



# Assessing Stakeholder Feedback on Implementation of New Nitrogen Reducing Regulations on Cape Cod

An Interactive Qualifying Project  
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## **Abstract**

MassDEP established new regulations regarding Title 5 and Watershed Permits to mitigate nitrogen pollution on Cape Cod. This project's goal was to collect the stakeholders' suggestions on the implementation of the new regulations that were made effective July 2023. Surveys and interviews with municipalities, boards of health, non-government organizations, and residents were conducted to gather feedback. Common concerns shared by the stakeholders were needs for more funding, clearer requirements to apply for a watershed permit, and increasing outreach to the citizens on Cape Cod about the new regulations. The three recommendations were: assist in garnering more funding; create clearer guidelines for the application process; and create an infographic to explain the new regulations.

## **Acknowledgements**

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## Executive Summary

In the last century, nitrogen production has more than doubled due to human activities. A major contributor is wastewater. Nitrogen pollution from on-site sewage disposal systems, most commonly known as septic systems, is an environmental problem negatively impacting Massachusetts. For Massachusetts, Title 5 regulations (310 CMR 15.000) establish standards for septic systems for the protection of the environment and public health. The Massachusetts Department of Environmental Protection (MassDEP) has created revisions to Title 5 as well as new watershed permits (314 CMR 21.00) to address and reduce nitrogen pollution in embayment's and estuaries of Cape Cod. The new watershed permits allow the local towns with a nitrogen sensitive watershed to decide how they would like to approach reducing the amount of nitrogen in the respective watershed.

The goal of this Interactive Qualifying Project was to determine stakeholder's perspectives on the regulations, identify concerns regarding implementation, and provide MassDEP with feedback from those stakeholders on the effectiveness of their public outreach efforts. The objectives to meet this goal were to:

1. Understand the impacts of nitrogen pollution, previous regulations, and the changes made on July 7th, 2023
2. Collect data about different perceptions of the new regulations through surveys and interviews
3. Analyze feedback from stakeholders to create quantitative and qualitative data
4. Create recommendations and deliverables for MassDEP

Understanding the impact of nitrogen pollution as well as what changes were made to the regulations allowed for insightful, relevant survey and interview questions to be made to gather public opinion. Four different surveys were made for four distinct groups, including Municipalities, Boards of Health, Non-Government Organizations, and the general public. Having four distinct groups allowed for a more detailed understanding of what each stakeholder is experiencing during the implementation of the new regulations.

### **Gathering Feedback**

Over 70 stakeholders from municipalities, boards of health, and non-government organizations were emailed with an attached survey asking them to share their insights on the new regulations to aid MassDEP in the process of implementation. Multiple emails were sent to each one, including by MassDEP, in order to receive as many responses as possible. The general public was reached through flyers posted in Mashpee, Barnstable, Yarmouth, and Dennis, as well as by asking people on the street, and posting the survey on the Cape Cod reddit and Facebook pages. Surveys received a total of sixteen responses from the general public, and fifteen responses from stakeholders composed of non-government organization, municipality, and board of health members. Three stakeholders, 2 from NGOs and 1 from a BOH, were also interviewed for more insight and information on their survey responses.

### **Analyzing Collected Data and Recommendations**

Responses from each group were analyzed separately, and common concerns between all of them were derived to help categorize their feedback on the implementation of the new regulations. These common concerns were consolidated and categorized for feasibility to create a list of recommendations to the Massachusetts Department of Environmental Protection.

The main feedback from NGOs were a lack of workers and a lack of funding, difficulty explaining to the public what the new regulations are, and the long-term management of these projects. The main feedback from municipalities were how multi-town partnerships will work, other nitrogen sources not being addressed in watershed permits, and funding for the projects. The main feedback from BOH were confusion on the requirements of the new regulations, the funding of the projects, and having too much burden be placed on them to install watershed permits. The main feedback from the general public was a general level of confusion towards the new regulations and not wanting to pay for individual upgrades. The most common themes seen across the responses from all stakeholders consisted of funding, watershed permits, awareness of regulations, and workforce.

