimization of any adverse impacts. Specifically, a discharge of dredged or fill material is allowed only to the limited extent specified in 314 CMR 9.00 and 314 CMR 4.06(1)(d). The Department retains the authority to deny discharges which meet the criteria of 314 CMR 9.00 but will result in substantial adverse impacts to the physical, chemical, or biological integrity of surface waters of the Commonwealth

(4) Protection of Special Resource Waters. Certain waters of exceptional significance, such as waters in national or state parks and wildlife refuges, may be designated by the Department in 314 CMR 4.06 as Special Resource Waters (SRWs). The quality of these waters shall be maintained and protected so that no new or increased discharge and no new or increased discharge to a tributary to a SRW that would result in lower water quality in the SRW may be allowed, except where:

(a) the discharge results in temporary and short term changes in the quality of the SRW, provided that the discharge does not permanently lower water quality or result in water quality lower than necessary to protect uses; and

(b) an authorization is granted pursuant to 314 CMR 4.04(5).

(5) Authorizations.

(a) An authorization to discharge to waters designated for protection under 314 CMR 4.04(2) may be issued by the Department where the applicant demonstrates that:

1. The discharge is necessary to accommodate important economic or social development in the area in which the waters are located;

2. No less environmentally damaging alternative site for the activity, receptor for the disposal, or method of elimination of the discharge is reasonably available or feasible;

3. To the maximum extent feasible, the discharge and activity are designed and conducted to minimize adverse impacts on water quality, including implementation of source reduction practices; and

4. The discharge will not impair existing water uses and will not result in a level of water quality less than that specified for the Class.

(b) An authorization to discharge to the narrow extent allowed in 314 CMR 4.04(3) or 314 CMR 4.04(4) may be granted by the Department where the applicant demonstrates compliance with 314 CMR 4.04(5)(a)2. through 314 CMR 4.04(5)(a)4.

(c) Where an authorization is at issue, the Department shall circulate a public notice in accordance with 314 CMR 2.06. Said notice shall state an authorization is under consideration by the Department, and indicate the Department's tentative determination. The applicant shall have the burden of justifying the authorization. Any authorization granted pursuant to 314 CMR 4.04 shall not extend beyond the expiration date of the permit.

(d) A discharge exempted from the permit requirement by 314 CMR 3.05(4) (discharge necessary to abate an imminent hazard) may be exempted from 314 CMR 4.04(5) by decision of the Department.

(e) A new or increased discharge specifically required as part of an enforcement order issued by the Department in order to improve existing water quality or prevent existing water quality from deteriorating may be exempted from 314 CMR 4.04(5) by decision of the Department.

(6) The Department applies its Antidegradation Implementation Procedures to point source discharges subject to 314 CMR 4.00.

(7) Discharge Criteria. In addition to the other provisions of 314 CMR 4.00, any authorized Discharge shall be provided with a level of treatment equal to or exceeding the requirements of the Massachusetts Surface Water Discharge Permit Program (314 CMR 3.00). Before authorizing a discharge, all appropriate public participation and intergovernmental coordination shall be conducted in accordance with Permit Procedures (314 CMR 2.00).

Thus, the assessment of eutrophication is based on site-specific information within a general framework that emphasizes impairment of uses and preservation of a balanced indigenous flora and fauna. This approach is recommended by the US Environmental Protection Agency in their draft Nutrient Criteria Technical Guidance Manual for Estuarine and Coastal Marine Waters (EPA-822-B-01-003, Oct 2001). The Guidance Manual notes that lakes, reservoirs, streams and rivers may be subdivided by classes, allowing reference conditions for each class and facilitating cost-effective criteria development for nutrient management. However, individual estuarine and coastal marine waters tend to have unique characteristics and development of individual water body criteria is typically required.

Appendix B: Summary of the Nitrogen Concentrations for Slocums and Little Rivers Embayment System

Table B-1: Summary of Nitrogen Concentrations for Slocums and Little Rivers Embayment System, 2000-2006.

Measured data, and modeled Total Nitrogen concentrations for the Slocums River and Little River System. All concentrations are given in mg/L N. "Data mean" values are calculated as the average of the separate yearly means. Data are provided courtesy of the Coalition for Buzzards Bay (BayWatchers; 2000-06) and the Coastal Systems Program at SMAST (2004-05).

Sub-Embayment	Head Slocums	Upper Slocums	Upper Slocums	Mid Slocums	Mid Slocums	Mid Slocums	Lower Slocums / Giles	Lower Slocums	Lower Slocums	Inner Little River	Basin Little River	Inlet - Little River
Monitoring station	SRT-3	SRT-4	SRT-5	SRT-6	SRT-7	SRT-10	SRT-11	SRT-12	SRT-13	SRT14	SRT15	SRT16
2000 mean	0.790			0.603				0.407				0.499
2001 mean	1.432			0.854				0.560				0.499
2002 mean	1.274			0.674				0.451				0.505
2003 mean	1.520			0.824								0.500
2004 mean	1.090	0.667	0.669	0.544	0.438	0.388	0.369	0.403	0.312	0.482	0.479	0.366
2005 mean	1.041	0.612	0.602	0.546	0.435	0.411	0.406	0.324	0.262	0.369	0.343	0.331
2006 mean	1.458			0.890								0.470
mean	1.175	0.641	0.636	0.620	0.437	0.399	0.385	0.390	0.285	0.409	0.403	0.394
s.d. all data	0.343	0.103	0.145	0.177	0.074	0.091	0.059	0.113	0.056	0.085	0.130	0.111
N	43	15	24	50	31	23	16	42	33	17	18	53
model min	1.442	0.845	0.656	0.532	0.419	0.301	0.348	0.293	0.287	0.327	0.313	0.289
model max	1.563	1.137	0.996	0.854	0.726	0.601	0.502	0.541	0.463	0.406	0.388	0.383
model average	1.499	0.994	0.826	0.690	0.586	0.450	0.398	0.392	0.337	0.365	0.349	0.325

Appendix C: Estimating the wasteload allocation (WLA) from runoff of all directly connected impervious areas (DCIA) within the Slocums and Little Rivers watershed.

Impervious surfaces such as roadways, parking lots, rooftops, sidewalks, driveways, and other pavements impede stormwater infiltration and generate surface runoff. It is widely known that the amount of impervious area (IA) in a watershed is correlated with a decrease in water and habitat quality including increased flood peaks and frequency, increased sediment, nutrient, and other pollutant levels, channel erosion, impairments to aquatic biota, and reduced recharge to groundwater. Directly connected impervious area (DCIA) is defined as the portion of IA with a direct hydraulic connection to the waterbody via continuous paved surfaces, gutters, drain pipes, or other conventional conveyance and detention structures that do not reduce runoff volume. (See http://www.epa.gov/region1/npdes/stormwater/ma/MADCIA.pdf)
DCIA does not include:

- IA draining to stormwater practices designed to meet recharge and other volume reduction criteria.
- Isolated IA with an indirect hydraulic connection to the MS4, or that otherwise drain to a pervious area.
- Swimming pools or man-made impoundments, unless drained to an MS4.
- The surface area of natural waterbodies (e.g., wetlands, ponds, lakes, streams, rivers).

When determining the TMDL for a pollutant, MassDEP has decided that stormwater from all areas defined as DCIA's should be considered part of the stormwater waste load allocation (WLA) regardless of whether the area is part of an EPA designated "urbanized area" and as such subject to the NPDES Phase II General Permit for stormwater discharges from Small Municipal Separate Storm Sewer Systems (MS4s). Since there are no other point sources of nitrogen to the Slocums and Little Rivers watershed, the WLA is simply the stormwater DCIA contribution.

To determine the extent of DCIA in the watershed the EPA NPDES Stormwater Regulated Communities website (https://www.epa.gov/npdes-permits/regulated-ms4-massachusetts-communities) was consulted. This site contains community specific information on all of the MS4 Stormwater Permits, including maps showing the geographic extent of permit coverage (designated urbanized area) as well as the number of acres of impervious area (IA) and estimated directly connected impervious area (DCIA) by subwatershed for each regulated community. Statistics available from this site for the watershed area in each town as well as the total watershed area are listed in Table B-1.

To complete the WLA calculation, the total stormwater load from impervious surfaces as determined by the MEP study (28 kg N/day from Table IV-6 in the MEP Technical Report) was multiplied by 0.64 (the percentage of IA that was determined to be DCIA in the watershed - see Table C-1).The resulting value (18 kg N/day) is the WLA and the remaining 10 kg N/day is assigned to the nonpoint source contribution or the load allocation (LA).

Table C-1: Impervious area statistics for the Slocums and Little Rivers watershed by municipality.

Town Sub-watersheds	Total Area (acres)	IA (acres)	% IA of Total Area	DCIA (acres)	% DCIA of IA	Urbanized Area (acres)	DCIA in Urbanized Area (acres)	% DCIA in Urbanized Area
Dartmouth	18753.43	1329.66	8.5	898.87	67.6%	4760.38	613.52	12.9%
New Bedford	6371.48	1181.28	18.5	877.71	74.3%	4205.2	819.73	19.5%
Freetown	7.01	2.05	29.3	1.69	82.4%	0.99	0.32	32.3%
Slocums/Little Watershed	25131.9	2777.95	11.1	1778.27	64%	8966.57	1433.57	16%

From: https://www.epa.gov/npdes-permits/regulated-ms4-massachusetts-communities

Appendix D: Summary of TMDLs for the Slocums and Little Rivers Embayment System

Table D-1: Slocums and Little Rivers Embayment System – 2 Total Nitrogen TMDLs, 4 Pollution Prevention[1] TMDLs.

Sub-embayment	Segment ID	Impairment/TMDL Status	TMDL kg N/day
Slocums River	MA95-34	Impaired for Estuarine Bioassessments, Nitrogen (Total), Fecal Coliform.	**11.92**
Little River	MA95-66	Impaired for Nitrogen (Total).	**18.4**
Paskamansett River	MA95-11[2,3]	Not impaired for Nitrogen (Total), but Pollution Prevention TMDL needed since embayments are linked.	91.59[1]
Destruction Brook	MA95-90_2018[2,3,5]		14.91[1]
Unnamed Tributary to Slocums River (aka Barneys Joy Rivers North)	MA95-91_2018[2,4,5]	Not impaired for Nitrogen (Total), but Pollution Prevention TMDL needed since embayments are linked.	7.54[1]
Unnamed Tributary to Slocums River (aka Barneys Joy River South)	MA95-92_2018[2,4,5]		4.60[1-]
System Total			144.35

[1] Pollution Prevention TMDLs (kg-N/day) for community planning and to prevent further downstream impairment.
[2] These freshwater segments were not assessed for Total Nitrogen.
[3] For Paskamansett River and Destruction Brook, the TMDL was apportioned based on relative watershed size, however, MEP Technical Report was unable to clearly define the hydraulic boundary between the two stream segments. For purposes of nitrogen reduction strategies, communities may consider the combined TMDL for Paskamansett River and Destruction Brook watershed.
[4] For the unnamed tributaries also known as Barneys Joy River North and South, the TMDL was apportioned based on relative watershed size used in the MEP Technical Report. For purposes of nitrogen reduction strategies, communities may consider the combined TMDL for Barneys Joy River North and South watershed.
[5] These segments to be added to a future Integrated Report.

Appendix E: Response to Comments

Massachusetts Estuaries Project (MEP)

Response to Comments For

DRAFT TOTAL MAXIMUM DAILY LOAD (TMDL) REPORT FOR

SLOCUMS RIVER AND LITTLE RIVER ESTUARY SYSTEM (CONTROL #315.0)

(REPORT DATED SEPTEMBER 2018)

THE FOLLOWING INCLUDES PUBLIC COMMENTS RECEIVED ON SEPTEMBER 20, 2018 AT THE PUBLIC MEETING AND WRITTEN RESPONSES RECEIVED BY OCTOBER 30, 2018. MASSDEP RESPONSES TO THOSE QUESTIONS/COMMENTS FOLLOWS.

Comments Received on September 20, 2018 at Public Meeting

1. **As the Dartmouth Environmental Affairs Coordinator, I think it's important to point out (and the TMDL has stated this) that Dartmouth has done a lot of work since the completion of the MEP Tech Report. We have sewered everything we can, according to the town's CWRMP (Comprehensive Water Resources Management Plan), we've done a lot of inflow and infiltration (I/I) work, commercial redevelopment upgrades, purchased land for open space, and passed a stormwater bylaw. Buzzards Bay Action Committee has done a lot work, collected a lot of water quality data and mapping of stormwater catchments. The Buzzards Bay Action Committee includes Dartmouth and eleven other towns bordering Buzzards Bay. In addition there have been physical changes to the river which is allowing more flushing. We plan to do additional sampling to demonstrate improvements in water quality in the estuaries.**

MassDEP Response: Thank you for your comments. We acknowledge the tremendous amount of the work that Dartmouth has done to improve the water quality in the watershed since the start of the MEP.

2. **I suggest we do more with oysters in the estuaries. We should drop seedlings of oysters to clean up the river. I think the best and most cost effective way to reduce nutrients is to add oysters. There used to be a lot more oysters in the bay and now the shellfishing beds are frequently closed.**

MassDEP Response: Oyster beds complement nitrogen removal and have shown some promise in water quality improvements. Though oyster beds and aquaculture do not address source control or reduction, they may help or supplement larger scale nitrogen reduction strategies. Closure of shellfishing beds is generally due to bacterial contamination and not necessarily nutrient enrichment. The most direct way to address excess nitrogen is through source control and reduction, however MassDEP understands that alternative methods may be used to assist in reducing the impacts of excess nitrogen. Several towns have explored oyster cultivation projects for water quality improvement including Wellfleet, Mashpee, Orleans and Falmouth. A lot of research is currently being conducted on the complicated and poorly understood shellfish nitrogen cycle, (ie. the uptake and release of nitrogen by shellfish).

3. **How do you get people to stop putting fertilizers on their lawns?**

MassDEP Response: Residents need to be reminded regularly of the impacts of fertilizers on the watershed. The most effective ways are through implementation of local bylaws, public outreach and education, and in the end, peer pressure has also shown to be effective. Keep in mind that fertilizers generally account for less than 10% of the nitrogen load, therefore even completely eliminating fertilizers will not solve the problem of over-enrichment of nutrients. For the Slocums River and Little River, agricultural, lawn and golf fertilizer is estimated to account for 23% and 21%, respectively, of the controllable nitrogen, therefore the town should continue to address the issue as part of their nitrogen management plan.

Massachusetts Department of Agricultural Resources (MassDAR) passed plant nutrient regulations (330 CMR 31.00) which became effective in June 2015. These regulations require specific restrictions for agricultural and residential fertilizer use, including seasonal restrictions, on nutrient applications and set-backs from sensitive areas (public water supplies and surface water) and Nutrient Management Plans. Compliance with the MassDAR regulations will result in reductions in future N loading from residential and agricultural sources.

4. **What is the contribution of TN from my septic system or a typical septic system? How much will it cost for me to upgrade it to increase my nitrogen removal.**

MassDEP Response: The predominant nitrogen load in the MEP TMDLs is septic load but in SLR system there are also multiple factors contributing to the nitrogen load (stormwater runoff, fertilizers from agriculture, lawns, and golf courses, and also the landfill). Installation of an Innovative Alternative system (IA) system will remove more nitrogen than the traditional septic system, however, current IA systems are energy intensive and less effective at TN removal than conventional wastewater treatment plants. Costs to upgrade septic systems depend on the age and condition of the system, but depending on the type of nitrogen removal system and site characteristics additional costs could range from $10,000 to $30,000. In some cases costs could be even higher.

Costs depend on the type of upgrade, the status of the existing system and whether or not some parts can be re-used. Costs to fund construction of sewers would be authorized through town appropriations. Towns with estuaries with approved TMDLs qualify for zero percent State Revolving Fund (SRF) loans for infrastructure construction projects for nutrient reduction and it will likely help in ranking of the project for SRF funding. Grants for stormwater Best Management Practices are available under the 319 Program for non-urbanized areas.

5. **Can we look at the slide with the pie chart and the various contributions of TN, Figures 4a and 4b in the TMDL? Where is the TN in the stormwater coming from? What other nitrogen sources can be removed beyond septic system improvements?**

MassDEP Response: Nitrogen in stormwater runoff originates from various sources such as leaf litter and grass clippings, pet waste, birds and other wild animal waste, as well as excess fertilizer that runs off lawns, golf courses and farms. Some nitrogen in the stormwater runoff is from atmospheric deposition of nitrogen that is only controlled through regional and national agreements.

6. **What was the date of the landuse data collection and the date of the water quality data used in the MEP modeling for the Tech Report?**

MassDEP Response: The landuse data used in the MEP modeling was collected in 2010, which is the most recent data available. The water quality data used in the model was collected in 2000 through 2006.

7. **What happens next after the TMDL is approved? What deadline(s) is the town expected to meet?**

MassDEP Response: There are no deadlines that the town is expected to meet specifically related to the TMDL. However, the town must develop a plan to restore and protect the estuary and take actions at a reasonable pace to achieve the goals of the TMDL. In the event that reasonable progress is not being made, MassDEP can use its discretion to enforce the requirements of the TMDL through the broad authority granted by the Massachusetts Clean Waters Act and the Massachusetts Water Quality Standards. MassDEP will work with communities to develop a plan to protect and restore impaired waters.

The towns of Dartmouth and New Bedford are EPA, NPDES (National Pollutant Discharge Elimination System) Stormwater Regulated Communities due to the presence of urbanized areas within their municipal boundaries. This TMDL treats stormwater discharge from all directly connected impervious areas (DCIA) (even those outside of regulated urbanized areas) as part of a waste load allocation of the TMDL. Dartmouth and New Bedford will be subject to the conditions of EPA and Massachusetts' MS4 stormwater permit when the permit is revised in 2023. In the current permit, communities with approved TMDLs for total nitrogen are required

to implement enhanced BMPs (best management practices) including education and outreach regarding proper use and disposal of grass clippings, leaf litter, fertilizers, and pet waste; and implement these same BMPs for town owned properties. Additionally, require stormwater management BMPs in new or redeveloped properties and optimize for nitrogen removal.