These concerns were then used to create the three main recommendations: to assist in garnering funding for the towns with affected watersheds via grants or loans, to create a clearer guideline on what the requirements are to apply for a watershed permit or to continue providing assistance to the board of health's that are still confused with the process, and to create an informative way to increase outreach to the general public, whether that is a pamphlet or a pdf that the stakeholders could spread to increase awareness of the new regulations.

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## **Chapter 1: Introduction**

Pollution, in its various forms, has become a global wide concern. Nitrogen pollution, which has a negative impact on ecosystems, ecosystem services, and the economy, is one of the most common types of water pollution. The excessive release of nitrogen, in the form of nitrates and ammonium compounds, largely comes from human activities such as agriculture, industrial processes, and most notably, sewage discharge. Massachusetts is currently facing the consequences of nitrogen pollution along its coastal areas and most notably, in Cape Cod. Cape Cod is a largely coastal area of Massachusetts that contains numerous affected watersheds. Due to Cape Cod being surrounded by marine and estuarine waters, nitrogen pollution has become a significant issue causing most of the area to be deemed nitrogen sensitive.

To mitigate these issues, the Massachusetts Department of Environmental Protection (MassDEP) has stepped in. Since around 80% of Cape Cod households use septic systems, which is the largest contributor to nitrogen pollution in the area, MassDEP has created new regulations concerning nitrogen influx from sewage discharge to watersheds. MassDEP has updated the existing regulation 310 CMR 15.000, also known as Title 5, which governs the various septic system models that homeowners may use, while also making new regulations for watershed permits, titled 314 CMR 21.00. The goal of these regulations is to limit the amount of nitrogen entering designated Nitrogen Sensitive Areas (NSA), areas where excess nitrogen in coastal embayment's and estuaries are causing ecological damage, by requiring Best Available Nitrogen Reducing Technology (BANRT). After receiving public feedback on these amendments between October 2022 and January 2023, MassDEP made the final revisions to the regulations, which went into effect on July 7th, 2023 (Title 5, 2023).

However, implementation of the new regulations is just beginning, and municipalities are still assessing their options. Implementation of these new regulations will take time, effort, planning, money, resources, and will affect all of the people who live in these NSAs of Cape Cod. MassDEP aims to gain a better understanding of the concerns of stakeholders and municipalities, along with the opportunities and barriers associated with implementation of the new regulations. This Interactive Qualifying Project will address the impacts of nitrogen pollution from septic systems in Massachusetts, specifically Cape Cod, and the concerns regarding the new wastewater regulations.

The goal of this project is to discover concerns and obstacles with the implementation of new nitrogen-reducing regulations from stakeholders and to report those concerns via recommendations to MassDEP. The objectives of this project are:

1. Understand the impacts of nitrogen pollution in Cape Cod
2. Understand the previous regulations
3. Understand the changes made on July 7th, 2023
4. Collect data about different perceptions of new regulations through surveys and interviews
5. Analyze feedback from stakeholders to create qualitative and quantitative data
6. Create recommendations and deliverables for MassDEP

The outcome of this project is to understand how different groups involved with water pollution around Cape Cod feel about the new regulations. The deliverables for this project are this technical report, a PowerPoint presentation, and a poster presentation.

## **Chapter 2: Background**

A report from the Association to Preserve Cape Cod (APCC) found that 33 out of 48 embayment's on Cape Cod need immediate restoration. The source of the pollution is primarily septic systems, which most of the Cape relies on for wastewater treatment. However, those septic systems ineffectively remove nutrients that pollute the waters (Association to Preserve Cape Cod, 2019). To gain a comprehensive understanding of this issue, it is essential to delve into three key aspects. The objectives for the background are:

1. Understand why nitrogen pollution is an issue
2. Understand previous regulations to combat nitrogen pollution
3. Understand updates to the regulations released on July 7th, 2023

This background chapter provides a review of these topics.

### **2.1: Effects of Nitrogen Pollution**

Nutrient pollution, meaning an overabundance of nutrients such as nitrogen and phosphorus, can have detrimental consequences for the environment and the economy.

#### **2.1.1: Environmental Effects of Nitrogen Pollution**

Nitrogen pollution results in contamination of bodies of water and is detrimental to aquatic ecosystems (US EPA *The Issue*, 2013). Nitrogen pollution leads to the dominance of fast-growing plants over slower, more beneficial ones, diminishing local biodiversity and facilitating the growth of invasive species (The Nature Conservatory, 2023).

Excess nitrogen is the most critical element in coastal ecosystems when it comes to nutrient pollution because it greatly facilitates algae blooms (Driscoll et al., 2003). When there are enough

nutrients available, algae grow at rapid, uncontrollable rates, resulting in a “bloom” of algae that contaminates clear water (National Oceanic and Atmospheric Association, 2014). These blooms can cause entire populations of fish to leave or die, as the algae can clog up fish gills, block sunlight, and consume oxygen at an unsustainable rate, resulting in water that can no longer support aquatic life. This is known as hypoxia—water with little to no oxygen. Water bodies may experience hypoxia briefly, while others experience it so frequently that they become dead zones. On top of killing off the aquatic wildlife, the algae can contaminate the fish still alive, making them unsafe for human consumption (Adams, 2022). The increasing amount of dead and contaminated fish can take a toll on the fishing industry, which is a large part of the Cape Cod economy.

### **2.1.2: Stakes in the Massachusetts Economy**

In 2019, Massachusetts was the second-leading state in catching lobster and the leading state in catching scallops. By 2021, the state was the second-highest contributor to the nation’s fishing industry, with a value of \$679.3 million (Raimondo et al., 2021). With such a financial reliance on the fish in the embayment’s, any problems with the water could be expensive. For example, in Long Island, a similar area to Cape Cod, tens of thousands of dead fish washed up on shore due to nitrogen pollution. The Buzzards Bay Coalition warns that this situation can happen in the Cape if nitrogen pollution is not addressed (Buzzards Bay Coalition, 2015).

A report by The University of Massachusetts at Amherst's Donahue Institute found that around 37% of Massachusetts Gross State Product and employees were from the coastal economy in 2004; \$117 billion and 1,161,326 people, respectively. In the Cape Cod National Seashore, tourists brought in \$450 million of total value and supported 6,710 jobs in 2021. The economic output was \$749 million (Cullinane, C. T., Flyr, M., & Koontz, L., 2022). All this to say that coastal

tourism is vital to not only Cape Cod, but to Massachusetts as a whole. However, with nitrogen pollution damaging the coast, tourism to the Cape takes a hit.

Coastal real estate values also decrease when the water quality is less than ideal. A study from the Cape Cod Commission found that for every 1% decline in water quality, or 1% increase in nitrogen concentration, the average home price fell 0.61% (Cape Cod Commission, 2015). The decrease in house value severely impacts the homeowners on Cape Cod and realtors whose income is tied to selling properties along the Cape.

## **2.2: Environmental Protection**

With the effects of nitrogen pollution being so detrimental, it is important to understand where it comes from. The global rate of nitrogen production has more than doubled due to human activities. A journal article published by BioScience revealed that wastewater was the major source of nitrogen loading in estuaries in the Northeastern United States (Driscoll et al., 2003).

### **2.2.1: Wastewater Treatment**

With wastewater being a major source of nitrogen loading, it is important to understand how wastewater is treated. Not all wastewater treatment methods purify water to the same extent. Some can remove more nutrients and bacteria from effluent more efficiently than others. There are two main systems for wastewater treatment: sewer systems and on-site wastewater systems. In order to monitor and reduce nitrogen pollution, it is important to understand how each system works, and the differences between how much their effluent contributes to nitrogen pollution.

Sanitary sewer systems are shared, large-scale public utility systems typically used in more urban, industrial, commercial, and densely populated areas where large volumes of wastewater are



generated. In sewer systems, main sewer lines transport wastewater from homes and other buildings to wastewater treatment plants. These plants can employ various advanced methods, such as biological and chemical processes, to treat the water from solids, pathogens, and sometimes nutrients in a tertiary level treatment. Wastewater treatment plants for public sewer systems remove nitrogen much more efficiently than septic systems and are capable of reducing nitrogen in effluent down to only 3 mg/L (Mountain Empire Community College, 2023).