8. **I understand the BBC had to sue DEP to get the Westport TMDL to move along in the process and get finalized. Did that happen here too?**

MassDEP Response: No, the Buzzards Bay Coalition sent a letter to the EPA in April 2017, requesting timely review of the Westport River TMDL (which was approved in May 2017). The EPA is required under the Clean Water Act to approve or deny TMDLs within 30 days of receiving the TMDL from a state. The public is allowed to provide written comments on the Slocums and Little Rivers TMDL through October 30, 2018. MassDEP will provide written responses to the comments received during the public meeting and those received during the remainder of the public comment period. After MassDEP internal reviews are complete, the TMDL is then submitted for final approval by EPA. This process can take six months to one year, before the TMDL is submitted to EPA depending on the number of comments received.

9. **As a representative of the Buzzards Bay Coalition, we encourage MassDEP to submit the TMDL to EPA for final approval as soon as possible. We would like to see this TMDL approved by the end of 2018.**

MassDEP Response: Thank you for your support of the TMDL. We will do our best to finalize the TMDL is a timely manner.

10. **As the Board of Health agent in Dartmouth, I reviewed the report and I do not see any specific calculations on composting facilities, in particular, post-consumer organic material composting. The emphasis was on septic systems and what the community has responsibility for. How can I tell residents to upgrade their septic systems when at the same time these composting facilities are directing nitrogen to the groundwater and surface water. Will MassDEP work with the town to identify and if necessary reduce the TN from these composting facilities?**

MassDEP Response: An additional nitrogen load, specifically due to composting activities, was not directly included in the TMDL. Some composting is considered part of normal agricultural land use and was therefore included intrinsically. Massachusetts food waste ban (on establishments creating more than one ton of food waste per week) began in October 2014. The data collection period used in the development of the Slocums and Little Rivers TMDL was 2000 to 2006. These composting facilities represent new nitrogen loads that did not exist during the initial study period, therefore the town still has to address the impacts from the baseline conditions outlined in the original MEP report.

Massachusetts Department of Agricultural Resources (MassDAR) regulates agricultural operations with composting under 330 CMR 25.00. Those wishing to compost on-farm need only submit a registration application and comply with the policies outlined in the Guidelines for Agricultural Composting, https://www.mass.gov/files/documents/2016/08/tz/guidetoagcomposting2011.pdf. These Guidelines have been developed for farmers engaged in agricultural composting, for waste generated by their own, as well as, taking in waste from other farming operations. Composting sites are to be located at such a distance to prevent erosion, siltation, and stormwater runoff to adjacent water bodies and wetlands. Compost operators are subject to annual self-certification that includes verification of the types and quantities of material accepted at the composting facility and that Best Management Practices are being followed. Composting requires managed decomposition to avoid unwanted results which can lead to complaints by neighbors and local officials.

If the site is not regulated by MassDAR then the site may be regulated by MassDEP under the solid waste regulations 310 CMR 16.00 as a general permit or a Recycling, Composting or Conversion (RCC) permit. The facility would require a solid waste site assignment by MassDEP if it was not eligible for a general or RCC permit (composting facility applicability, volume limitations and permit requirements) or did not comply with 16.04 or 16.05.

Composting is an environmentally beneficial activity, but it is crucial that the compost facilities employ best management practices (i.e. proper carbon to nitrogen ratio, water content, etc.) to mitigate adverse impacts. MassDEP is committed to helping the towns address nitrogen impacts from compost facilities. Compost facilities that do not comply with the solid waste regulations have the potential to cause nitrogen impacts and MassDEP has and will continue to inspect compost facilities to determine if the facilities are in compliance with the regulations. Whenever, the MassDEP has cause to believe that non-compliance has occurred it will take appropriate action(s), including but not limited to enforcement actions, to bring the site into compliance to protect public health, safety, or the environment.

Complaints of sediment laden or discolored runoff, odor or other nuisance should be reported to MassDEP or MassDAR and appropriate actions will be taken.

11. Water quality is better closer to the mouth of the bay, since there is better flushing with the ocean. The bay is silting up more each year and there is less flushing that occurs. Can we model this scenario to look at the feasibility of increased flushing?

MassDEP Response: Increasing circulation between the estuary and ocean can in some cases reduce the TN in the estuary through dilution, however, flushing does not address the root

causes for the excess nitrogen in the estuary. Increased tidal flushing was incorporated into the TN TMDL for Tisbury Great Pond, Martha's Vineyard. In this case, tidal flushing through breaching of the barrier beach was in place prior to the TMDL in order to lower the water table and reduce flooding in basements of the abutters. MassDEP would not endorse tidal flushing if the sources of the nitrogen were not also addressed. Increased flushing with ocean waters will likely require additional permitting. In some cases, dredging may actually worsen the situation resulting in a smaller tidal prism and a longer residence times. An additional modeling scenario could be run to evaluate the feasibility of increased flushing. Remediating changes in circulation in lieu of source reduction due to development or other artificial conditions would be looked on more favorably than trying to actively manage the migration of inlets. Any alterations to an inlet would be required to meet the Wetlands Protection Act and regulations.

12. **I have lived on the Little River for 40 years, the shoaling and siltation has worsened. We cannot go out in low tide sailing any longer. The sand is shifting, the sand bar is huge now.**

    Comment from Michael O'Reilly, Dartmouth - The siltation in the bay has worsen over time, however a recent storm created a channel, increasing circulation around the sentinel station SLR-12 and improving water quality.

MassDEP Response: Thank you for the information. The sand bars in the estuary will continue to shift and change circulation patterns given the high intensity storms we experience in the northeast in general. It is a natural process that occurs when large storms pass through, the ocean currents lift and entrain the sand, then redeposit elsewhere.

13. **How long will it take to get this TMDL approved? I see no reason why we cannot get this approved right away.**

MassDEP Response: There is a 30-day comment period after the public meeting is held on the draft TMDL. MassDEP prepares written comments on the questions received both at the public meeting and in writing. After MassDEP internal reviews are complete, the TMDL is then submitted for final approval by EPA. This process can take six months to one year, particularly if significant comments are received on the TMDL.

14. **Dartmouth was an original participant in the MEP, back in the early 2000's, and we see no reason why this cannot be approved by the end of the year. This TMDL has been a long time in coming. We would like to see this TMDL approved so that Dartmouth can continue their good work towards improving the water quality of the estuaries.**

MassDEP Response: MassDEP appreciates your support and will make every effort to finalize the TMDL in a timely manner.

General Frequently Asked Questions:

1. **Can a Comprehensive Water Resources Management Plan (CWRMP) include the acquisition of open space, and if so, can State Revolving Funds (SRF) be used for this?**

MassDEP Response: State Revolving funds can be used for open space preservation if a specific watershed property has been identified as a critical implementation measure for meeting the TMDL. The SRF solicitation should identify the land acquisition as a high priority project for this purpose which would then make it eligible for the SRF funding list. However, it should be noted that preservation of open space will only address potential future nitrogen sources (as predicted in the build-out scenario in the MEP Technical report) and not the current situation. The town will still have to reduce existing nitrogen sources to meet the TMDL.

2. **Do we expect eelgrass to return if the nitrogen goal is higher than the concentration that can support eelgrass?**

MassDEP Response: There are a number of factors that can control the ability of eelgrass to re-establish in any area. Some are of a physical nature (such as boat traffic, water depth, or even sunlight penetration) and others are of a chemical nature like nitrogen. Eelgrass decline in general has been directly related to the impacts of eutrophication caused by elevated nitrogen concentrations. Therefore, if the nitrogen concentration is elevated enough to cause symptoms of eutrophication to occur, eelgrass growth will not be possible even if all other factors are controlled and the eelgrass will not return until the water quality conditions improve.

3. **Who is required to develop the CWRMP? Can it be written in-house if there is enough expertise?**

MassDEP Response: The CWRMP can be prepared by the town. There are no requirements that it must be written by an outside consultant; however, the community should be very confident that its in-house expertise is sufficient to address the myriad issues involved in the CWRMP process. MassDEP would strongly recommend that any community wishing to undertake this endeavor on its own should meet with MassDEP to develop an appropriate scope of work that will result in a robust and acceptable plan.

4. **Have others written regional CWRMPs (i.e. included several neighboring towns)?**

MassDEP Response: The Cape Cod Commission prepared a Regional Wastewater Management Plan or RWMP which formed a framework and set of tools for identifying several solutions for restoring water quality for each watershed on the Cape. The Section 208 Plan Update (or 208 Plan) is an area-wide water quality management plan and in general each town then prepared

or is preparing its own CWRMP. An example of neighboring towns working on a regional plan is the Pleasant Bay Alliance which consists of Orleans, Brewster, Harwich, and Chatham. Harwich, Dennis and Yarmouth are in discussions regarding a shared wastewater treatment plant.

Joint Comprehensive Wastewater Management Plans (CWMPs) have been developed by multiple Towns particularly where Districts are formed for purposes of wastewater treatment. Some examples include the Upper Blackstone Water Pollution Abatement District that serve all or portions of the towns Holden, Millbury, Rutland West Boylston and the City of Worcester and the Greater Lawrence Sanitary District that serves the greater Lawrence area including portions of Andover, N. Andover, Methuen and Salem NH. There have also been recent cases where Towns have teamed up to develop a joint CWMP where districts have not been formed. The most recent example is the Towns which discharge to the Assabet River. They include the Towns of Westboro and Shrewsbury, Marlboro and Northborough, Hudson, and Maynard. The reason these towns joined forces was because as a group, they received more priority points in the State Revolving Fund application process than they otherwise would have as individual towns.

5. **Does nitrogen entering the system close to shore impair water quality more? If we have to sewer, wouldn't it make sense to sewer homes closer to the shore?**

MassDEP Response: Homes closer to the waterbody allow nitrogen to get to that waterbody faster (shorter travel times). Those further away may take longer but still get there over time and are dependent upon the underlying geology. However, what is more important is the density of homes. Larger home density means more nitrogen being discharged thus the density typically determines where to sewer to maximize reductions. Also there are many factors that influence water quality such as flushing and morphology of the water body.

6. **Do you take into account how long it takes groundwater to travel?**

MassDEP Response: Yes, the MEP Technical report has identified long term (greater than 10 years) and short term time of travel boundaries in the ground-watershed.

7. **What if a town can't meet its TMDL?**

MassDEP Response: A TMDL is simply a nutrient budget that determines how much nitrogen reduction is necessary to meet water quality goals as defined by state Water Quality Standards. It is unlikely that the TMDL cannot be achieved however in rare occasions it can happen. In those rare cases the Federal Clean Water Act provides an alternative mechanism which is called a Use Attainability Analysis (UAA). The requirements of that analysis are specified in the Clean Water Act but to generalize the process, it requires a demonstration would have to be made that

the designated use cannot be achieved. Another way of saying this is that a demonstration would have to be made that the body of water cannot support its designated uses such as fishing, swimming or protection of aquatic biota. This demonstration is very difficult and must be approved by the U.S. Environmental Protection Agency. As long as a plan is developed and actions are being taken at a reasonable pace to achieve the goals of the TMDL, MassDEP will use discretion in taking enforcement steps. However, in the event that reasonable progress is not being made, MassDEP can take additional regulatory action through the broad authority granted by the Massachusetts Clean Waters Act, the Massachusetts Water Quality Standards, and through point source discharge permits.

8. What is the relationship between the linked model and the CWRMP?

MassDEP Response: The model is a tool that was developed to assist the Town to evaluate potential nitrogen reduction options and determine if they meet the goals of the TMDL at the established sentinel station in each estuary. The CWRMP is the process used by the Town to evaluate your short and long-term needs, define options, and ultimately choose a recommended option and schedule for implementation that meets the goals of the TMDL. The models can be used to assist the Towns during the CWRMP process.

9. Is there a federal mandate to reduce fertilizer use?

MassDEP Response: No, it is up to the states and/or towns to address this issue. However, the Massachusetts Department of Agricultural Resources (MassDAR) passed plant nutrient regulations (330 CMR 31.00) in June 2015, which requires specific restrictions for agricultural and residential fertilizer use, including seasonal restrictions, on nutrient applications and set-backs from sensitive areas (public water supplies and surface water) and Nutrient Management Plans. Compliance with the MassDAR regulations will result in reductions in future N loading from agricultural sources.

10. Will monitoring continue at all stations or just the sentinel stations?

MassDEP Response: At a minimum, MassDEP would like to see monitoring continued at the sentinel stations bi-monthly, May-September in order to determine compliance with the TMDL. However, ideally, it would be good to continue monitoring all of the stations, if possible. The benthic stations can be sampled every 3-5 years since changes are not rapid. The towns may want to sample additional locations if warranted. MassDEP intends to continue its program of eelgrass monitoring.

11. What is the state's expectation with CWRMPs?

MassDEP Response: The CWRMP is intended to provide the Towns with potential short and long-term options to achieve water quality goals and therefore provides a recommended plan and schedule for sewering/infrastructure improvements and other nitrogen reduction options necessary to achieve the TMDL. The state also provides a low interest loan program called the state revolving fund or SRF to help develop these plans. Towns can combine forces to save money when they develop their CWRMPs.

12. Can we submit parts of the plan as they are completed?

MassDEP Response: Submitting part of a plan is not recommended because absent a comprehensive plan, a demonstration cannot be made that the actions will meet the requirements of the TMDL. With that said however the plan can contain phases using an adaptive approach if determined to be reasonable and consistent with the TMDL.

13. How do we know the source of the bacteria (septic vs. cormorants, etc.)?

MassDEP Response: This was not addressed because this is a nitrogen TMDL and not a bacteria TMDL.

14. Is there a push to look at alternative new technologies?

MassDEP Response: MassDEP recommends communities consider all feasible alternatives to develop the most effective and efficient plans to meet water quality goals. The 208 Plan Update includes an analysis of a wide range of traditional and alternative approaches to nutrient reduction, remediation, and restoration. If a CWRMP relies on such alternative technologies and approaches, the plan must include demonstration protocols, including monitoring, that will confirm that the proposed reduction credits and, when appropriate, removal efficiencies are met. The implementation schedule is in the demonstration protocol for each alternative technology or approach, at which time a determination must be made as to whether the alternative technology/approach meets the intended efficacy goal. MassDEP is also developing a Watershed Permit Pilot program, which includes but is not limited to Under Ground Injection Control (UIC) and groundwater discharge permits and provides a permitting mechanism to approve nontraditional methods of wastewater management and/or impact mitigation that could not otherwise be approved by MassDEP under a typical wastewater management and discharge permit. Watershed permits would include implementation timetables, standards to be achieved, and long-term monitoring to evaluate water quality improvements.

The Massachusetts Septic System Test Center, located on Cape Cod and operated by the Barnstable County Department of Health and Environment, tests and tracks advanced innovative and alternative septic system treatment technologies. In addition MassDEP evaluates pilot studies for other alternative technologies; however, absent a CWRMP and Watershed Permit, MassDEP will not approve a system for general use unless it has been thoroughly studied and documented to be successful.

15. How about using shellfish to remediate and reduce nitrogen concentrations?

MassDEP Response: The use of shellfish to remediate and reduce nitrogen concentrations is an alternative approach that has been utilized and is being evaluated in some areas of Long Island Sound (LIS), Wellfleet, and Chesapeake Bays. More recently, some Cape communities have been evaluating this method, including Falmouth, Mashpee and Orleans. While this approach has demonstrated promise for reducing nitrogen concentrations, there remain questions regarding the effectiveness and circumstances where it can be successfully utilized. MassDEP recommends communities considering this option discuss such plans with the Department, and evaluate the results from ongoing efforts on the Cape and on other states.

16. The TMDL is a maximum number, but we can still go lower.

MassDEP Response: The state's goal is to achieve designated uses and water quality criteria. There is nothing however that prevents a Town from implementing measures that go beyond that goal. It should also be noted that the TMDL is developed conservatively with a factor of safety included.

17. Isn't it going to take several years to reach the TMDL?

MassDEP Response: It is likely that several years will be necessary to achieve reductions and to see a corresponding response in the estuary. However, the longer it takes to implement solutions, the longer it is going to take to achieve the goals.

18. The TMDL is based on current land use but what about future development?

MassDEP Response: The TMDL is based on a habitat restoration target(s)for conditions during the period of data collection. Buildout was considered in the MEP model as part of scenario runs to evaluate implementation strategies. Evaluation of buildout conditions must be considered as part of the CWMP.

Comments received via email on September 21, 2018 from Sandra Medeiros, Dartmouth Town Meeting Member

Dear Ms. Kickham,

As I was unable to attend the meeting at Dartmouth Town Hall last evening I would like to offer my comments to you through email.
I fully support the Mass DEP draft Total Maximum Daily Load (TMDL) for limiting nitrogen to the amounts that the water bodies can absorb without violating water quality standards and impairing uses such as fishing and recreational activities. It is imperative that we take action to improve the quality of water in our local rivers, streams and bays. I have supported the work of the Buzzards Bay Coalition that advocates for clean water, educates the public, conserves lands to protect our waters and researches ways to improve our waters. Some of their water quality testing results are appalling. We should continue to support measures to reduce contaminants entering our water. Therefore I fully support the TMDL draft.

I think a state wide mandate for septic system upgrades to those systems which reduce nitrogen should be in place for all waterfront homes. We should not wait for a home sale to trigger a Title 5 upgrade which does not insist on nitrogen management.

Sandra Medeiros
Dartmouth Town Meeting Member
17 Ball St
Dartmouth, MA 02747

MassDEP Response: Thank you for your comments and support of the TMDL for Slocums and Little Rivers estuarine system. MassDEP is considering changes to Title 5 regulations that broaden the definition of nitrogen sensitive areas to include embayments that have a nitrogen TMDL.

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Comments received via email on September 27, 2018 from Sara H. Johnson

I am wholeheartedly in favor of implementing your recommended TMDL for the above river systems. My main comment is that perhaps these are too lenient because the latest monitoring data contained in the report was for 2006, which is TWELVE YEARS AGO!!
What is your plan for updating the monitoring data and getting the City of New Bedford and the Town of Dartmouth to start cleaning up the Slocum/Paskamansett watershed?
I did attend the Dartmouth public hearing on Sept. 20 and was disappointed that there is no firm schedule for implementation for a TMDL that could require up to 80% reductions in N loading from septic systems. Also, Dartmouth should be required to reduce impervious surface runoff -- from the huge paved/parking lots at the Dartmouth Mall, Target/Dick's Sporting Goods, and I-195 and Route 6 highways in addition to wastewater sources.
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It's about time to initiate action!

Sincerely,

Sara H. Johnston
170 Jordan Road
So. Dartmouth, MA 02748

MassDEP Response: The data used in the Technical Report to create the baseline was collected between 2000 and 2006. While we agree that this data is old and does not reflect current conditions, the data and the Technical Report represent a point in time, a baseline. The data collected was used to calibrate and verify the watershed model and the model is still valid to evaluate the impact of subsequent nitrogen land use changes. The TMDL presents a possible scenario to meet the target threshold concentrations, however MassDEP allows each community to decide how and when it will proceed to reduce nutrient loads to the estuary. There are a number of changes that have occurred in the watershed that have potentially increased or decreased the nutrient loading to the estuary. We agree that an additional model run to update the changes in the watershed will help the Town refocus priorities for restoration of the estuary. The TMDL does not specify a schedule or timeline for restoration. The Massachusetts Small MS4 General Stormwater Permit for communities includes a schedule for implementation and has additional requirements for communities that discharge to waters with a TMDL. A portion of the town of Dartmouth is designated as urbanized area and is therefore subject to regulation under the MS4 General Stormwater permit. The stormwater WLA identified in the TMDL will be included in the next MS4 permit (expected re-issue date 2021). Municipalities discharging to waters with a TN TMDL are currently required to conduct enhanced public outreach and education, optimize stormwater management BMPs for nitrogen removal, and establish procedures to manage fertilizers, grass clippings, and leaf litter on permittee owned properties and conduct street sweeping bi-annually.

MassDEP is now piloting a Watershed Permits program for wastewater management and impact mitigation. The Watershed Permit approach will allow communities more flexibility in designing efforts to comply with nutrient load limitations defined in the permit. The permit requires that the municipality or a Wastewater Management Agency (WMA) develop a CWMP or a Targeted Watershed Management Plan (TWMP) for each permitted watershed. Watershed permits would include implementation timetables, standards to be achieved, and long-term monitoring to evaluate water quality improvements. The CWMP or TWMP will need to achieve compliance with established restoration targets for the receiving waters as identified in a TMDL or MEP technical report. For nitrogen mitigation, compliance shall be demonstrated by the achievement of a threshold nitrogen concentration at a sentinel station, or stations, as identified in a TMDL or MEP technical report.

Voluntary enrollment in the program will allow the town to receive watershed specific permit(s) based on an adaptive management approach rather than reliance solely on traditional technologies with customary discharge limit-based permits. Towns will have the time to develop a CWMP or TWMP for each permitted watershed, along with the time to implement the proposed solutions of their plan. The Watershed Permit will be a renewable 20-year permit, up to a 40-year planning and implementation time-line, that provides built-in flexibility to try different methods of wastewater management and impact mitigation.

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Comments received via email on October 2, 2018 from Natalie Garfield

Dear Ms. Kickham,

I attended the public meeting on September 20th, and am writing to voice my support of finally setting the TMDL nitrogen limit for the Slocum, Paskamansett & Little Rivers. This process has taken far too long. Without the TMDL, Dartmouth's hands are tied regarding any restorative measures. Please move this forward. Thank you.
Natalie Garfield
PO Box 70055
Dartmouth, MA 02747
508-636-2425

MassDEP Response: Thank you for your support of the TMDL for the Slocums and Little Rivers estuary system.

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Comments Received via email October 30, 2018 from Steve Bliven

Ms. Kickham—
I recently attended a meeting in Dartmouth Town Hall regarding the final stages of development of the TMDL for the Slocum/Paskamansett River Complex (mostly) in Dartmouth.
It was good to hear that a desired base nutrient level and sentinel station have been established for the complex.

However, it was disheartening to listen to the discussion on the sources of nutrients projected by the model used for the background study. Sadly, this was based on dated information, providing a rather skewed vision of the areas the Town should address in its attempts to meet desired nutrient levels. Since the time the model was run the Town has undertaken several initiatives to reduce nutrient inputs, including expanded sewering in the watershed and better stormwater management practices. Potentially more significant has been the establishment of a reported

eight industrial composting facilities in the watershed—facilities whose input have not been calculated, are not reflected in the TMDL modeling efforts, and which are minimally regulated under State programs. The result of this less than comprehensive sense of sources of inputs leaves the Town with a difficult task of trying to address nutrient loading issues.

To provide a realistic sense of the scope of the loading issues, two significant steps need to be taken:

1. Ascertain the levels of input from the existing and projected composting facilities, and
2. Rerun the model with contemporary data.

Without this information, the Town may not be able to direct its efforts—and limited resources—toward solving the real problems. It would be a shame to expend time, effort and funds on activities that might not ultimately have any measurable impact on water quality in the rivers.

Something that was not pointed out in the meeting is the time that will be necessary for nutrient levels in groundwater to decrease, even after the sources are removed. The nutrients from all those septic systems from homes now sewered and the nutrients from presently operating composting facilities will take years—and possibly decades—to move through ground water at speeds on the order of feet per day to reach faster flowing surface waters. Consequently, the Town will have to make the argument to residents/tax payers that the funds it spends today may not show measurable effects for a significant time period.

I hope that the DEP will be able to address the two major issues raised above and rework the model to provide the Town with meaningful information on which to address its mitigation efforts.

Sincerely,
Steve Bliven
49 Plains Field Drive
South Dartmouth, MA 02748

MassDEP Response: The TMDL had determined the nutrient load from several controllable sources; fertilizers (farms, lawns, and golf courses), septic systems, and stormwater and agricultural activities (plants and animal waste) and the landfill. The commercial composting facilities were not in place in 2000-06 when the data was collected for the Technical Report and the model was calibrated. The nitrogen and phosphorous load exiting the compost and entering the watershed via groundwater and overland flow appears to be a significant source of additional nutrients. However, if properly managed the nutrient load from the composting facilities should be minimized and preferably contained on-site. If composting facilities are violating their MassDAR registration and violating 310 CMR 16.04(1), than MassDAR has the authority to revoke their registration and thereafter MassDEP will take appropriate actions to bring the site into compliance to protect public health, safety, or the environment.

It is true that there will be a time lag from source removal at locations further from the estuaries in the watershed. The longer it takes to implement nitrogen reduction strategies, the longer it will take to see improvements in the estuaries. As part of the CWMP or TWMP source reduction can be targeted to see improvement sooner within the estuaries, or intermediary measures such as construction of permeable reactive barriers. Additional model runs, including more recent data, could be requested from SMAST.

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Comments Received via email November 5, 2018 from Steve Bliven

Ms. Kickham—

After re-reading my comments (above) on the Slocum/Paskamansett system TMDL, I realize that I may not have been entirely clear on my position regarding the TMDL process itself. To clarify, I think a Final TMDL for this complex should be issued in the hopes that such action will assist the Town in addressing the present concerns regarding nutrients.

However, this comes with the strong feeling that the data provided through the Massachusetts Estuary Project is considerably out of date—as discussed below. Better data are needed to help shape the response of the Town to the current situation as well as to plan for the future. If a completed TMDL would help in that process—and the DEP will commit to assisting the Town to get better information—then I would support the issuance of a Final TMDL.

Sincerely,

Steve Bliven

MassDEP Response: Thank you for your support for the TMDL. The on-going data collection efforts by the Buzzards Bay Coalition and the Town of Dartmouth could be incorporated into additional model runs to evaluate more current conditions. This would be an alternative scenario and would not negate the usefulness of the baseline modeling completed for the Technical Report.

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Comments received via letter dated October 19, 2018 from Christopher Michaud, Town of Dartmouth, Director of Public Health (supporting photos and attachments can be found on page 105)

Town of Dartmouth
Board of Health
400 Slocum Road
Dartmouth, MA 02747

Public Health
Prevent. Promote. Protect.

Christopher Michaud, Director
Telephone: 508-910-1804
Fax Telephone: 508-910-1893

Lynne Brodeur, Chair
Leslie E.J. McKinley
Thomas Hardman

October 19, 2018

MassDEP
Barbara Kickham
Division of Watershed Management
8 New Bond Street
Worcester, MA 01606

Re: Comments on Slocum River Total Maximum Daily Loads

Dear Ms. Kickham:

On September 30, 2018, MassDEP held a public hearing at the Dartmouth town hall for the purpose of presenting the DRAFT Slocums and Little Rivers Embayment System Total Maximum Daily Loads for Total Nitrogen (CN 315.0), dated September 2018, hereinafter called the Draft TMDL. The Draft TMDL is premised upon the Massachusetts Estuary Project's (MEP) data that was collected in the watersheds of the Slocum River and Little River from 2000 through 2006. It is understood that the Draft TMDL is part of a regulatory process that will result in a mandate to reduce controllable total nitrogen within the target watersheds of the Slocum River, Paskamansett River and Destruction Brook, herein after called the Watersheds. MassDEP reported during the hearing that once a TMDL is established as regulation, the Town will be responsible for implementation of strategies and MassDEP will be available to support the Town with technical assistance and guidance.

On page 10 of the DRAFT, Figure 4a: Percent Contribution of Controllable Nitrogen Sources to the Slocum River System, provides a forecast on where efforts to reduce nitrogen will reside. Figure 4a distributes controllable nitrogen sources within the Slocum River system as follows: 29% impervious surfaces, 29% wastewater, 15% lawn/golf course fertilizer, 13% farm animals, 8% agricultural fertilizer and 6% landfill; however, in the twelve years leading to the TMDL hearing, the Watersheds have not been static and the distributions of controllable nitrogen in the chart are outdated due to a variety of positive and negative influences. These influences are a result of voluntary municipal initiatives and state regulations.

The Town of Dartmouth was very aggressive with sewering areas previously served by onsite wastewater disposal systems leading up to and throughout the course of the Draft TMDL. Correspondingly, Dartmouth has now installed public sewers over much of the areas identified on the Town's sewer master plan and the wastewater treatment plant does not have available capacity to contemplate sewer extensions to areas not identified beyond the master plan. Moreover, sewering the remaining areas by unconventional wastewater disposal methods such as shared systems or small treatment systems is not financially viable due to housing density, remoteness, geology, availability of land and lack of homeowner associations.

Additionally, Dartmouth has long been proactive with approaches to stormwater management. Improvements have been made to existing facilities through preemptive Town by-laws and regulations. Moreover, zoning by-laws since 2005, have targeted individual residential lots for roof runoff infiltration for new construction when they reside within the Town's Aquifer Protection overlay district; Aquifer Protection District 20.700 Performance Standards. Moreover, additional subsections within the Performance Standards section of the by-law requires stormwater controls in certain instances for existing residential properties. Significant areas of the aquifer zones largely fall within the Destruction Brook and Paskamansett River watersheds. Therefore, reductions in controllable nitrogen from impervious surfaces has been ongoing.

As you are aware there are ongoing efforts in other communities through the MEP to reduce controllable nitrogen in watersheds and these actions target onsite sewage disposal systems. Removal of total nitrogen through onsite sewage disposal systems is without a doubt a more costly proposition for individual homeowners than a conventional sewage disposal system. It shall be noted that the targeted areas for nitrogen contribution reductions is non-waterfront properties, locations that are less likely to have excessive real estate values that offset the added cost for nitrogen removal. Nevertheless, wastewater from onsite sewage disposal systems is clearly the primary target of the DRAFT TMDL.

During the data collection phase of the MEP within the Watersheds, the Town of Dartmouth was proactively addressing many of the contributing sources of controllable total nitrogen. Conversely, the Commonwealth of Massachusetts, mostly through MassDEP, has worked against Dartmouth's efforts to reduce total nitrogen within the Watersheds. Specifically, efforts to reduce total nitrogen sources in the Watersheds has been undermined through the composting of organic materials by initiatives and requirements of the Commonwealth of Massachusetts as follows:

1. Massachusetts General Laws Chapter 21H, Section 7(b) in which MDAR is delegated with the ability to authorize agricultural composting.
    - The delegation to MDAR has largely created an enforcement vacuum at the agricultural composting sites. MDAR is not a named enforcing authority of the varied environmental regulations of the state to prevent air and water pollution, impacts to wetlands and drinking water supplies, and nuisances.
    - Agricultural composting practices, so long as acceptable to MDAR, are not governed by MassDEP.

2. The implementation of the organics waste ban from landfills in 2014 facilitated the proliferation of nutrient rich organic materials destined for composting sites.
    - Many of these materials are not suitable for human consumption (donation), repurposing into animal feed and limited anaerobic digestion facilities has largely left composting as the sole option for organics disposal.

3. The accompanying deregulation of non-agricultural composting facilities under MassDEP oversight. This deregulation overstepped local input on the siting of composting facilities that receive no more than 105 tons per week of group 2 materials, which are higher nitrogen ratio materials than group 1 organic materials, and no more than 30 tons per day of said group 2 materials; under 5,000 cubic yards of organic materials per acre; and 50,000 cubic yards of organic materials onsite at any one time. See 310 CMR 16.04(1)(a) –(c) for reference.

4. The deregulation exempted the aforementioned composting facilities from the former site assignment provisions and instead, now relies upon a self-certification, lifetime permit absent specific regulations to address water pollution through specific controls, oversight and documentation; unless the operations exceed 50,000 cubic yards at one time.
    - While MassDEP through 310 CMR 15.211 imposes setbacks from septic systems to wetlands, the Department fails to impose setbacks from composting facilities to wetlands, and unlike septic systems that provide secondary treatment to wastewater, composting leachate flows without treatment into wetlands and watersheds.
    - See attachments 1 – 16 for composting operations in Dartmouth impacts on the Watersheds.

Here in Dartmouth, I can report that the Commonwealth of Massachusetts, mostly through MassDEP, has been successful with building capacity to handle this diverted organic waste material, and the corresponding diversion of organics from landfills to the composting facilities. The Town of Dartmouth as of October 4, 2018, has eight state sanctioned composting facilities, with authorization to operate granted by either MassDEP or MDAR, all obtaining approval absent local considerations or local environmental concerns. This wide scale diversion of organics away from site assigned, engineered and intricately regulated landfills has resulted in an average of 4000 tons per month of organic waste materials being brought to these deregulated and largely unsupervised sites. To put the 4,000 tons

per month in perspective, I call your attention the Crapo Hill Landfill in Dartmouth, a lined landfill, which is permitted to accept up to 115,000 tons per year. Therefore, the current use of composting sites in Dartmouth by commercial garbage haulers is approximately 40% of the volume of solid waste that the site assigned lined landfill can accept.

Consequently, the state's initiative to divert organic wastes from facilities with proper safeguards, to deregulated facilities has irrefutably contributed to the total nitrogen loading into the Watersheds. Fundamental changes to the composting initiative of the state for the protection of the Watersheds cannot include guidance or technical assistance to the composting facilities that operate under the state's deregulated composting regime. As a result, when the implementation phase arrives for the reduction of total nitrogen in the Watersheds, MassDEP **must** fulfill their legislative mandate and implement substantive changes that will reduce total nitrogen contribution from composting facilities, irrespective if it is a MassDEP or MDAR compost site.

Failure of MassDEP to address this significant total nitrogen contribution will unduly place economic hardships on non-waterfront homes while large for-profit composting operations discharge tens of thousands of gallons of nutrient rich runoff into the Watersheds, and in some cases, in the backyards of the homeowners who will bear the financial burden of the TMDL reduction mandate. Furthermore, a continuation of uncontrolled discharge of nitrogen into the Watersheds by state sanctioned for-profit compost facilities will negate many of the efforts made by the individual residents and the Town.

Based on the growing number of compost facilities in Dartmouth and the significant volume of organic waste that is destined for these locations, the state must acknowledge the unintended consequences of MassDEP's ill-conceived deregulation of composting and the enforcement vacuum at agricultural composting sites, and take the lead on correcting the immediate harm to the Watersheds. Only strict oversight, regulations and engineered controls over all non-residential composting operations, without limitation to which department of the Commonwealth of Massachusetts Executive Office of Environmental Affairs is permitting, will ensure protection of the public health and the environment.

Finally, please be advised that the comments expressed in this letter are specific and focused to the Draft TMDL and should not be construed as limiting of the interests of the Town of Dartmouth Board of Health in regards to impacts on public health and the environment from the current composting regime of the Commonwealth of Massachusetts through the respective overseeing agencies, rules, regulations, statutes and procedures.

Thank you for the opportunity to provide this written response to the DRAFT TMDL. Please feel free to reach out if I can be of further assistance.

On behalf of the Dartmouth Board of Health,

Christopher Michaud, Director of Public Health

Cc: Mark C. Montigny, Senator, 888 Purchase Street #305, New Bedford, MA 02740
Shawn MacInnes, Town Administrator, Town of Dartmouth, 400 Slocum Road, Dartmouth, MA 02747
David Hickox, Director of Public Works, Town of Dartmouth, 400 Slocum Road, Dartmouth, MA 02747
Michael O'Reilly, Environmental Affairs Coordinator, Town of Dartmouth, 400 Slocum Road, Dartmouth, MA 02747
Matthew Armendo, Director of Public Health, Town of Westport, 856 Main Road, Westport, MA 02790
Mark Rasmussen, Buzzards Bay Coalition, 114 Front Street, New Bedford, MA 02740
Korrin Petersen, Buzzards Bay Coalition, 114 Front Street, New Bedford, MA 02740
Deborah Weaver, Westport River Watershed Alliance, 1151 Main Road, Westport, MA 02790

MassDEP Response: The photos and supporting attachments to this letter (pg 104-121) appear to indicate that the composting facility is not operating in compliance with MassDEP or MassDAR regulations. MassDEP has and will continue to enforce the solid waste regulations and take appropriate actions, including enforcement, against compost facilities that do not comply with solid waste regulations. Please note that the possession of a solid waste general permit for a composting facility does not relieve the compost facilities owner(s)/operator(s) from complying with other federal, state and local regulations. Refer to MassDEP Response to Question 10 during the public meeting.