Septic systems are individual wastewater treatment systems typically used in more rural or low-density suburban areas where sewer systems are not feasible. Septic systems work by treating and disposing of household wastewater through a combination of bacterial digestion and natural filtration in an underground tank and drain field. Conventional septic systems are expected to limit nitrogen in effluent to 35 mg/L, although research suggests that value is actually much higher. Some septic systems, especially those within nitrogen sensitive areas, may contain innovative or alternative (I/A) technology such as special filters that provide further purification steps to help remove more nitrogen than conventional septic systems. These technologies currently in use are expected to reduce nitrogen in effluent to 19 mg/L, which is still much more than public sewer wastewater treatment plants.

### **2.2.2: Massachusetts Department of Environmental Protection**

The Massachusetts Department of Environmental Protection, commonly referred to as MassDEP, is one of many agencies overseen by the Executive Office of Energy and Environmental Affairs. MassDEP's mission is “to protect and enhance the Commonwealth's natural resources—air, water, and land—to provide for the health, safety, and welfare of all people in Massachusetts; and to ensure a clean and safe environment for future generations” (Mass.gov, 2021). They are part of

six departments overseen by the Secretary of Energy and Environmental Affairs, who is appointed by the governor.

MassDEP's regional offices are "the focal point for most MassDEP permitting, compliance, enforcement, emergency response and site cleanup activity that protects Massachusetts citizens and their environment on the local level" (Commonwealth of Massachusetts *About MassDEP*, 2021). MassDEP is also the source of all environmental concerns and aids, where environmental laws are made to help out the environment, including regulations with waste site cleanups, recycling, and federal water statutes (Commonwealth of Massachusetts *MassDEP Laws*, 2021).

MassDEP plays a vital role in addressing nitrogen pollution concerns. They regulate everything related to septic and sewer overflows and systems in Massachusetts to ensure compliance with the Massachusetts Clean Water Act requirements and regulations for water quality certification (Commonwealth of Massachusetts *Sanitary Sewer Systems*, 2021). They also inform the public of any untreated sewage flows into the water supply, whether accidental or not.

### **2.2.3: Title 5 (310 CMR 15.00)**

310 CMR 15.000: Septic Systems ("Title 5") is a Massachusetts regulation on septic systems. Title 5 was originally created in 1978 by the Massachusetts Department of Environmental Protection, previously known at the time of creation as the Massachusetts Department of Environmental Quality Engineering. Since its creation, Title 5 has undergone numerous revisions, including a complete rewrite in 1994, and subsequent updates in 1995, 1998, 2006, 2016, and most recently in 2023 (310 CMR 15.00, 2016). These amendments have focused increasingly on environmental protection in the regulation of septic system design and implementation. As explained in the 2016 Title 5 amendment:

The purpose of Title 5, 310 CMR 15.000, of the State Environmental Code is to provide for the protection of public health, safety, welfare, and the environment by requiring the proper siting, construction, upgrade, and maintenance of on-site sewage disposal systems and appropriate means for the transport and disposal of septage (310 CMR 15.00, 2016).

Title 5 includes regulations regarding septic system construction, installation, upgrades, maintenance, and inspection. It addresses construction location considering proximity to pavement, buildings, wells/public drinking water, depth underground and accessibility, as well as environmental factors including velocity zones, floodways, nitrogen sensitive areas, and soil profiles. Septic system design is also strictly regulated based on the size of the facility that it's meant to serve, with specific criteria for design flow, tanks and pipes sizes, maximum daily capacity, and requirements for multiple compartments (310 CMR 15.00, 2016).

### 2.3: New Regulations

Numerous areas of Cape Cod, as displayed in Figure 1, are considered nitrogen sensitive based on scientific evaluation. Nitrogen sensitive areas (NSA) are areas that have “logged so much nitrogen that they do not meet Massachusetts water quality standards,” and can lead to negative impacts like water pollution or ecosystem disruption (Town of Mashpee, n.d.). Due to the harmful effects of nitrogen pollution,



Figure 1: The places in green are the Nitrogen Sensitive Areas being targeted by the new regulations

MassDEP has developed new regulations to reduce nitrogen influx and enhance environmental protection. With these new regulations, each municipality within an NSA has a specific amount of nitrogen they need to remove, determined by MassDEP as necessary to meet Surface Water Quality Standards, 314 CMR 4.00. There are two options to remove nitrogen: either through upgrading septic systems or upgrading watersheds. The municipalities are given two years to state that they will apply for a watershed permit to MassDEP. If they do, that municipality has five years following the initial two-year period to apply for a watershed permit. If they do not give a notice of intent, then the homeowners in their respective area will have five years to upgrade their septic systems.

### **2.3.1: Title 5 Amendments**

On July 7th, 2023, the new Title 5 regulations MassDEP had been drafting over several years became amended and effective. Due to Cape Cod's decentralized nature and dense population, the percentage of households that use septic systems is approximately 80-85%, but can be higher depending on region demographics, infrastructure, and local regulations (Walton, 2016). Due to the high amount of nitrogen pollution from septic systems, these new amendments create a higher standard for new and existing septic systems within designated NSAs in order to reduce the amount of pollution from the effluent. These new Title 5 amendments will require homeowners to upgrade their septic systems to comply with the new regulations through integrating innovative alternative systems that are certified by MassDEP. These alternative systems are called Best Available Nitrogen Reducing Technology (BANRT) (310 CMR 15.00, 2023).

Ideally, BANRT is defined as systems that have a total nitrogen effluent performance value equal to or less than 10 mg/L. In other circumstances, one can make upgrades from a conventional

septic system to an innovative/alternative system instead. These systems can be used to provide on-site sewage disposal differently than conventional systems or can provide enhanced treatments to the disposal. Any units that provide additional treatment such as enhanced nitrogen removal are types of alternative systems. (310 CMR 15.00, 2023).

### **2.3.2: Watershed Permits (314 CMR 21.00)**

Reducing nitrogen in watersheds is a key focus of the new regulations proposed by MassDEP. A watershed is an area of land where rainfall, runoff, and groundwater enter a lower common body of water. They are highly affected by nitrogen pollution since contaminated groundwater will travel via the watershed area and flow into the embayment's and estuaries, bringing nitrogen to rivers, lakes, bays, and the ocean.

One of the largest additions to the new amendments are the new watershed permits. Watershed permits may be applied for by the local municipalities that contain nitrogen sensitive areas. Watershed permits are the counter option to the new septic system regulations. Instead of requiring the homeowners in the nitrogen sensitive areas to upgrade their personal septic systems to comply with the new regulations, municipalities can apply for a watershed permit instead.

A watershed permit is a permit from MassDEP given to municipalities that prove that they have a plan to meet the Total Maximum Daily Load that lasts up to twenty years. The first step for a municipality to get a watershed permit is to give a Notice of Intent (314 CMR 21.00). Any coastal community in Massachusetts can apply for a watershed permit. Once a Notice of Intent is given, that Local Government Unit will have to apply for a watershed permit. MassDEP will then approve or deny giving that government unit a watershed permit and once they are approved, that town will then be required to fulfill that model they drafted.

The municipalities are given two years to state that they will apply for a watershed permit to MassDEP. If they do, that municipality has five years to apply for a watershed permit. If they do not give a notice of intent, then the homeowners in their respective area will have five years to upgrade their septic systems.

In terms of effectiveness at nitrogen reduction and meeting surface water quality standards, watershed permits beat individual septic system upgrades. Not only will they cost less in the long run, but also remove more nitrogen than septic system upgrades. This also reduces the financial burden from individual homeowners to the municipality.

### **2.3.3: Initial Feedback and Revisions**

MassDEP has received a round of over a thousand comments prior to the release of the amendments. These comments were collected through over 45 public meetings, 3 legislative briefings, 5 public hearings, and 32 municipalities meetings across Cape Cod. Numerous stakeholders also provided feedback to MassDEP (*MassDEP Natural Resource Amendments*) (*MassDEP Frequently Asked Questions*).

Comments wanted more focus on Cape Cod to allow non-Cape Cod municipalities to be given more time for planning. MassDEP limited NSA designations to amend this concern. It was also clarified that Necessary Nitrogen Load Reductions are the focus on watershed permits. De Minimis Nitrogen Load Exemption was also created, allowing municipalities to not be required to remove nitrogen when the cost is high and the environmental benefit is low.