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Comments received via letter dated October 29, 2018 from Michael O'Reilly, Town of Dartmouth, Environmental Affairs Coordinator (supporting photos and attachments can be found on page 123)

DARTMOUTH MASSACHUSETTS
CONSERVATION COMMISSION
400 Slocum Road • P.O. BOX 79399
Dartmouth, MA 02747

MICHAEL O'REILLY
Environmental Affairs Coordinator
TEL: 508-910-1822
http://www.town.dartmouth.ma.us

October 29, 2018

MassDEP
Barbara Kickham
Division of Watershed Management
8 New Bond St.
Worcester, MA 01606

Re: Comments Regarding Draft Slocum/Little River Total Maximum Daily Loads

Dear Ms. Kickham:

The Town of Dartmouth is in receipt of the Draft Slocums and Little Rivers Embayment System (SLR) Total Maximum Daily Loads for Total Nitrogen (CN 315.0) (DTMDL), dated September 2018. On September 30, 2018 MassDEP held a public hearing at the Dartmouth town hall to discuss the document and to solicit public input. The DTMDL report was developed by the Massachusetts Estuary Project (MEP), with the School of Marine Science and Technology of the University of Massachusetts Dartmouth as coordinating manager. Data was collected in cooperation with the "Turn the Tide" project that consisted of members from the Town of Dartmouth, The Lloyd Center for Environmental Studies, Inc. and the Coalition for Buzzards Bay. Data was collected in the watersheds of the Slocum River and Little River from 2000 through 2006.

The development TMDL's for impaired waters is being required by section 303 (d) of the Federal Clean Water Act. The SLR has been identified as impaired, with nitrogen being the nutrient of concern. This regulatory process will result in a mandate that the Town of Dartmouth reduce controllable total nitrogen contribution from the watersheds of the Slocums and Little River estuaries to a specific water concentration as developed through the MEP process. The Town will be required to implement (or continue to implement and expand upon) strategies that will reduce nitrogen to the Slocums and Little Rivers.

The following comments are intended to address the DTMDL document, to describe continued challenges and as an update to more current conditions.

1 - Proliferation of Organic Composting:

Conflicting State regulations are continuing to undermine Dartmouth's attempts to reduce nitrogen within the SLR watersheds

The DTMDL was developed with data collected from the years 2000 - 2006. During those years and to the current time Dartmouth has made significant strides to reduce nitrogen pollution to receiving waters using several regulatory and infrastructure approaches (see items 2 – 5 in attached letter of July 7, 2016). Since the end of data collection changes in State regulations have undermined Dartmouth's

efforts to address and reduce nitrogen contribution to receiving waters. The implementation of an organics waste ban from landfills in 2014, while commendable and well-intentioned, created a large (and profitable) market for composting of the nutrient rich organics that were removed from the waste stream. This has resulted in a proliferation of organic composting facilities and the substantial enlargement of existing agricultural composting facilities. At the same time as organic composting was expanding changes to State regulations, policies and procedures related to composting activities have removed some of the regulatory controls previously in place. Massachusetts General Laws Chapter 21H, Section 7(b) specifies Mass Department of Agricultural Resources (MDAR) as the State authority with jurisdiction over composting facilities. MDAR is a program intended to assist in the development of agriculture and is without specific regulatory power to protect natural resources. Traditionally Massachusetts Department of Environmental Protection (MDEP) fulfills that role. Agricultural composting practices, so long as acceptable to MDAR, are not directly regulated by MDEP. What this has resulted in is incomplete oversite of composting facilities as they pertain to environmental protection.

As of October 2018 the Town of Dartmouth has eight large-scale composting facilities where none existed at the time of data collection from which the DTMDL was developed. Seven of these facilities were authorized by MDAR or MDEP without any local input as to local or environmental concerns. Most of these composting operations are located in the SLR watersheds. It is important to point out that nearly all of the high nutrient organic matter (primarily post-consumer food waste and fish and shellfish processing waste) used in these composting facilities originated **outside of** the SLR watersheds which exacerbates the problem of nitrogen contribution from within the SLR watersheds. Further, the eighth large-scale compost facility is within the Shingle Island River watershed complicating Westport's efforts to reduce nitrogen in the Westport River.

On October 23, 2018 the Dartmouth Conservation Commission issued an Enforcement Order to an MDEP registered composting operation, the Wilfred Francis facility. Operations associated with this composting facility have likely caused the destruction of approximately 1.1 acres of Bordering Vegetated Wetland (see attached graphics).

2 - Equity:

Given the issues as outlined in comment #1 as it relates to the siting of composting facilities it is difficult for the Town to ignore the issue of equity. At the same time as a TMDL will require the Town to potentially spend large sums of public money to address the nitrogen pollution problem, changes to State regulations and policy are directly contributing nitrogen to the same watershed where this public money is being spent to remove nitrogen.

Perhaps more significantly, as discussed in comment #3 the town is limited in its ability to reduce nitrogen inputs through sewering within the watersheds. What this will likely result in is the necessity for the town to implement regulations that will require the use of nitrogen removing septic systems within the watersheds when sub-standard septic systems are replaced or new septic systems are constructed.

New septic system technologies that exist and that are being developed are significantly more costly to install than conventional septic systems and also have operating costs that are much more substantial than conventional septic systems. This will result in increased costs to the citizens of Dartmouth while

at the same time composting facilities are contributing nitrogen to the estuaries due to inadequate controls or regulatory oversite.

The Town of Dartmouth believes that the State should implement substantive changes to State regulation of composting facilities that reduce nitrogen inputs to impaired estuaries and allow for local input related to the siting of these facilities.

3 - Sewering in Dartmouth:

Dartmouth is faced with a continuing dilemma. The report recommends additional sewering within the Slocums River/Little River watersheds as the primary means to reduce nitrogen concentrations to a level that would restore eelgrass and improve benthic infauna to the middle basin of the Slocum River. Removal of nitrogen from wastewater contribution through sewering is considered the most direct and practical method of removing nitrogen. The Town of Dartmouth's Growth Management Master Plan strongly discourages sewer expansion outside of existing sewered areas. The Comprehensive Wastewater Management Plan, following the recommendations of the GMMP does not provide for sewer expansion within the under-developed portions of the Slocums/Little River watershed. Further, any additional capacity available within the existing wastewater treatment plant is reserved for infilling within existing sewered areas, much of which has already occurred.

While MDEP acknowledges that reductions in total nitrogen through sewering completed since the data was collected for the MEP report will be credited to Dartmouth through the Comprehensive Wastewater Management Plan (see attached DEP response to comment letter dated January 30, 2018) reduction of nitrogen inputs to the estuaries using other regulatory or management methods will be a significant and potentially costly challenge.

4 - Age of data, Improvements and Changes Within the Watersheds

Since the data was collected and the model run there have been several changes within the watersheds that may have an impact on the accuracy of the model. These changes have both potentially positive and negative effects. Improvements that the Town has made during the 12 years since the data collection ended are described in the attached comment letter (see items 2 – 5 in attached letter of July 7, 2016). A Potential negative impact from the proliferation of commercial scale organic composting is described in comment #1 above. In a response to the July 7, 2018 letter MDEP acknowledged the significant contribution that the Town has made[1]. MassDEP has requested that SMAST contact Dartmouth to work with the Town to complete two model runs at no additional cost to Dartmouth. The Town did have a discussion with SMAST regarding the Apponagansett Bay model however SLR has not been discussed nor have additional model runs been completed.

Before the Town studies options and develops adaptive strategies for reducing nitrogen sources, and potentially expends significant public funds, the Town believes that the model should be rerun incorporating current data prior the issuance of a final TMDL.

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[1] MassDEP acknowledges the significant financial contributions made by Dartmouth for both Apponagansett Bay and SLR TMDLs…. $340,000.00 to the MEP process for the development of data and reports for both the Apponagansett Bay and the Slocums and Little Rivers.

5 - Changes to the Inlet;

During the 2000 - 2006 data collection phase, the hydraulics of the Slocums and Little Rivers appears to have been quite different than the period after data collection. Beginning in approximately 2006 a new channel has developed within the sand bar at the mouth of the inlet to both the Slocums and Little rivers. Prior to this time, and for many decades before, the outlet flow for both systems traveled eastward to Mishaum Point and southward along the shore to its outlet at Buzzards Bay a distance of approximately 2,500 meters. The new channel discharges in a more direct path to Buzzards Bay a distance of approximately 900 meters. This new channel configuration was confirmed on the water on October 19, 2018 by Town of Dartmouth and USEPA staff (see attached Graphics).

While nitrogen source reduction will continue to be aggressively pursued by the Town of Dartmouth the additional flushing provided by the new inlet may have contributed to increase flushing of the system with nitrogen concentration reductions. Maintenance of this channel configuration, with possible placement of sand to the nearby Demarest Lloyd State Beach, will likely be a management option considered by the town.

6 - Continued Water Quality Monitoring and the Impacts of Climate Change:

The Town of Dartmouth supports continued water quality monitoring. For the last 25 years baseline water quality data has been collected yearly by the Buzzards Bay Coalition. That data was used in the development of the MEP report. That snap shot in time may not represent current conditions (see comment #4 above). Current conditions may differ, with nitrogen concentrations being better, or worse, than when data was collected. Even if static or reduced nitrogen levels have been already achieved it will be critical to continue monitoring. Several factors, including watershed development, remnant contribution from septic systems taken offline and the recent proliferation of commercial scale organic composting may have offset any reductions achieved. Exacerbating the problem are indications that recent-term warming of Buzzards Bay waters has occurred which appears to have caused an increase in algal pigment contributing to water quality degradation.

While development has continued within the SLR watersheds since the end of data collection, the town is hopeful that nitrogen reduction strategies that have been implemented, and will continue to be further refined and developed, and changes to the hydrologic conditions at the mouth of the rivers (as discussed in Comment #4) may have mitigated nitrogen concentration within these embayments. In the worst case scenario nitrogen concentrations have increased. It is only through continued monitoring will this be able to be verified and effective adaptive strategies to further reduce nitrogen sources be able to be developed. The Town of Dartmouth is willing and able to work with DEP, the Buzzards Bay Coalition and others to facilitate continued monitoring.

Be assured that the Town of Dartmouth will continue its efforts to reduce nitrogen to the Slocums and Little Rivers, will assist in continued sampling and will work with SMAST to refine the DTMDL as necessary.

For the Commission,

Michael O'Reilly
Environmental Affairs Coordinator

Cc:

Mark C. Montigny, Senator, 888 Purchase Street #305, New Bedford, MA 02740
Shawn MacInnes, Town Administrator, Town of Dartmouth, 400 Slocum Road, Dartmouth, MA 02747
David Hickox, Director of Public Works, Town of Dartmouth, 759 Russells Mills Rd. Road, Dartmouth, MA 02747
Christopher Michaud, Director of Public Health, Town of Dartmouth, 400 Slocum Road, Dartmouth, MA 02747
Korrin Petersen, Buzzards Bay Coalition, 114 Front Street, New Bedford, MA 02740

MasDEP Response to letter dated October 29, 2018 from Michael O'Reilly, Town of Dartmouth, Environmental Affairs Coordinator

1. **Proliferation of Organic Composting**

MassDEP Response: MassDEP acknowledges the increase in the number of composting facilities in the town and the increase in the volume of waste disposed of at these facilities since the regulatory changes in 2012. MassDEP is committed to working with our sister agency MassDAR to properly oversee and regulate these facilities. If composting facilities are violating a MassDAR registration and violating 310 CMR 16.04(1), than MassDAR has the authority to revoke the registration and thereafter MassDEP will take appropriate actions, including but not limited to enforcement actions, to bring the site into compliance to protect public health, safety, or the environment. Apparent violations at composting facilities regulated by MassDEP should be reported to the MassDEP regional office.

The additional nutrient loads attributable to the composting facilities was not included in the development of the TMDL since the data collection period for the TMDL (2000-06) was prior to the changes in the solid waste regulations. The TN load allocations estimated in the Technical Report did not include the additional load from the composting facilities. Additional load due to organic composting should be managed separately from the TMDL because it was not included in the orginal data collection. It is clear that proper oversight and management of commercial composting facilities is needed in order to reduce the burden of nitrogen reduction by the town.

2. **Equity**

MassDEP Response: The increase in composting within the watershed does not alleviate the town from its obligations to address baseline nitrogen loading conditions. These composting facilites represent a new load not present during the original evaluation. However, MassDEP does recognize the need to address the nitrogen impacts from these composting facilites and will continue to work with the town and the facilities to correct operations.

The Town of Dartmouth is concerned that expansion of sewering outside existing areas is contrary to the town's Master Plan. The TMDL allows the Town the flexibility to decide how and where nitrogen reduction efforts will be focused within the Towns control. Within the Slocums River watershed wastewater accounts for 29% of the controllable total nitrogen load, while an equal amount is due to runoff from impervious surfaces and 36% is due to agricultural activies and fertilizers (TMDL page 10).

3. **Sewering in Dartmouth**

MassDEP Response: The TN TMDL for Slocums and Little Rivers Estuary allows the watershed towns flexibility in decisions regarding nitrogen reduction strategies. MassDEP is not requiring

sewering but through the TMDL has provided watershed specific information on the sources of the nitrogen discharging to the estuary. The scenario put forth by SMAST in the Technical Report involved sewering 80% of the Paskamansett and Destruction Brooks watershed and is just one of a variety of scenarios that can be developed to address nitrogen impacts. Agricultural animal waste, fertilizers applied to farms, lawns and golf courses account for a higher percentage of controllable nitrogen load than the wastewater contribution.

4. **Age of the Data, Improvements and Changes within the Watershed**

MassDEP Response: The on-going data collection efforts by the Buzzards Bay Coalition and the Town of Dartmouth could be incorporated into additional model runs to evaluate more current conditions. However, this would be an alternative scenario and would not negate the usefulness of the baseline data used in the modeling and Technical Report. Revising the TMDL with more current data would delay the approval of the TMDL for years, in the meantime, the health of the estuary continues to degrade. Buildout was considered in the MEP model as part of scenario runs to evaluate implementation strategies. Furthermore, evaluation of buildout conditions must be considered as part of the CWMP.

5. **Changes to the Inlet**

MassDEP Response: Increased flushing within the estuary may result in lower nitrogen concentrations with the estuary and locally, improvements in habitat. The placement of the target sentinel stations may need to be re-evaluated in the future as additional benthic infauna and water quality data is collected. This is a dynamic system and artificially managing the migration of the inlet or channel system would be subject to regulatory review to evaluate compliance. Management of the current channel configuration can potentially be addressed in the targeted watershed management plan.

6. **Continued Water Quality Monitoring and Impacts to Climate Change**

MassDEP Response: MassDEP recognizes the importance of the Town of Dartmouths' long-term commitment to working with the Buzzards Bay Coalition in collection of water quality data. The importance of Dartmouth's support of these monitoring efforts is essential to successful remediation of the estuary. MassDEP recognizes that long-term climate change impacts to southeastern Massachusetts are occurring based on known science. However, the details of how climate change will effect precipitation, streamflow, sediment and nutrient loading in specific locations are generally unknown. In light of the uncertainties, MassDEP has chosen to address the uncertainty of climate change through an implicit MOS (i.e., incorporated into the TMDL through conservative assumptions). Furthermore, TMDLs are developed and implemented with an adaptive management approach. MassDEP will address climate change issues more specifically through TMDL implementation, as warranted.

Email received on November 2, 2018 from Michael O'Reilly, Town of Dartmouth, Environmental Affairs Coordinator

Ms. Kickham,
I'd like to clarify my comments on the Draft TMDL for the Slocums/Little River estuaries. As evidenced by the Town of Dartmouth's efforts to reduce nitrogen inputs to the Slocums/Little River estuaries (SLR) through regulatory methods and infrastructure expansions, the Town has been, and will remain, committed to water quality improvements to all coastal waters of Dartmouth. The Town of Dartmouth has never been opposed to the issuance of a TMDL for SLR and understands that, as identified impaired waters, reduction of nitrogen inputs will be required. Water quality testing and benthic sampling used in the formulation of the draft TMDL confirm the need for nitrogen reduction within the SLR. Our concern has been that dated data could lead to unnecessary initiatives, and expenditures, that the use of updated and current data within the model might otherwise suggest. However, the issuance of a final TMDL could serve as a catalyst for change. As has been discussed in my comment letter, and through comments from others, commercial scale organic composting has become a potentially significant contributor of nitrogen to SLR. If the issuance of a final TMDL leads to changes to state regulatory processes related to composting then the Town is not opposed to the issuance of a final TMDL for the Slocums/Little River estuaries.

Sincerely,
Mike O'Reilly

Michael O'Reilly, CFM
Environmental Affairs Coordinator
Town of Dartmouth, MA
508-910-1822
moreilly@town.dartmouth.ma.us

41.628555 -70.965388

MassDEP Response: Thank you for your support of the TMDL.

Comments Received via letter dated October 30, 2018 from Korrin Peterson, Buzzards Bay Coalition

October 30, 2018

Barbara J. Kickham, TMDL Section Chief
MA Department of Environmental Protection
Division of Watershed Management
8 New Bond Street
Worcester, MA 01616

Re: Buzzards Bay Coalition Request for Immediate Approval of the Slocums and Little Rivers Embayment System Total Maximum Daily Loads for Total Nitrogen (CN 315.0) as Final.

Dear Ms. Kickham,

The Buzzards Bay Coalition (Coalition) renews and incorporates herein its July 8, 2016 comments (attached) in support of the Slocums and Little Rivers Embayment System Total Maximum Daily Loads for Total Nitrogen, CN 315.0 (draft Slocums/Little TMDL) and **urges the Massachusetts Department of Environmental Protection (MassDEP) to submit the TMDL to the U.S. Environmental Protection Agency (EPA) for immediate approval.**

The Coalition is a membership-supported non-profit organization dedicated to the restoration, protection and sustainable use and enjoyment of Buzzards Bay and its watershed including the Slocums/Little Rivers watershed. The Coalition is supported by more than 9,000 individuals, families, and businesses throughout the region including 781 members affected by water quality in Dartmouth.

Summary

The Slocums/Little TMDL confirms the need for nitrogen reductions and forms the basis for the Town of Dartmouth to create a plan for how it will reduce nitrogen pollution in the watershed to achieve water quality goals. In the Slocums River target threshold nitrogen levels are set as 0.36 mg/L N at Station SRT-12 (lower Slocums River) and 0.5 mg/L N at Station SRT-15 (in Little River). The TMDL finds that water quality standards will be met when those target concentrations are maintained. Improved water quality in the Slocums River should allow the restoration of eelgrass habitat in the Lower Slocums River. In order to meet the nitrogen threshold levels in the Slocums River the TMDL requires a 23.8% reduction in nitrogen loading to the Slocums River sub-embayment and an 11.3% reduction in nitrogen loading to the Paskamansett River & Destruction Brook sub-embayment.

www.savebuzzardsbay.org
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21 Luscombe Avenue, Woods Hole, Massachusetts 02543 | Tel: 508-540-6222

Based on these TMDL nitrogen targets, the next step is for the Town to assess the most cost-effective options for achieving the target nitrogen watershed loads.

New Nitrogen Source Challenges

While the Town considers how to reduce existing nitrogen loads to meet the TMDL, it is also faced with new sources. Since about 2014, numerous composting facilities have been sited within the Slocums/Little River watershed potentially adding new sources of nitrogen to the River. Even without these new sources of nitrogen, the TMDL outlines the need for nitrogen reductions. MassDEP must take immediate action to assist the town in controlling these new sources of nitrogen while the town moves forward to address the sources of nitrogen identified in the TMDL. MassDEP must also consider these sources in future iterations of a Slocums TMDL.

MassDEP's TMDL Delays are Unacceptable

The Coalition submitted comments in support of this TMDL more than two years ago. The final MEP for the Slocums/Little River was complete in May 2013, more than five years ago. The pace at which MassDEP releases draft TMDLs continues to stifle communities' efforts to take action. The Coalition continues to urge MassDEP to properly invest in the expeditious completion and release of meaningful TMDLs. Delay in TMDL approval will postpone and hinder local action on nitrogen reductions and lead to further degradation of the Slocums and Little Rivers.

Conclusion

The issuance of a FINAL Slocums/Little TMDL is a critical step in restoring the water quality of the Slocums and Little Rivers, and the Coalition encourages MassDEP to immediately issue the current draft as Final. The Slocums/Little TMDL confirms the need for nitrogen reductions and requires the Town of Dartmouth to create a plan for how it will reduce nitrogen to meet the TMDL.

Sincerely,

Korrin Petersen, Esq.
Senior Attorney

Attachment

cc: Matthew Beaton, MA Secretary of Energy & Environmental Affairs
Martin Suuberg, MassDEP Commissioner
Patti Kellogg, Bureau of Water Resources, MassDEP – SERO
Kenneth Moraff, US EPA

Town of Dartmouth, Select Board, Board of Public Works, Conservation Commission, Board of Health, Planning Board

MassDEP Response: Thank you for comments. MassDEP is working with EPA to finalize the TMDL and acknowledges the additional nitrogen discharging from composting facilities poses a challenge and must be addressed separately from the TMDL. Refer to MassDEP Response to question 10 during the public meeting.

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Comments received via letter dated July 8, 2016 from Mark Rasmussen, Buzzards Bay Coalition

July 8, 2016

Barbara J. Kickham, TMDL Section Chief
MA Department of Environmental Protection
Division of Watershed Management
8 New Bond Street
Worcester, MA 01616

Re: Buzzards Bay Coalition Request for Immediate Approval of the Slocums and Little Rivers Embayment System Total Maximum Daily Loads for Total Nitrogen (CN 315.0) as Final.

Dear Ms. Kickham,

The Buzzards Bay Coalition (Coalition) has reviewed the draft Slocums and Little Rivers Embayment System Total Maximum Daily Loads for Total Nitrogen, CN 315.0 (draft Slocums/Little TMDL) dated May 2016, and urges the U.S. Environmental Protection Agency (EPA) to approve the draft Slocums/Little TMDL as final.

The draft Slocums/Little TMDL confirms the need for nitrogen reductions and forms the basis for the Town of Dartmouth to create a plan for how it will reduce nitrogen pollution in the watershed to meet the TMDL. Delay in TMDL approval will postpone and hinder local action on nitrogen reductions and lead to further degradation of the Slocums and Little Rivers.

The Coalition is a membership-supported non profit organization dedicated to the restoration, protection and sustainable use and enjoyment of Buzzards Bay and its watershed including the Westport Rivers watershed. The Coalition is supported by more than 8,000 individuals, families, and businesses throughout the region including 781 members affected by water quality in Dartmouth.

The Coalition requests that the EPA and Massachusetts Department of Environmental Protection (MassDEP) consider the following comments in assessing whether the draft Slocums/Little TMDL successfully achieves water quality standards in the Slocums and Little Rivers Embayment System.

Background:

An important feature of the Town of Dartmouth is clean, productive and beautiful marine waters. Swimming, fishing, boating, fin-fishing, and shellfishing all support the local economy.

www.savebuzzardsbay.org
114 Front Street, New Bedford, Massachusetts 02740 | Tel: 508-999-6363 Fax: 508-984-7913
21 Luscombe Avenue, Woods Hole, Massachusetts 02543 | Tel: 508-540-6222

However, as recognized by the draft Slocums/Little TMDL, water quality degradation due to nitrogen pollution reduces the recreational and commercial values of this critical natural resource and threatens the health of the local economy. The draft Slocums/Little TMDL notes that EPA classifies the Slocums and Little Rivers as "high priority" embayments due to the initiative that the Town of Dartmouth has taken to assess the conditions of the entire embayment system; the Town of Dartmouth's commitment to restore the Slocums and to preserve the Little River; and the extent of impairment in the Slocums system and the need to prevent future impairments of the Little River.

The water quality in the Slocums and Little Rivers Embayment System is degraded. High nitrogen loads from septic systems, stormwater, fertilizers, and agriculture cause loss of eelgrass beds, undesirable increases in macro algae, low dissolved oxygen levels, decreased diversity and quantity of marine animals, and periodic algae blooms. The Coalition has collected water quality data from 8 sites in the past 24 years throughout the Slocums and Little Rivers Embayment System that clearly documents this impairment. Without reduction, these nitrogen loads will lead to fish kills, unpleasant odors and scums, and loss of critical marine animal communities.

The Federal Clean Water Act requires the Commonwealth of Massachusetts to identify waters that fail to meet water quality standards. The state is required to draft TMDLs establishing the maximum load (amount) of pollution from all sources that the identified water may receive and still meet water quality standards.

The Slocums and Little Rivers were initially listed as impaired, failing to meet water quality standards, for nutrient pollution in 2003. A Massachusetts Estuaries Project (MEP) report was finalized for the Slocums and Little River Embayment System. On May 12, 2016, the Massachusetts Department of Environmental Protection (MassDEP) released the draft TMDL to the town of Dartmouth.

Major TMDL Findings:

The draft Slocums/Little TMDL establishes that nitrogen pollution is the primary ecological threat to the Slocums and Little Rivers Embayment System. In the Slocums River, most of the nitrogen load comes from septic systems and runoff from paved surfaces. Target threshold nitrogen levels are set as 0.36 mg/L N at Station SRT-12 (lower Slocums River) and 0.5 mg/L N at Station SRT-15 (in Little River). The draft Slocums/Little TMDL finds that water quality standards will be met when those target concentrations are maintained in the Little River or reached in Slocums River. Improved water quality in the Slocums River should allow the restoration of eelgrass habitat in the Lower Slocums River. In order to meet the nitrogen threshold levels in the Slocums River requires a 23.8% reduction in nitrogen loading to the Slocums River sub-embayment and an 11.3% reduction in nitrogen loading to the Paskamansett River & Destruction Brook sub-embayment.

The draft Slocums/Little TMDL states that Little River is already meeting its water quality standards based on the current high level of infaunal habitat quality. The Town of Dartmouth must keep the current loading rates from increasing in order to prevent future impairment. This is particularly important given that Coalition monitoring in the Little River has shown increased algal levels since the MEP report study period (2000-2006). The total algal pigment levels in the Little River from 2007 to 2015 were about 30% higher than the levels from 2000 to 2006 (Figure 1, below).

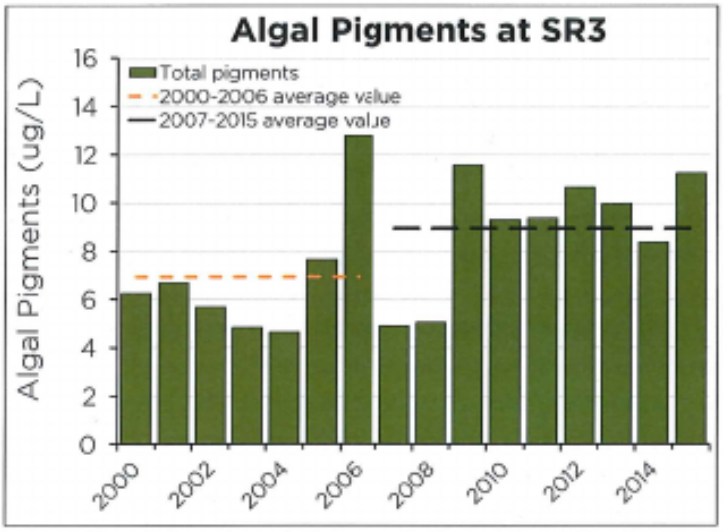

Figure 1. Algal pigment (chlorophyll a + phaeophytin) concentrations at the Inlet to Little River from 2000 to 2015.

Based on the TMDL nitrogen targets, the Town must develop and implement a Comprehensive Wastewater Management Plan (CWMP) that will assess the most cost-effective options for achieving the target N watershed loads, including sewering at either centralized or de-centralized (i.e., neighborhood scale) locations, the use of denitrifying septic systems for all private residences, and stormwater controls.

The Coalition looks forward to working with the Town of Dartmouth, MassDEP, EPA, and local stakeholders in the development and implementation of a CWMP.

Comments:

In order to expeditiously proceed with nitrogen reduction planning and implementation, the Coalition urges the EPA to approve the draft Slocums/Little TMDL as final as soon as possible. However, we request that EPA and MassDEP consider the following comments in the implementation of this TMDL and in future updates of the Slocums/Little TMDL. We do not suggest that any of the issues discussed below justify re-evaluation or further delays in issuance of the current Slocums/Little TMDL.

1. **The TMDL's categorization of all septic systems into the Load Allocation portion of the draft Slocums/Little TMDL is inaccurate.**

The draft Slocums/Little TMDL defines point sources as "discernable, confined, and concrete sources such as pipes". Some, if not all, of the septic systems within the Slocums and Little River embayment systems meet that definition. The allocation of all septic systems within the Slocums and Little River watershed into the Load Allocation portion of the TMDL is not justifiable. Regardless, the TMDL is accurate in that it identifies septic systems as the most significant source of nitrogen to be addressed in order to meet the target threshold concentrations. Nevertheless, we encourage EPA to finalize the TMDL, but suggest that MassDEP and EPA develop a methodology for allocating septic systems into the Waste Load Allocation portion of TMDLs in order to more effectively regulate septic systems as the primary point source of nitrogen in southeastern Massachusetts estuaries.

2. **The effects of climate change on water quality has not been adequately addressed in this TMDL; a larger Margin of Safety should be considered in future TMDLs.**

The draft Slocums/Little TMDL states that "MassDEP believes that impacts of climate change should be addressed through TMDL implementation with an adaptive management approach in mind." The TMDL notes that the extent of climate change impacts on nutrient loading in specific locations is generally not well known. However, recent research (attached) shows that Buzzards Bay waters are warming, based on data from the Coalition's long-term water quality monitoring program. Over the past two decades, the relationship between nitrogen concentrations and algae growth (as measured by algal pigment concentrations) has shifted in Buzzards Bay, with higher levels of algae growth occurring in more recent years than 20 years ago at the same nitrogen concentration. This shift in the relationship suggests that with a warming climate, greater algae growth and ecological impairment may occur than expected based on historic nitrogen concentrations. To effectively restore water quality, it is critical that TMDL implementation be done in a manner that allows for the incorporation of new understandings such as this.

3. **The TMDL describes the importance of water quality monitoring for effective TMDL implementation.**

The TMDL identifies continued monitoring of the Slocums/Little River embayment system as a programmatic margin of safety that will support adaptive management. The Coalition has collected water quality monitoring data in the Slocums/Little River embayment system every summer for the last 24 years with the help of citizen volunteers from the Town of Dartmouth. This data served as the long-term baseline data used in the MEP report. The Coalition will continue to monitor the water quality in the Town of Dartmouth and to provide the data so that residents and town officials can develop effective nitrogen reduction plans and track progress.

Summary:

The issuance of the draft Slocums/Little TMDL is a critical step in restoring the water quality of the Slocums and Little Rivers, and the Coalition encourages EPA to immediately issue the

current draft as Final. The Slocums/Little TMDL confirms the need for nitrogen reductions and requires the Town of Dartmouth to create a plan for how it will reduce nitrogen to meet the TMDL.

Sincerely,

Mark Rasmussen
President

Attachment

cc: Matthew Beaton, MA Secretary of Energy & Environmental Affairs
Martin Suuberg, MassDEP Commissioner
Bethany Card, Deputy Commissioner MassDEP
Patti Kellogg, Bureau of Water Resources, MassDEP – SERO
Kenneth Moraff, US EPA

Town of Dartmouth
- Select Board
- Board of Public Works
- Conservation Commission
- Board of Health
- Planning Board

City of New Bedford
- Mayor Jon Mitchell
- Department of Environmental Stewardship
- Department of Planning, Housing and Community Development

Town of Westport
- Board of Selectmen
- Water Resources Committee
- Conservation Commission
- Board of Health
- Planning Board
- Agricultural Commission

Town of Freetown
- Board of Selectmen
- Building Department
- Conservation Committee
- Planning Board

MassDEP Response: Thank you for your support of the TMDL for the Slocums and Little Rivers estuary system. In addition, thank you for your long term commitment (>24 years) to data collection efforts in this estuary and throughout Buzzards Bay. The importance of these data cannot be overstated. Your major comments are addressed below.

The TMDL's categorization of all septic systems into the Load Allocation portion of the draft Slocums and Little River TMDL is inaccurate.

MassDEP Response: The scientific analysis underlying TMDLs is designed to address pollutant loading based on watershed scale modeling. The Linked Model that was used to develop the TMDL is not a fate and transport model that predicts the movement of individual pollutants (e.g., nitrate) in groundwater from a particular source or sources. Instead, it is designed to assess the sensitivity to nitrogen loading within the embayment; the assimilative capacity for nitrogen within that surface water; and water quality responses within the embayment to changes in nitrogen loading rates (i.e., as opposed to measuring nitrogen loads from particular sources). Accordingly, the Linked Model does not contain the type of data or level and scale of analysis necessary to predict the fate and transport of pollutants through groundwater from any specific source or to support a specific determination that a discharge to the ground or groundwater has a direct and immediate hydrological connection to surface water. Although the model links watershed inputs with embayment circulation and nitrogen characteristics, it conservatively assumes that nitrogen moves through groundwater and that nitrogen directly transported via groundwater enters the embayments. In short, the data and analysis provided, which supports the regional framework required for a TMDL, simply does not contain the type of data or level and scale of analysis that can support the site- and source-specific ecological determinations necessary to find that a discharge via groundwater has a direct and immediate hydrological connection to surface waters for any given source on Cape Cod. Therefore, MassDEP considered the pollutant loads discharged from septic systems and WWTFs discharging to soils to be nonpoint sources for purposes of the TMDL, and it allocated these sources to the LA.

The effects of climate change on water quality have not been adequately addressed in this TMDL; a larger Margin of Safety should be considered in future TMDLs.

MassDEP Response: MassDEP recognizes that long-term climate change impacts to southeastern Massachusetts are possible based on known science. However, the details of how climate change will effect precipitation, streamflow, sediment and nutrient loading in specific locations are generally unknown. In light of the uncertainties, MassDEP has chosen to address the uncertainty of climate change through an implicit MOS (i.e., incorporated into the TMDL through conservative assumptions). Furthermore, TMDLs are developed and implemented with an adaptive management approach. MassDEP will address climate change issues more specifically through TMDL implementation, as warranted.

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Comments received via letter dated July 7, 2016 from Michael O'Reilly, Town of Dartmouth, Environmental Affairs Coordinator

DARTMOUTH MASSACHUSETTS

CONSERVATION COMMISSION
400 Slocum Road • P.O. BOX 79399
Dartmouth, MA 02747

MICHAEL O'REILLY
Environmental Affairs Coordinator
TEL: 508-910-1822 • FAX: 508 910-1897
http://www.town.dartmouth.ma.us

July 7, 2016

Barbara Kickham, P-HGW
TMDL Section Chief
Watershed Planning Program, MassDEP
New Bond Street, Worcester, MA 01606

Dear Ms. Kickham:

The Town of Dartmouth appreciates the efforts by DEP in the preparation of the *Draft* Slocums and Little Rivers Embayment System TMDL for Total Nitrogen (CN 315.0) dated May 2016, and has taken the opportunity to review and comment on the report. We offer the following questions and comments.

1. Town of Dartmouth contribution to the MEP process:

It should be noted that the Town of Dartmouth contributed $340,000.00 to the MEP process for the development of data and reports for both the Apponagansett Bay and the Slocums and Little Rivers estuaries. It is our understanding that the amount contributed by the Town far exceeds contributions from other municipalities.

Given the magnitude of the Town's contribution we would request that additional model runs related to strategies for reducing nitrogen loading the Slocums and Little Rivers (and Apponagansett Bay) would be performed at no cost to the Town. Two initial suggestions for model runs are

- **Removal of the sand bar blocking tidal exchange at the mouth of the Slocums River which would greatly increase tidal flushing of the partially impounded basin. Altering the Slocums River hydrodynamics with the removal of this tidal restriction could increase the tidal circulation sufficiently and be a cost-effective way to improve water quality, while utilizing the dredged material for appropriate reuses (e.g. badly needed beach nourishment at adjacent Demarest Lloyd State beach).**
- **The potential benefit of requiring nitrogen reducing septic systems for new construction (as a reasonable alternative to sewering).**
- **Installation of oyster aquaculture within the Slocums river to attenuate nitrogen.**
- **Quantification of compliance with the requirements of the Phase II stormwater permits in the communities of Dartmouth and New Bedford will contribute to the goal of reducing the nitrogen load as prescribed in this TMDL for the Paskamansett/Destruction Brook subwatershed. Is this quantifiable and what effects will on-going efforts to comply with MS4 have?**

2. Sewer extensions within the Slocum River watershed that have occurred since about the start of the study data collection and continuing to current:

Examples:

- Tucker Road extension, north end. Started shortly before the study but the vast number of homes resulted in connections occurring over several years.
- Hathaway Road extension
- Cross Road extension
- Bay View extension
- Old Westport Road extension
- Tucker Road extension, south end
- Route 6 and Morton Park extension. Started shortly before the study but the vast number of homes resulted in connections occurring over several years.