Municipalities mainly requested more clarification for the application expectations and time. Their main concerns were not having enough time to decide to and create an application with the right information. The deadlines were extended and the expectations were clarified. Instead of

eighteen months to provide a notice of intent, municipalities now have two years to, and the timeline required for Title 5 upgrades only commences after two years. To lessen administration burdens, municipalities with multiple watersheds only need to apply for one watershed and need to provide five-year reports instead of one annual (MassDEP *Response to Comments*, 2023). Furthermore, joint watershed permits were created for municipalities with shared watersheds, with an agreement for the share of pollution load reduction stated for each municipality (MassDEP *Natural Resource Amendments*) (MassDEP *Frequently Asked Questions*).

Moreover, towns already working on reducing nitrogen pollution, specifically with a Comprehensive Wastewater Management Plan or Targeted Watershed Management Plan will receive help from the MassDEP to aid in integration to meet criteria for a Watershed Management Plan; as these towns feared the new regulations will slow down their process (MassDEP *Natural Resource Amendments*, 2023) (MassDEP *Frequently Asked Questions*, 2023). Additional solutions take the form of changing the WMP to be more flexible and the exemption for previously installed nitrogen removal systems was increased from one to ten years.

Particular concerns about Best Available Nitrogen Reduction Technology (BANRT) were also brought up. The definition for BANRT was broadened to avoid potential monopolies with the technology. Additionally, It was clarified that recirculating sand filters do not count as BANRT for natural resource area NSA but will remain for drinking water NSA. That being said, in the case of overlapping between the two areas, BANRT is required (MassDEP *Response to Comments*, 2023, 2023).

For individual septic system upgrades, cost concerns arose. MassDEP has pointed to some funding options including the Community Septic Management Loan Program. Clarification was also provided on when septic systems have to be upgraded; after the two-year notice of intent

period expires and the municipality has not filed, a five-year mandatory upgrade period begins (MassDEP *Natural Resource Amendments*, 2023) (MassDEP *Frequently Asked Questions*, 2023).

#### **2.4: Background Conclusion**

Although naturally found in water bodies, excess nitrogen can cause detrimental effects to the environment and the economy. The leading source of nitrogen pollution in the northeastern United States is wastewater, especially from septic systems since effluent from septic systems is not treated as well as the wastewater in public sewer systems. Septic systems are fully regulated under Title 5 (310 CMR 15.00) regulations, which are controlled and enforced by the Massachusetts Department of Environmental Protection. Cape Cod has 31 watersheds designated by MassDEP as Nitrogen Sensitive Areas, meaning that they are especially sensitive to nitrogen pollution and the consequences they pose due to high nitrogen influx. Due to the area's nitrogen sensitivity, and the high percentage of septic systems used for wastewater treatment in the area, MassDEP has revised Title 5 regulations and introduced watershed permits as an attempt to limit nitrogen influx into Cape Cod to better protect the environment. However, implementation of these new regulations requires a lot of time, money, resources, and planning, and it will affect tens of thousands of people.



## **Chapter 3: Methodology**

Our team worked on this project for seven weeks in the fall of 2023 with the objective of creating recommendations for MassDEP and a developing project report in order to help inform others of the stakeholder perspectives regarding the implementation of new regulations. Our goal was to help with the implementation process by understanding how stakeholders and the general public feel about the new regulations regarding Title 5 and watershed permits. In order to make these recommendations, our project elicited stakeholders, gained data regarding their opinions, and analyzed the results to provide insight into their challenges and concerns with consideration to their role and background. Our methods of data collection included surveys and interviews.

### **3.1: The Objectives**

The goal of this Interactive Qualifying Project was to work with MassDEP to advise implementation on their Title 5 amendments to reduce nitrogen pollution off the shores of Massachusetts. In order to achieve this goal, these objectives needed to be reached:

1. Review and understand the new regulations regarding nitrogen pollution in Cape Cod.
2. Decide who would be a good candidate for surveys and interviews and create the specific surveys and interviews for each group.
3. Send out surveys and conduct interviews.
4. Collect and analyze the data from survey responses.
5. Consolidate data into qualitative and quantitative data to help create and present recommendations to our sponsors and IQP group.