Figure 4 represents wastewater contributing 29% of the nitrogen to the Slocums/Little River watershed during the study period. A recent GIS analysis of the Board of Health database was performed to determine the total number of septic systems that were abandoned and connected to municipal sewers between 1989 and June 2016, and the number of septic system upgrades that occurred. Throughout the entire town 1371 septic systems were abandoned and connected to municipal sewer, with 469 of those septic systems within the Slocums/Little River watershed. The analysis also showed that 399 sub-standard septic systems within the Slocums/Little River watershed were upgraded to Title V where municipal sewer was not available.

In addition, in 2009 a single family house was purchased (and demolished) by the Conservation Commission and a 7 acre riverside park was created. The failed cesspool associated with this property had a pipe directly discharging into the Paskamansett River. This source of direct contamination has been eliminated.

The recommendations should consider the number of properties sewered and septic systems repaired and include data from outside the MEP testing period, as modeled using the above mentioned GIS analysis due to ground water travel time, and how that has benefitted water quality.

3. Comprehensive revisions to the Aquifer Protection Zoning By-Law in 2005:

- A significant area of the Slocum River watershed falls within the aquifer zones.
- The requirements in the revised by law triggers onsite recharge of stormwater for residential and commercial properties.

Figure 4 represents impervious areas contributing 29% of the nitrogen to the Slocum River during the study period. The adoption of the comprehensive revisions in 2005 and ongoing implementation has resulted in decreases in runoff from building footprints that may have otherwise resulted in uncontrolled discharge to the watershed.

4. Nutrient management regulations:

In 2014, in response to a legislative mandate, MASSDAR created **330 CMR 31.00 PLANT NUTRIENT APPLICATION REQUIREMENTS FOR AGRICULTURAL LAND AND LAND NOT USED FOR AGRICULTURAL PURPOSES.** See excerpt from the regulation's Purpose section below.

330 CMR 31.00 establishes limitations on the application of plant nutrients to lawns and non-agricultural turf to prevent these non-point source pollutants from entering the surface and groundwater resources of the Commonwealth of Massachusetts. These state-wide limitations on plant nutrient applications will enhance the ability of municipalities to maximize the credits provided in the National Pollution Discharge Elimination System permits issued by the United States Environmental Protection Agency. 330 CMR 31.00 further ensure that plant nutrients are applied to agricultural land in an effective manner to provide sufficient nutrients for plant growth while minimizing the impacts of the nutrients on water resources in order to protect human health and the environment. 330 CMR 31.03 and 31.04 shall not be enforced until six months after June 5, 2015 in order for the Department to provide appropriate educational and technical assistance to the agricultural operations subject to 330 CMR 31.00.

- The aforementioned regulations apply broadly throughout the watershed to all lands.
- The intent of these regulations is to limit the unnecessary application of nutrients to both residential and agricultural lands.
- The report does not discuss the recent adoption of these regulations and therefore, fails to consider the intended results from the decreased nutrient application to lands within this watershed.

These regulations have the ability to reduce both agricultural fertilizer and lawn/golf course fertilizer; collectively 23% of controllable nitrogen discharge to the Slocum River as shown in Figure 4 in the report. How would this regulation effect nitrogen inputs the system?

5. Improvements to existing commercial properties and infrastructure.

As older commercial properties, with little or no water quality improvement BMP's, have proposed renovations the Planning Board and Conservation Commission have required stormwater quality improvements.

- The North Dartmouth Mall made significant stormwater improvements in 2005.
- Faunce Corner road drainage was improved in 2009 and 2016 (currently in process).
- In 2016 a 1000' section of Russell's Mills Rd that previously discharged untreated stormwater to the Paskamansett River was eliminated with the installation of two water quality BMP's.

Figure 4 represents impervious areas contributing 29% of the nitrogen to the Slocum River during the study period. The Town of Dartmouth has continued to make stormwater water quality improvements through the study period and has continued to make improvements since the cessation of data collection. Those improvements would likely have made a positive contribution by decreasing nutrient inputs.

6. Age of data collection

In general, and as outlined in above items, the Town feels that in the decade since testing ended progress have been made by the Town to improve that water quality of the Paskamansett/Slocums system. The report may not address these changes and a TMDL developed from the report might not accurately reflect current conditions.

7. Difficulty with conflicting State regulations.

Destruction Brook watershed nutrient measurements show relatively high values. The Destruction Brook

watershed is relatively undeveloped. Located within the watershed are two composting facilities, one a

very large operation. Both are permitted by MA Department of Environmental Protection and Department of Agriculture Resources. How does the Town regulate these state permitted uses, and why should the Town incur the costs to mitigate for these uses as part of the Commonwealth's recommended 80% reduction in nitrogen contribution assigned to the Paskamansett/Destruction Brook watershed.

It is difficult for Towns to reduce nitrogen contributions to receiving waters when State regulations and policies continue to register (and encourage) composting facilities which are contributing to overall nitrogen loads. Additional stormwater controls related to water quality (and strict enforcement of existing regulations and policies) for these operations should be required by state permits to reduce nitrogen inputs.

8. Probability of sewer extension within the watershed.

Dartmouth is faced with a problem. The report recommends additional sewering within the Slocums River/Little River watersheds as the primary means to reduce nitrogen concentrations to a level that would restore eelgrass and improve benthic infauna to the middle basin of the Slocum River. Removal of nitrogen from wastewater contribution through sewering is considered the most direct and practical method of removing nitrogen. However for Dartmouth:

The Town of Dartmouth's Growth Management Master Plan (GMMP), developed through a cooperative effort of municipal staff and public input, strongly discouraged sewer expansion outside of existing sewered areas. The Comprehensive Wastewater Management Plan, following the recommendations of the GMMP does not provide for sewer expansion within the under-developed portions of the Slocums/Little River watershed. Any additional capacity of the existing wastewater treatment plant (developed with the aggressive inflow and infiltration program that is ongoing) is reserved for infilling within existing sewered areas. It is important to point out however that a portion of this infilling is likely to occur within the Slocums/Little River watershed which would further attenuate nitrogen inputs to these coastal waters. In addition, the cost of expanding sewers into rural areas for homeowners would be prohibitive due to the low density of development and expansive rural nature of the non-sewered areas. Sewering (with the exception of infilling) is not a practical, cost-effective alternative.

9. Open space within watershed.

It should be pointed out that the Town of Dartmouth, the State of Massachusetts and local NGO land trusts have permanently significant amounts of open space within the Slocums/Little River watersheds. Of the 40 square mile watershed, 8.6 square miles, or 22% of the land area has been permanently protected.

10. Target nitrogen levels justification.

The Town has concerns in two areas related to the target nitrogen levels and the adequacy of the model to predict future successes.

- The target concentration for nitrogen is proposed to be 0.36 mg/l at the sentinel station within the Slocums River. Pages 19 & 20 of the report state "A well studied eelgrass bed within the lower Oyster River in Chatham has been stable at a tidally averaged water column N of 0.37 mg/L N, while eelgrass was lost within the Lower Centerville River at a tidally averaged N of 0.395 mg/L N and also within Waquoit Bay at 0.39 mg/L N.

While the Town recognizes that no two coastal embayments are alike, what is the justification for the target concentration at 0.36 mg/l, when it appears that eelgrass can thrive at concentrations of 0.37 mg/l?

- Removal of nitrogen through sewering removes nitrogen from groundwater. Page 16 of the report states "the Linked Model process does not contain the type of data or level and scale of analysis necessary to predict the fate and transport of nitrogen through groundwater from specific sources."

  If the model does not adequately predict the fate of nitrogen through groundwater transport how can the Town justify the cost sewer expansions (even if practical, see comment #8) if one of the main justifications is to meet a TMDL?

The Town of Dartmouth has always been committed to the improvement of our water resources, increasing our native populations, and increasing species diversity in all of our ecosystems, where practicable. The report recommends sound theories, many of which have already been implemented by the Town where appropriate and cost-effective. The Town continues to strive to make increased improvements but is now faced with the specter of cost-efficacy and return on investment. With that constraint understood the Town of Dartmouth will continue its work toward improving water quality it its coastal embayments by reducing nitrogen.

For the Town of Dartmouth,

Michael O'Reilly
Environmental Affairs Coordinator

MassDEP Response to letter dated July 7, 2016 from Michael O'Reilly, Town of Dartmouth, Environmental Affairs Coordinator

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
One Winter Street Boston, MA 02108 • 617-292-5500

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Matthew A. Beaton
Secretary

Martin Suuberg
Commissioner

January 30, 2018

Dartmouth Conservation Commission
400 Slocum Road
PO Box 79399
Dartmouth, MA 02747
Attention: Michael O'Reilly

RE: Slocum's and Little Rivers
Draft Total Nitrogen TMDL

Dear Mr. O'Reilly

MassDEP would like to schedule a public meeting presentation on the Draft Total Maximum Daily Load (TMDL) for Slocum's and Little Rivers (SLR) in the coming months. Prior to the public meeting we would like to provide some clarification on your questions in the letter dated July 7, 2016 (attached) and our subsequent meeting in Dartmouth on September 6, 2016. The comments and questions along with MassDEP responses follow below.

1. Town of Dartmouth Contribution to the MEP Process.
   It should be noted that the Town of Dartmouth contributed $340,000.00 to the MEP process for the development of data and reports for both the Apponagansett Bay and the Slocums and Little Rivers estuaries. It is our understanding that the amount contributed by the Town far exceeds contributions from other municipalities. Given the magnitude of the Town's contribution we would request that additional model runs related to strategies for reducing nitrogen loading the Slocums and Little Rivers (and Apponagansett Bay) would be performed at no cost to the Town. Two (sic) initial suggestions for model runs are:

   Removal of the sand bar blocking tidal exchange at the mouth of the Slocum's River which would greatly increase tidal flushing of the partially impounded basin. Altering the Slocums River hydrodynamics with the removal of this tidal restriction could increase the tidal circulation sufficiently and be a cost-effective way to improve water quality, while utilizing the dredged material for appropriate reuses (e.g. badly needed beach nourishment at adjacent Demarest Lloyd

State beach).

- The potential benefit of requiring nitrogen reducing septic systems for new construction (as a reasonable alternative to sewering).
- Installation of oyster aquaculture within the Slocums River to attenuate nitrogen.
- Quantification of compliance with the requirements of the Phase II stormwater permits in the communities of Dartmouth and New Bedford will contribute to the goal of reducing the nitrogen load as prescribed in this TMDL for the Paskamansett/Destruction Brook subwatershed. Is this quantifiable and what effects will on-going efforts to comply with MS4 have?

MassDEP acknowledges the significant financial contributions made by Dartmouth for both Apponagansett Bay and SLR TMDLs. Per MassDEP's Interagency Service Agreement (ISA) with SMAST, SMAST was to provide each Town with the option of requesting an additional model run for each estuary. MassDEP has requested that SMAST contact Dartmouth to work with the Town to complete two model runs at no additional cost to Dartmouth Status. The Town should contact Dean Lohrenz at SMAST directly for assistance with the additional model runs.

Dartmouth and New Bedford are MS4 communities with portions of the upper watershed within regulated areas. The additional requirements for communities with a total nitrogen TMDL are provided in Appendix H, Section I of the Massachusetts MS4 General Permit. Requirements includes enhanced public education and outreach, regulatory revisions for new development or redevelopment to consider Best Management Practices (BMPs) for nitrogen removal, and good housekeeping and pollution prevention for permittee (Town) owned properties such as increased street sweeping and fertilizer management. An addition model run could be used to help quantify the contribution of these efforts in reducing the N load in the watershed and moving you towards the overall goal of habitat restoration.

2. Sewer Extensions within the SLR watershed that have occurred since about the start of the study data collection and continuing to current.
   Examples:
   - Tucker Road extension, north end. Started shortly before the study but the vast number of homes resulted in connections occurring over several years.
   - Hathaway Road extension
   - Cross Road extension
   - Bay View extension
   - Old Westport Road extension
   - Tucker Road extension, south end
   - Route 6 and Morton Park extension. Started shortly before the study but the vast number of homes resulted in connections occurring over several years.

Figure 4 represents wastewater contributing 29% of the nitrogen to the Slocum's/Little River watershed during the study period. A recent GIS analysis of the Board of Health database was performed to determine the total number of septic systems that were abandoned and connected to municipal sewers between 1989 and June 2016, and the number of septic system upgrades that occurred. Throughout the entire town 1371 septic systems were abandoned and connected to municipal sewer, with 469 of those septic systems within the Slocum's/Little River watershed. The analysis also showed that 399 substandard septic systems within the Slocum's/Little River watershed were upgraded to Title V where municipal sewer was not available.

In addition, in 2009 a single family house was purchased (and demolished) by the Conservation Commission and a 7 acre riverside park was created. The failed cesspool associated with this property had a pipe directly discharging into the Paskamansett River. This source of direct contamination has been eliminated.

The recommendations should consider the number of properties sewered and septic systems repaired and include data from outside the MEP testing period, as modeled using the above mentioned GIS analysis due to ground water travel time, and how that has benefitted water quality.

The sewering and Title 5 upgrades that Dartmouth has completed supports the recommendations of the TMDL and MassDEP has acknowledged it in the TMDL. The removal of total nitrogen (TN) from the watershed will be demonstrated through an improved estuarine habitat; return of eelgrass and increased numbers and diversity in the benthic habitat. The MEP modeling represented the baseline TN load, a snapshot in time. The reductions in total nitrogen through sewering completed since the data was collected for the MEP report will be credited to Dartmouth through the Comprehensive Wastewater Management Plan (CWMP).

3. Comprehensive Revisions to the Aquifer Protection Zoning By-Law in 2005
    - A significant area of the Slocum River watershed falls within the aquifer zones.
    - The requirements in the revised by law triggers onsite recharge of stormwater for residential and commercial properties.

Figure 4 represents impervious areas contributing 29% of the nitrogen to the Slocum's River during the study period. The adoption of the comprehensive revisions in 2005 and ongoing implementation has resulted in decreases in runoff from building footprints that may have otherwise resulted in uncontrolled discharge to the watershed.

The addition of Aquifer Protection Zoning will be noted in the TMDL. Adoption of more a comprehensive zoning bylaw, which includes stormwater recharge requirements for properties with >15% or 2,500 square feet of impervious cover, will result increased infiltration of runoff resulting in improvements to estuarine water quality. This revision to the Town's Aquifer Protection Zoning Bylaw was required to be in compliance with MassDEP's Wellhead Protection requirements in the Drinking Water Regulations, 310 CMR 22.21 (2)(b)7.

4. Nutrient Management Regulations
   In 2014, in response to a legislative mandate, MASSDAR created 330 CMR 31.00 PLANT NUTRIENT APPLICATION REQUIREMENTS FOR AGRICULTURAL LAND AND LAND NOT USED FOR AGRICULTURAL PURPOSES. See excerpt from the regulation's Purpose section below.

   330 CMR 31.00 establishes limitations on the application of plant nutrients to lawns and non-agricultural turf to prevent these non-point source pollutants from entering the surface and groundwater resources of the Commonwealth of Massachusetts. These state-wide limitations on plant nutrient applications will enhance the ability of municipalities to maximize the credits provided in the National Pollution Discharge Elimination System permits issued by the United States Environmental Protection Agency. 330 CMR 31.00 further ensure that plant nutrients are applied to agricultural land in an effective manner to provide sufficient nutrients for plant growth while minimizing the impacts of the nutrients on water resources in order to protect human health and the environment. 330 CMR 31.03 and 31.04 shall not be enforced until six months after June 5, 2015 in order for the Department to provide appropriate educational and technical assistance to the agricultural operations subject to 330 CMR 31.00.

   - The aforementioned regulations apply broadly throughout the watershed to all lands.
   - The intent of these regulations is to limit the unnecessary application of nutrients to both residential and agricultural lands.
   - The report does not discuss the recent adoption of these regulations and therefore, fails to consider the intended results from the decreased nutrient application to lands within this watershed.

   These regulations have the ability to reduce both agricultural fertilizer and lawn/golf course fertilizer; collectively 23% of controllable nitrogen discharge to the Slocum River as shown in Figure 4 in the report. How would this regulation effect nitrogen inputs to the system?

MassDEP has added language to the TMDL to reflect the recent regulations regarding Plant Nutrient Application Requirements for Agricultural Land (330 CMR 31.00). These regulations which require basic plant nutrient management plans for 10 or more acres and adherence to application and seasonal restrictions will result in reduced the agricultural TN load entering the surface water and groundwater throughout Massachusetts, including Slocum's and Little Rivers Estuarine System.

Farmers requesting access to federal funding such as the Environmental Quality Incentives Program, or EQIP, must develop a plan of operations that addresses at least one natural resource concern. This program provides financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land. Those that receive funding are subject to periodic check-ins to ensure that plans are being followed.

The Plant Nutrient Application Regulations are expected to result in reductions to the nitrogen load that enters the estuary. The additional reductions in load should be accounted for in the town's CWMP.

5. Improvements to Existing Commercial Properties and Infrastructure
   As older commercial properties, with little or no water quality improvement BMP's, have proposed renovations the Planning Board and Conservation Commission have required stormwater quality improvements.

   The North Dartmouth Mall made significant stormwater improvements in 2005.
   - Faunce Corner road drainage was improved in 2009 and 2016 (currently in process).
   - In 2016 a 1000' section of Russell's Mills Rd that previously discharged untreated stormwater to the Paskamansett River was eliminated with the installation of two water quality BMP's.

   Figure 4 represents impervious areas contributing 29% of the nitrogen to the Slocum River during the study period. The Town of Dartmouth has continued to make stormwater water quality improvements through the study period and has continued to make improvements since the cessation of data collection. Those improvements would likely have made a positive contribution by decreasing nutrient inputs.

MassDEP has included this information in the SLR draft TMDL.

6. Age of Data Collection
   In general, and as outlined in above items, the Town feels that in the decade since testing ended progress has been made by the Town to improve the water quality of the Paskamansett/Slocums system. The report may not address these changes and a TMDL developed from the report might not accurately reflect current conditions.

MassDEP acknowledges that the data collection period ended over 10 years ago. The estuary is still experiencing the effects of excess nitrogen observed through the loss of eelgrass, loss of diversity and number of macroinvertebrates, low dissolved oxygen, and increases in macroalgae. The modeling represents the TN load at a point in time and while Dartmouth has continued to upgrade septic systems and construct sewer extensions, growth within the subwatershed has also continued. MassDEP encourages Dartmouth to continue to address the excess nitrogen load

within the estuarine system using the Comprehensive Wastewater, or Water Resources, Management Plan (CWMP or CWRMP) and the TMDL to focus the Town's efforts on the areas of highest density development and proximity to the estuaries.

7. Difficulty with Conflicting State Regulations
   Destruction Brook watershed nutrient measurements show relatively high values. The Destruction Brook watershed is relatively undeveloped. Located within the watershed are two composting facilities, one a very large operation. Both are permitted by MA Department of Environmental Protection and Department of Agriculture Resources. How does the Town regulate these state permitted uses, and why should the Town incur the costs to mitigate for these uses as part of the Commonwealth's recommended 80% reduction in nitrogen contribution assigned to the Paskamansett/Destruction Brook watershed. It is difficult for Towns to reduce nitrogen contributions to receiving waters when State regulations and policies continue to register (and encourage) composting facilities which are contributing to overall nitrogen loads. Additional stormwater controls related to water quality (and strict enforcement of existing regulations and policies) for these operations should be required by state permits to reduce nitrogen inputs.

The Kingfisher Composting Facility on Fisher Road, is in the Paskamansett Brook subwatershed and is permitted by MassDEP. This site has been a concern to the town and the subject of enforcement actions by MassDEP. On June 2, 2017, MassDEP issued an Administrative Consent Order (ACOP-00001446 to King Fisher Corp) for noncompliance with solid waste regulations as a result of their accepting solid waste at this site without valid site assignment, handling the solid waste and creating a dumping ground. The ACOP requires that King Fisher Corp. pay a penalty of $12,070 within 30 days. MassDEP issued a Unilateral Order (UAO-SE-16-4001) on January 13, 2016 which required King Fisher Corp immediately to cease accepting solid waste, implement measures to prevent emissions of offensive odors and/or nuisance conditions and discharges of pollutants to the environment. In addition, King Fisher Corp. was required within 30 days to submit a plan to MassDEP detailing proper management of solid waste at the Site. King Fisher Corp. complied with the UAO.

The Wilfred Francis facility is located directly across the street from Kingfisher and is registered by MassDAR. The Old Dartmouth Farm Compost Site is located in the Paskamenskett Brook subwatershed, regulated by MassDEP through a General Composting Permit.

Some composting is considered part of normal agricultural land use however, MassDAR regulates composting under 330 CMR 25.0. Guidelines for Agricultural Composting, (http://www.mass.gov/eea/docs/agr/programs/compost/guidetoagcomposting2011.pdf) have been developed for farmers engaged in agricultural composting, for waste generated by their own, as well as, taking in waste from other farming operations. Composting sites are to be located at such a distance to prevent erosion, siltation, and stormwater runoff to adjacent water bodies and wetlands. Compost operators are subject to annual self-certification that includes verification of

the types and quantities of material accepted at the composting facility and that Best Management Practices are being followed. Composting requires managed decomposition to avoid unwanted results which can lead to complaints by neighbors and local officials. At any time, should complaints of odor or nuisance be lodged with MassDAR or MassDEP, a site inspection will be conducted.

8. Probability of Sewer Extension within the Watershed
   Dartmouth is faced with a problem. The report recommends additional sewering within the Slocums River/Little River watersheds as the primary means to reduce nitrogen concentrations to a level that would restore eelgrass and improve benthic infauna to the middle basin of the Slocum River. Removal of nitrogen from wastewater contribution through sewering is considered the most direct and practical method of removing nitrogen. However for Dartmouth:

   The Town of Dartmouth's Growth Management Master Plan (GMMP), developed through a cooperative effort of municipal staff and public input, strongly discouraged sewer expansion outside of existing sewered areas. The Comprehensive Wastewater Management Plan, following the recommendations of the GMMP does not provide for sewer expansion within the under-developed portions of the Slocums/Little River watershed. Any additional capacity of the existing wastewater treatment plant (developed with the aggressive inflow and infiltration program that is ongoing) is reserved for infilling within existing sewered areas. It is important to point out however that a portion of this infilling is likely to occur within the Slocums/Little River watershed which would further attenuate nitrogen inputs to these coastal waters. In addition, the cost of expanding sewers into rural areas for homeowners would be prohibitive due to the low density of development and expansive rural nature of the non-sewered areas. Sewering (with the exception of infilling) is not a practical, cost-effective alternative.

The Town of Dartmouth's Growth Management Master Plan (GMMP) discourages expansion of the sewers outside the existing sewered areas. The CWMP, following the recommendation of the GMMP did not include sewer expansion within the less developed portions of the Slocums and Little River Watershed. It is acknowledged that some in-filling of the sewered areas will occur. The scenario that was presented in the MEP Tech Report is just one possible scenario that will address the excess nitrogen load within the watershed.

9. Open Space within the Watershed
   It should be pointed out that the Town of Dartmouth, the State of Massachusetts and local NGO land trusts have permanently protected significant amounts of open space within the Slocums/Little River watersheds. Of the 40 square mile watershed, 8.6 square miles, or 22% of the land area has been permanently protected.

MassDEP has added a statement in the TMDL to acknowledge that approximately 8.6 square miles or 22% of the watershed is now protected open space.

10. Target Nitrogen Levels Justification

The Town has concerns in two areas related to the target nitrogen levels and the adequacy of the model to predict future successes.

The target concentration for nitrogen is proposed to be 0.36 mg/l at the sentinel station within the Slocums River. Pages 19 & 20 of the report state "A well studied eelgrass bed within the lower Oyster River in Chatham has been stable at a tidally averaged water column N of 0.37 mg/L N, while eelgrass was lost within the Lower Centerville River at a tidally averaged N of 0.395 mg/L N and also within Waquoit Bay at 0.39 mg/L N.

While the Town recognizes that no two coastal embayments are alike, what is the justification for the target concentration at 0.36 mg/l, when it appears that eelgrass can thrive at concentrations of 0.37 mg/l?

- Removal of nitrogen through sewering removes nitrogen from groundwater. Page 16 of the report states "the Linked Model process does not contain the type of data or level and scale of analysis necessary to predict the fate and transport of nitrogen through groundwater from specific sources."

If the model does not adequately predict the fate of nitrogen through groundwater transport how can the Town justify the cost sewer expansions (even if practical, see comment #8) if one of the main justifications is to meet a TMDL?

The target concentrations at the sentinel stations are estimated using the water quality modeling however, if the restoration of the estuary is not observed and the target concentration is met, then the target concentration will be re-evaluated and possibly lowered. The TMDL will be met through this process of adaptive management.

Nitrogen in groundwater is conservative; however, the model of SLR accounts for natural attenuation of nitrogen through streams.

Thank you for your participation in the Massachusetts Estuaries Project and we look forward to proceeding with the public meeting regarding the TMDL for SLR.

Sincerely,

Barbara J. Kickham
TMDL Section Chief
Watershed Planning Program

cc: Rebecca Weidman, MassDEP
Kimberly Groff, MassDEP
Brian Dudley, MassDEP
Roland Samimy, SMAST
Brian Howes, SMAST
Korrin Petersen, Buzzards Bay Coalition

Supporting Materials-Attachments 1-15 to letter dated October 19, 2018 from Christopher Michaud, Town of Dartmouth, Director of Public Health

Attachments 1 – 15

Pictures appearing in attachments 1 -15 were taken by Christopher Michaud, Director of Public Health, Town of Dartmouth, 400 Slocum Road, Dartmouth, MA, 02747

Pictures were taken at or of composting sites within the Town of Dartmouth that are registered with MDAR or permitted by MassDEP.

Pictures were taken between January 13, 2016 and December 1, 2017

Attachment 1

Organics waste mixing area with organics wastewater on exposed soil at a compost site within Paskamansett River watershed.

Attachment 2

Adjacent woodland impacted from stormwater flow from a composting site within the Paskamansett River watershed. Note mature tree fatality and loss of the understory vegetation. Photo taken in July 2017.

Attachment 3

Leachate pooling from compost area at compost site within Destruction Brook watershed. The pooling is occurring atop a sandy geologic deposit with a shallow depth to groundwater residing below the ground surface.

Attachment 4

Exposed high nitrogen content organic waste within Paskamansett River watershed.

Attachment 5

Low point down gradient of compost windrow with vegetation impacts within Destruction Brook watershed.

Attachment 6

Mature tree fatality in wetland that receives stormwater flow within Destruction Brook watershed. See compost windrow in Attachment 5 for up-gradient conditions.

Attachment 7

Uncontrolled stormwater flow into the watershed from a compost site in the Paskamansett River watershed.

Attachment 8

Stormwater flow path from compost windrows as it enters the woodlands and watershed without treatment, within the Paskamansett River watershed. Note the absence of growth and yellow vegetation along the edge. Tree fatality lies just outside of the field of view and can be observed in Attachment 2.

Attachment 9

Leachate exuding from one of many compost windrows at a compost site in the Paskamansett River watershed. Note the presence of seafood waste materials on the edges and surface of the windrow.

Attachment 10

Compost area with poor drainage and organic pile placement such that stormwater flow intercepts piles and pools against, thus promoting leachate. Site is within the East Branch of the Westport River watershed.

Attachment 11

Ammonia off gassing from compost windrow due to inadequate carbon to nitrogen ratio at compost site within the Paskamansett River watershed. This is a cured pile of organic material and the off gassing is not heat or steam from an active biological composting process.

Attachment 12

Closer view of ammonia gassing off finished compost pile in the Paskamansett River watershed.

Ammonia Odors

Tom Richard

Ammonia is among the most common odors found at composting facilities. Fortunately, ammonia is not a pervasive odor, so it does not require a large number of dilutions to reduce concentrations below the odor threshold. Ammonia also disperses easily, since is lighter than air (its density is 60% that of air), and does not settle in low lying areas the way hydrogen sulfide and other dense odorous compounds do. These factors make ammonia odors more prevalent on-site than off-site.

Ammonia odors can be formed aerobically as well as anaerobically, so the control strategies recommended for anaerobic odors may not apply. Noticeable ammonia losses primarily result from a low C/N ratio. The microorganisms are very efficient at utilizing nitrogen when that is the limiting nutrient. The smell of ammonia is an indicator that nitrogen is in excess, and carbon/energy is limiting instead. Ammonia losses are common when composting high nitrogen materials such as fresh grass clippings or manure, and are often accompanied by other nitrogen losses in runoff or infiltration. At large composting facilities these nitrogen losses could threaten surface or groundwater quality.

Full article can be found at http://compost.css.cornell.edu/odors/ammonia.html

Attachment 13

Attraction of wildlife to composting area that results in added nutrients into the watershed from the waste. At a compost site in the Paskamansett River watershed.

Attachment 14

Compost windrows up-gradient of a pond with direct stormwater flow into the pond. At a compost site in the Destruction Brook watershed.

Attachment 15

Overhead view of pond receiving stormwater flow from compost windrows on a site within the Destruction Brook watershed. Note a sheen on pond from organic waste materials runoff. This pond discharges into a wetland near Destruction Brook.

Attachment 16

Data from samples collected at and near a compost facility in the Destruction Brook watershed on December 7, 2017 by the Town of Dartmouth and a consultant for the Town. Samples analyzed by ESS Laboratory, 185 Frances Avenue, Cranston, Rhode Island.

Project ID: N/A		ESS Project ID: 1712179					
	Sample No.	**1712179-01**	**1712179-02**	**1712179-03**	**1712179-04**	**1712179-05**	**1712179-06**
	Sample Date:	**12/07/2017**	**12/07/2017**	**12/07/2017**	**12/07/2017**	**12/07/2017**	**12/07/2017**
	Client Sample :	**SW-1 Inlet from Leachate Area**	**SW-2 Outlet to Pond**	**SW-3 Southern Pond**	**L-1 Leachate North Pile**	**L-2 Leachate Central Pile**	**L-3 Leachate Southern Leaf Pile**
Total Nitrogen	mg/L	**91.3**	**30.1**	**1.42**	**3910**	**3860**	**211**
Total Phosphate as P	mg/L	**1.99**	**2.96**	<0.1	**10.8**	**328**	**151**
Total Coliform	MPN/100mL	**>1600**	**>1600**	**110**	**1600**	**>1600**	**>1600**

Sample SW-3 was taken from a pond that was not impacted by stormwater flow from the composting area. Samples SW-1 and SW-2 were taken from the pond shown in Attachment 15.

- Samples from pond impacted by stormwater runoff with a total nitrogen range from 30.1 – 91.3 mg/l, and the non-impacted pond had total nitrogen of 1.42 mg/l

Samples L-1, L-2 and L-3 were taken from the active compost area where leachate collected in shallow pools.

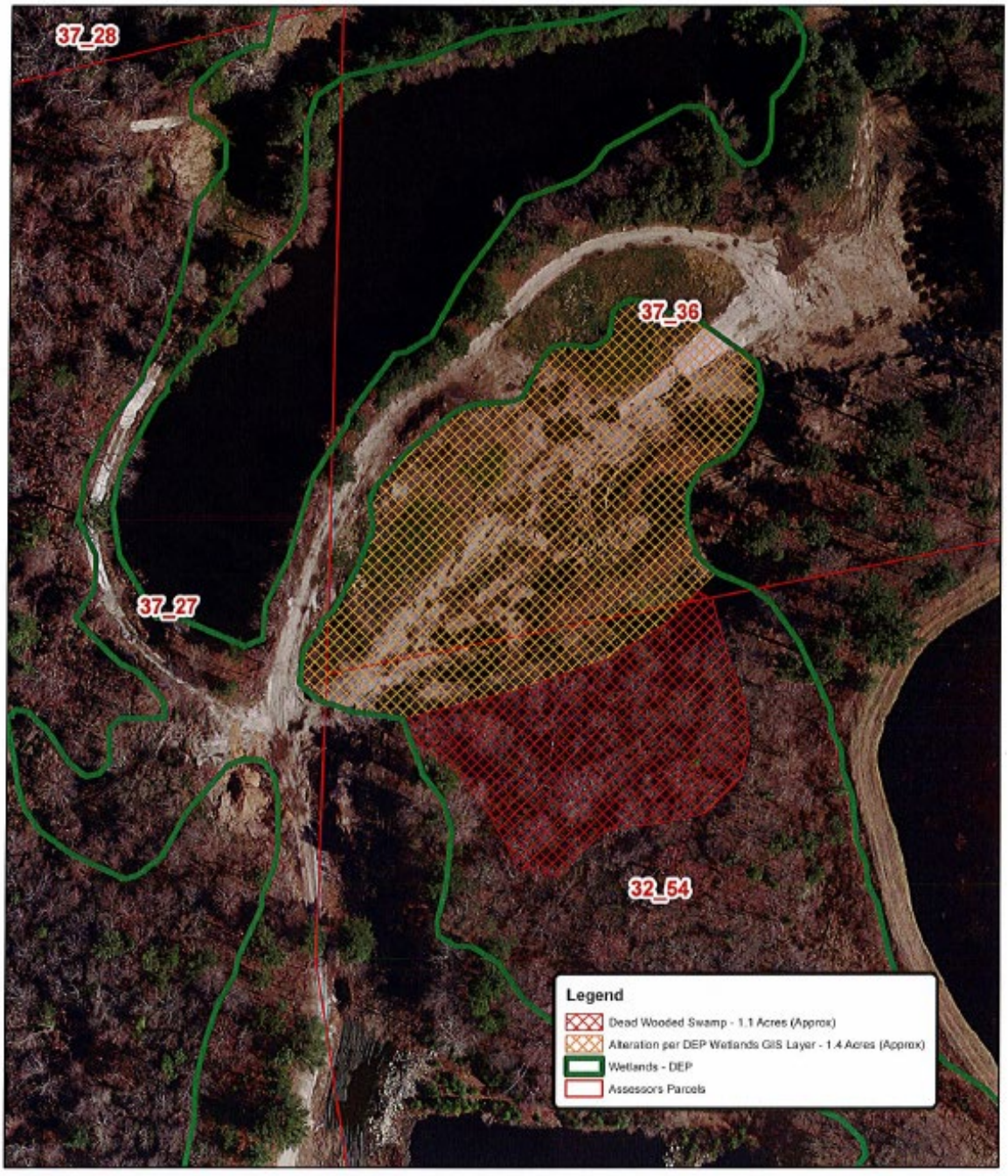
- Samples associated with leachate had a range of total nitrogen range from 211 – 3910 mg/l
- Samples associated with food waste ranged from 3860 – 3910 mg/l

Supporting Materials to letter dated October 29, 2018 from Michael O'Reilly, Town of Dartmouth, Environmental Affairs Coordinator

Francis Composting Operation
Alteration Areas

Francis property - Dartmouth Assessors Map 37 Lot 36 & Map 37 Lot 27
Owner of Record: Francis, Wilfred N. Jr Life Estate

King Fisher Corp property – Dartmouth Assessors map 32 Lot 54
Owner of Record: King Fisher Corp