### **3.1.1: Understanding the New Regulations**

To achieve the final goal of this project, which is to learn about public concerns and create recommendations for MassDEP, it was crucial to first understand several key components. First, we had to grasp the big-picture issues at hand that MassDEP is trying to solve with these new regulations, being nitrogen pollution and its harmful effects. We then had to evaluate these new regulations and understand what changes and challenges they posed, as well as exactly how they would address the overarching problem. To do this, extensive research was done and multiple MassDEP documents and news articles were read by the team, as well as the official MassDEP regulations, and public comments and responses.

All of this information enabled us to create relevant in-depth questions to ask on surveys to get a good understanding of public opinion. Additionally, this allowed us to conduct competent interviews with in-depth conversations and follow up questions for the interviewee whose job deeply involves these new regulations. This data allowed us to make insightful recommendations based on the public's concerns.

### **3.1.2: Drafting Surveys and Interview Questions**

Not every resident of Cape Cod may be fully aware or knowledgeable about the new regulations and watershed permits being imposed on Cape Cod. In order to receive helpful and insightful feedback, the right people needed to be reached. It was determined that there were four distinct groups as potential surveyors who could give us great insights: municipalities, boards of health, non-government organizations, and the general public. As a result, four different surveys were drafted for each group of potential surveyors in order to tailor questions to each group's unique position or areas of expertise. For example, municipalities were asked about applying for watershed

permits since they are the ones who would be doing so. Each survey had contained background on the project and the survey itself, with assurance to the surveyors that they were completely anonymous and contained a box for the surveyor to sign off on.

Survey questions were all first drafted as open-ended, open-response questions. However, because completing a survey with full open-response questions can be time consuming and uninviting, many of the questions were converted into multiple choice or net promoter score questions. Not only did this make the survey quick and inviting to increase the likelihood of more people taking it, but it also provided more easily comparable responses and quantitative data. The original open-response survey questions were then used during the interviews instead to receive a more in-depth and thoughtful response than they got from the surveys. More interview questions were also drafted based on research on the interviewee and their exact work and expertise, as well as the interviewee's responses to the surveys. During the interview, these questions served as a guide to the conversation, and the open-endedness allowed the interviewee to have control over topics, as well as a natural flow of conversation. Appendix A is the interview consent form that was drafted, and Appendix B is the survey introduction and consent form drafted. Appendixes C - F are the specific surveys sent out to each group.

### **3.1.3: Sharing Surveys and Interview Process**

MassDEP provided an extensive list of contacts for each of the municipalities, non-government organizations, and boards on health on and around Cape Cod to survey. All the contacts MassDEP provided were emailed, asking them to partake in our research with a link to the survey attached. Since the general public's information is private, a trip was made down to Cape Cod to speak with them and share the surveys in person instead. A total of twenty flyers, which can

be seen at Appendix G, containing a QR code to the survey were posted in various stores, libraries, town halls, and post offices of four different towns in Cape Cod, including Mashpee, Barnstable, Yarmouth, and Dennis. For each group, the survey taker was asked on the survey to show their interest (or lack of) for an interview. People who showed interest in being interviewed gave their contact information and were put in a list for potential interviewees. Interviewees were decided based on research on their organization's specific insights, goals and projects, as well as how they responded to the survey. Those with different or opposing views made good candidates for interviewees to get as much insight, ideas and concerns discussed as possible and reduce any form of bias from similar chosen interviewees.

Some NGOs were reached through email with the goal of having interviews as well. The Association of Cape Cod, for example, was directly asked for a meetup and interview as they agreed with MassDEP to show the students around the area. After establishing interviewees, an email was sent and a meeting time was set up to be either in person or on zoom. Interviews were designed to take no more than an hour, using the interview questions as a guide to get a deeper view of their own personal view and concerns. An interview consent form was sent to the interviewee prior to the interview. If given consent by the interviewee, the interview was recorded and a transcript was made. If no consent to record was given, extensive notes were taken during the interview to gather data.