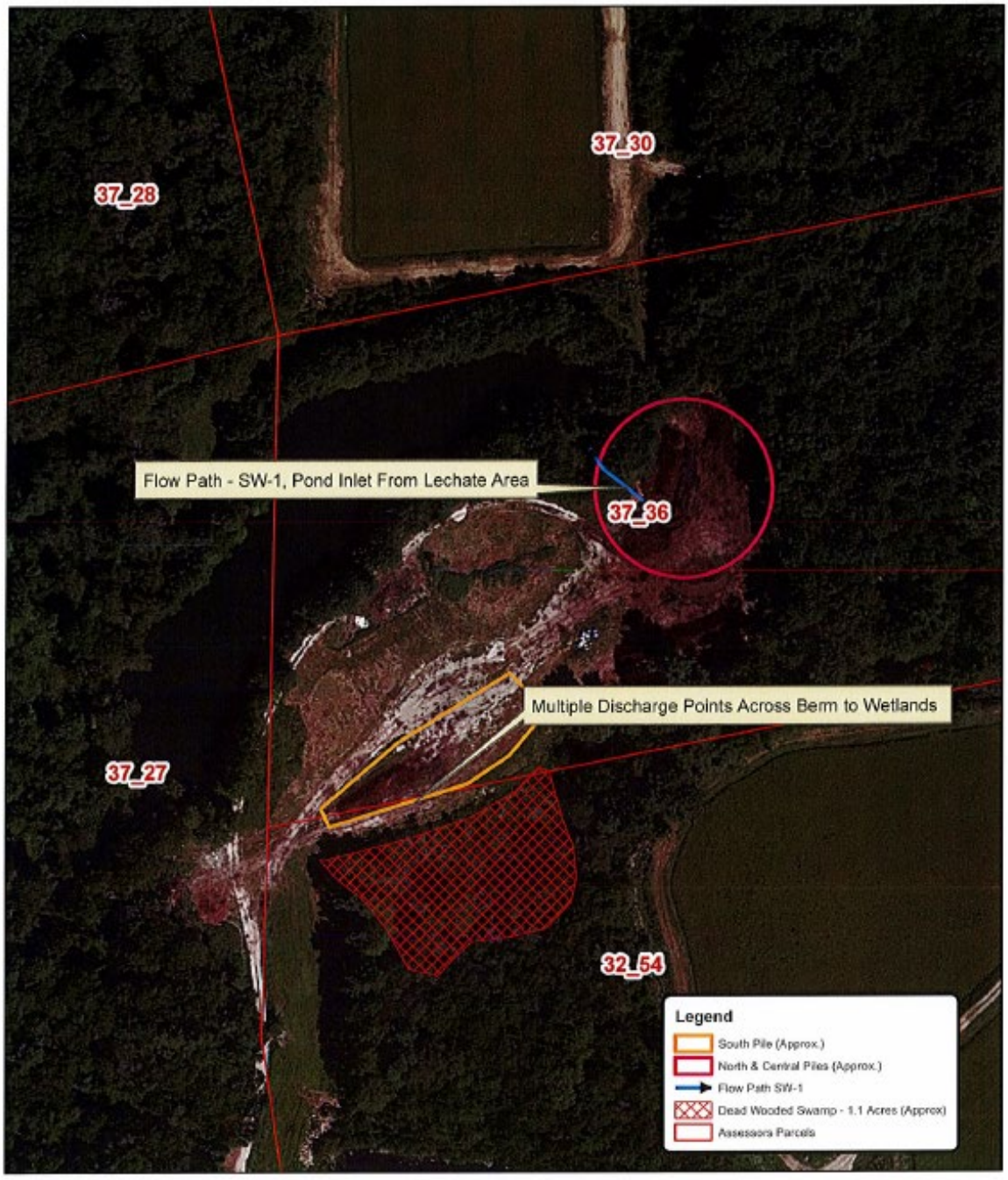


Aerial Photograph: Town of Dartmouth 2014

Francis Composting Operation
Flow Path & Discharge Locations

Francis property - Dartmouth Assessors Map 37 Lot 36 & Map 37 Lot 27
Owner of Record: Francis, Wilfred N. Jr Life Estate

King Fisher Corp property – Dartmouth Assessors map 32 Lot 54
Owner of Record: King Fisher Corp

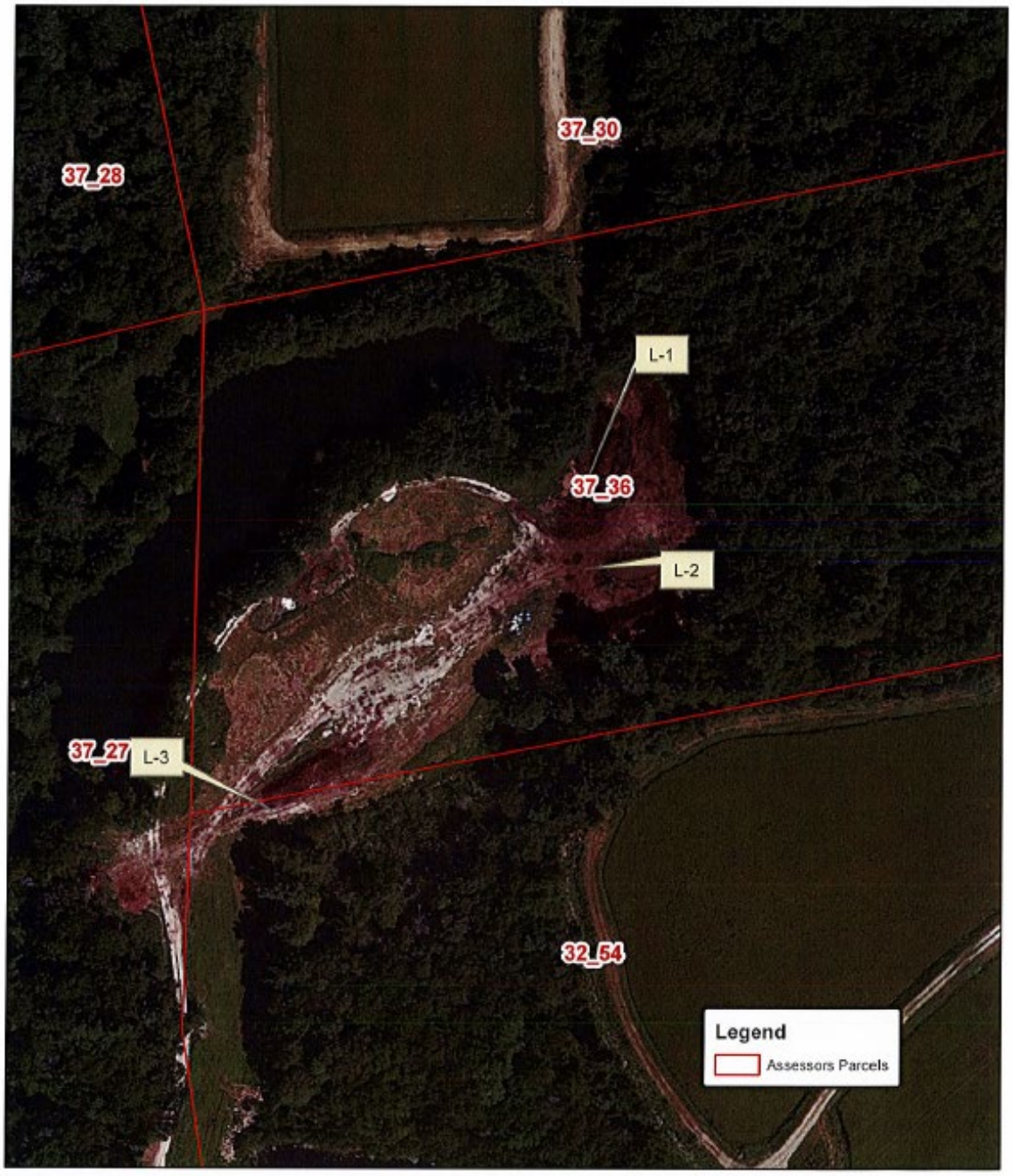


Aerial Photograph: Google 2016

Francis Composting Operation
Lechate Sampling Locations

Francis property - Dartmouth Assessors Map 37 Lot 36 & Map 37 Lot 27
Owner of Record: Francis, Wilfred N. Jr Life Estate

King Fisher Corp property – Dartmouth Assessors map 32 Lot 54
Owner of Record: King Fisher Corp

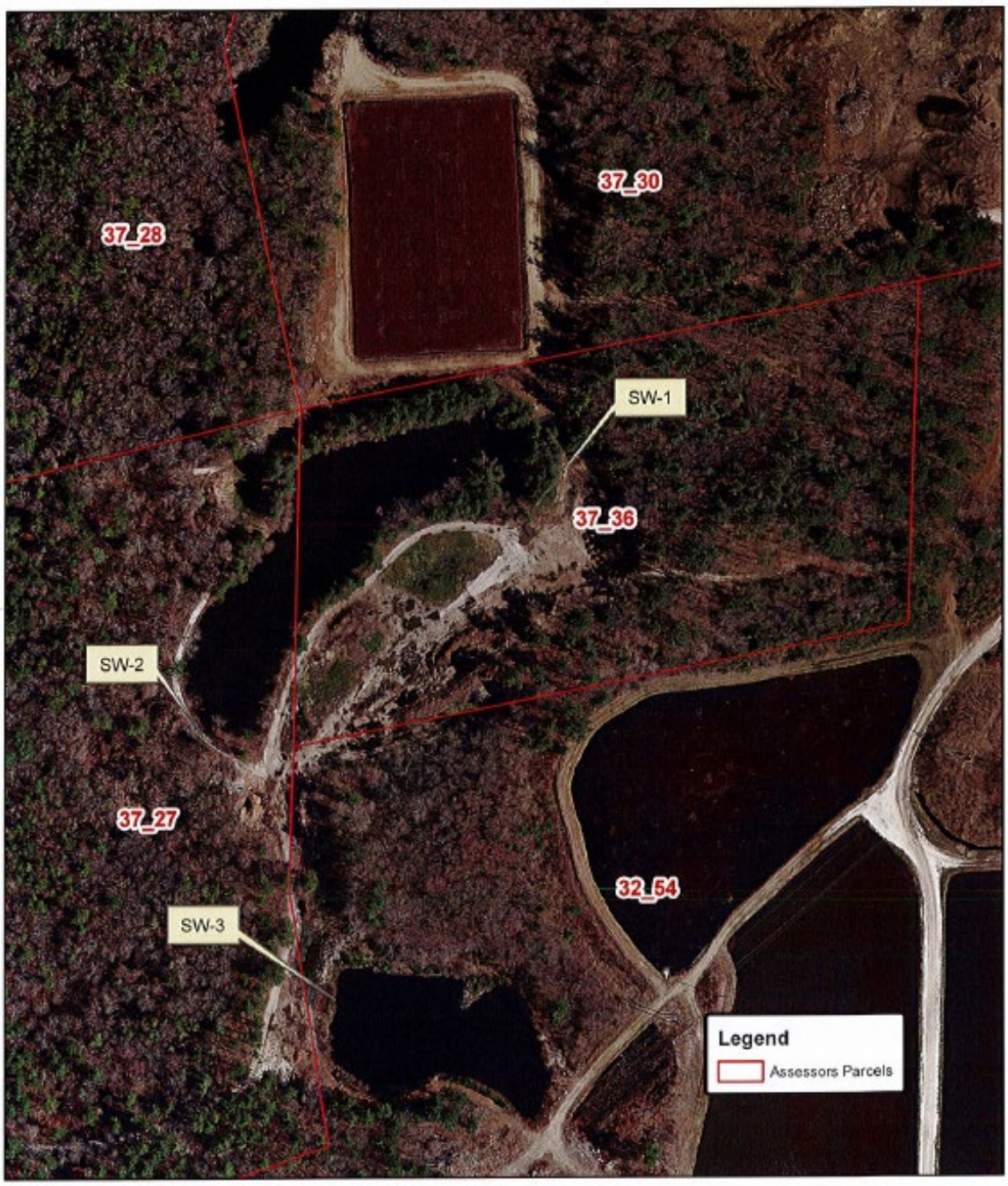


Aerial Photograph: Google 2016

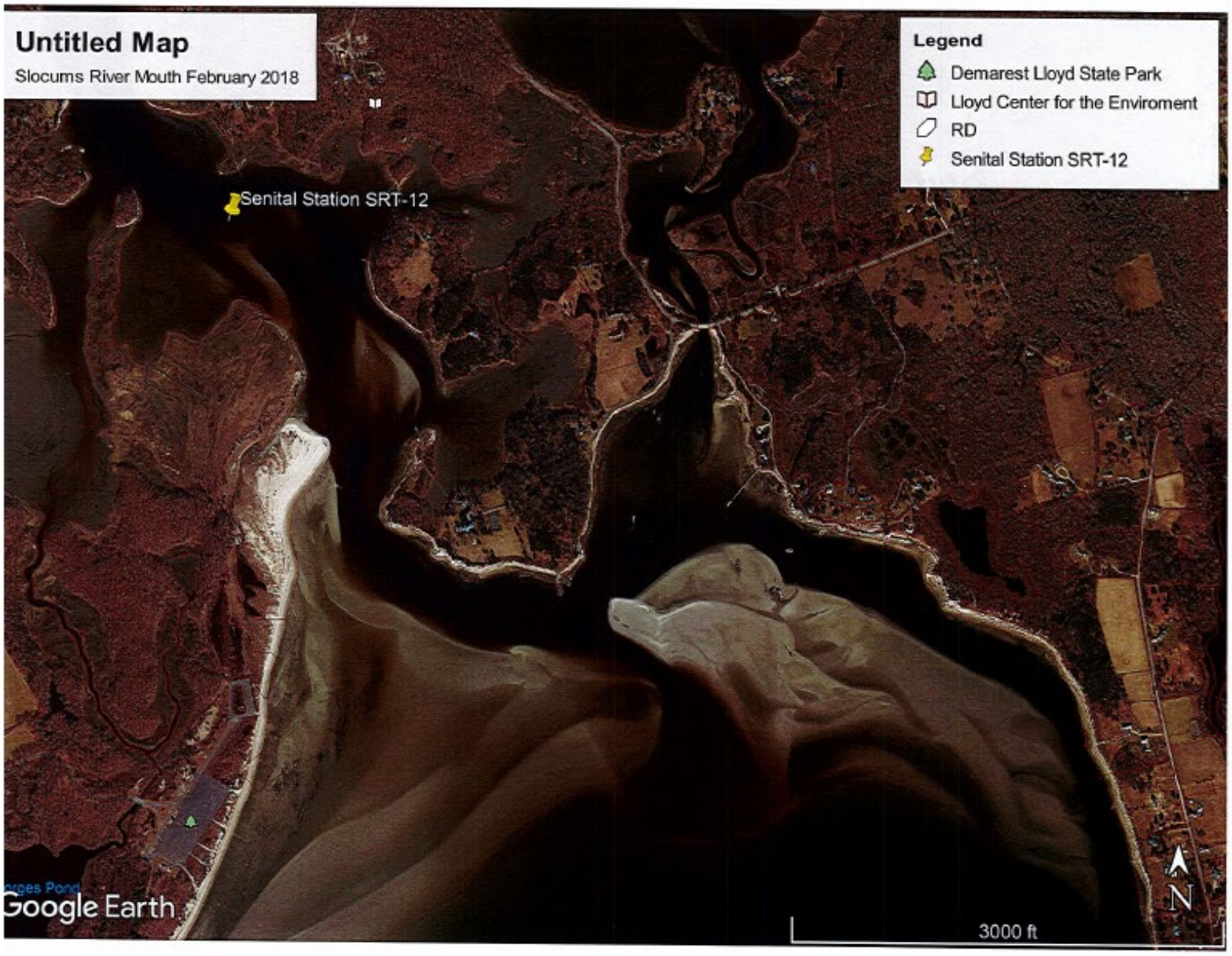
Francis Composting Operation
Surface Water Sampling Locations

Francis property - Dartmouth Assessors Map 37 Lot 36 & Map 37 Lot 27
□Owner of Record: Francis, Wilfred N. Jr Life Estate

King Fisher Corp property – Dartmouth Assessors map 32 Lot 54
□Owner of Record: King Fisher Corp

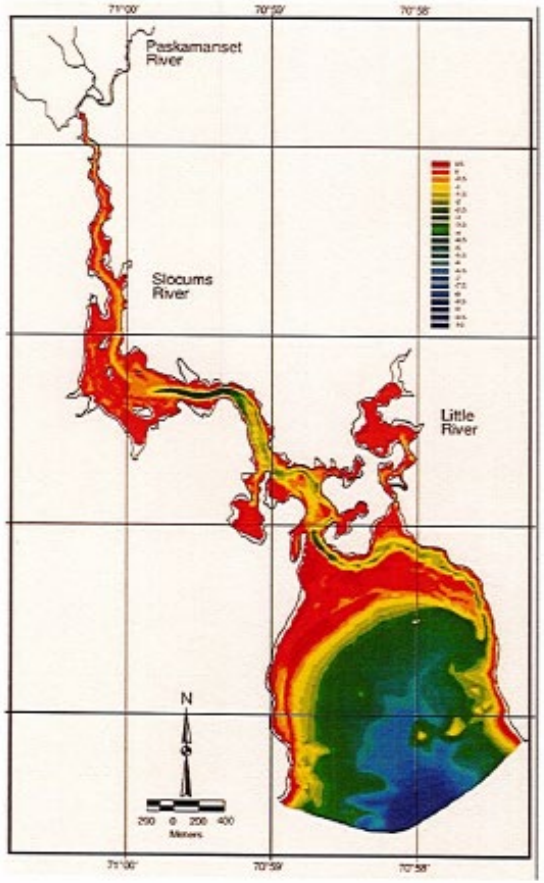


Aerial Photograph: Google 2016


Untitled Map
Slocums River Mouth February 2018
Legend
Demarest Lloyd State Park
Lloyd Center for the Enviroment
RD
Senital Station SRT-12
Senital Station SRT-12
Google Earth
3000 ft
N


Untitled Map
Slocums River Mouth February 2005
Cedar Island
Legend
Demarest Lloyd State Park
Lloyd Center for the Enviroment
RD
Senital Station SRT-12
Senital Station SRT-12
George Pond
Google Earth
MassGIS, Commonwealth of Massachusetts EOEA
U.S. Geological Survey
N
3000 ft

Slocums River Estuary (SRE) bathometry prior to 2005



SIGN IN SHEET 9/20/2018
Slocums and Little Rivers TMDL Public Meeting

	Print Name	Affiliation
1.	Michael O'Reilly	Town of Dartmouth
2.	Lynn Seymour	Dartmouth Resident
3.	Sarah Pinney	owner of Little River Realty
4.	Peg Gildersleeve	Dartmouth resident
5.	DAVID HICKOX	DARTMOUTH DPW
6.	Steve Bliven	Resident
7.	Roy E. Rece	Dartmouth Res.
8.	Sara Johnston	Dart. Res., former EPA employee
9.	STEVE MELO	Dartmouth Harbormaster & Shellfish
10.	Courtney Cohen	Dart. Board of Health
11.	Chris Michaud	Dart Board of Health
12.	KATE White	DART. Resident

SIGN IN SHEET 9/20/2018
Slocums and Little Rivers TMDL Public Meeting

	Print Name	Affiliation
13.	Felicity Hoyt	Dartmouth resident
14.	Austin Hoyt	Slocum River abutter
15.	Tally Garfield	Slocum River resident,
16.	Karin Peterson	Buzzards Bay Coalition
17.	Chloe Shelford	Dartmouth Week
18.	Margot Hand + Robert Anderson	Slocums River abutter
19	Susan Sargent / Tom Peters	Slocum River abutter
20.		
21.		
22.		
23.		
24.		