#### **3.1.4: Collecting and Analyzing Survey Results**

The survey responses were recorded on Qualtrics and were exported to an excel sheet. Some surveys, specifically the Board of Health and municipalities survey, were categorized into on-Cape and off-Cape. Survey questions were also categorized into general topics, such as general support

and concerns. All surveys included multiple choice and net promoter score questions. These questions provided analytical, numerical data on how the surveyors feel about things like the significance of nitrogen pollution and the development of the new regulations and permits. Some of these responses were displayed in graphs and tables. This provided us with the overall sense of the general feelings and opinions of the public towards the new regulations. The rest of the open-response questions, as well as the interview questions, provided a deeper explanation of why they feel how they feel about the new regulations, what concerns or ideas they may have and what MassDEP could potentially do better.

### **3.1.5: Consolidating and Presenting Data**

Responses from surveys and interviews were categorized into groups based on different factors, such as the popularity of each concern or idea mentioned. Recommendations for MassDEP were made in order of most popular views to least popular views. The recommendations were then sent to MassDEP and consolidated into our final presentation, final report, and final poster.

### **3.3: Summary**

From August 24th to October 13th, we had seven weeks to complete our project goal and objectives. The surveys and interviews provided a good indication on how different groups of people feel about the new regulations regarding the septic systems and watersheds. With these observations, we put together a list of recommendations and comments for MassDEP for future regulations. We made this report, a PowerPoint presentation, and a poster for our IQP deliverables.

## **Chapter 4: Results and Findings**

This chapter provides the surveys and interviews results related to the stakeholder perspectives on the new regulations. For the purposes of this presentation, the data we collected from our surveys and interviews is split into 4 main stakeholder groups: non-government organizations, municipalities, boards of health, and the general public. Results were also organized into categories based on questions, such as general support and concerns. Interview responses were analyzed separately from surveys.

### **4.1: Non-Government Organization (NGO) Results**

Non-Government Organizations provided 5 survey responses, with two of the respondents agreeing to be interviewed. This section separately summarizes the surveys and interviews.

#### **4.1.1: Non-Government Organization (NGO) Survey Results**

Out of the 10 non-government organizations that the survey was sent to, 4 different organizations responded to the survey. The survey received 5 NGO responses in total, with 2 being from The Nature Conservatory.

##### **4.1.1.1: Perspectives on Nitrogen Pollution**

Non-government organizations unanimously agreed that nitrogen pollution is a big concern for Cape Cod. Due to this concern for the environment, when asked if they believe the NSA should be extended or reduced, 3 out of the 4 people who responded said it should be extended, while the other said it should remain the same. Each organization that took the survey also agreed that watershed permits are the better option for municipalities. However, one noted that neither option is

technically “better” than the other, and that they would need to work together in order to achieve the desired results as different options will work better in different places.

**4.1.1.2: General Feelings Towards New Regulations**

When the NGOs were asked to rank their opinions on the new regulations, the mean rank was a 7.6 with a minimum of 3 from the Cape Cod Realtors Association, and a maximum of 10 from the Association to Preserve Cape Cod. The ranking of 3 was quite different from the others and if it were not included, the mean score would be an 8.75 with a minimum of 8. As displayed in Table 1, each NGO gave a similar ranking to how well of a job they feel MassDEP did with addressing initial concerns. Cape Cod Realtors Association ranked a 2, Association to Preserve Cape Cod gave them a 10, and the others ranked them a 7, resulting in a mean score of 6.6.

Table 1: NGO scores on new regulations and concerns

NGO	Rank on new regulations (0-10)	Rank on how well concerns were addressed (0-10)
Cape Cod Realtors Association	3	2
Buzzards Bay Coalition	8	7
The Nature Conservatory	8	7
The Nature Conservatory	9	7
Association to Preserve Cape Cod	10	10

**4.1.1.3: NGO Concerns**

The most common concern expressed by non-governmental organizations about implementation was a lack of resources or workers. Figure 2 displays the frequency of specific concerns among the NGO survey participants.

Three respondents expressed concerns that were not specifically listed in the survey. These 3 respondents specified that their worry was that towns might not treat nitrogen pollution seriously,

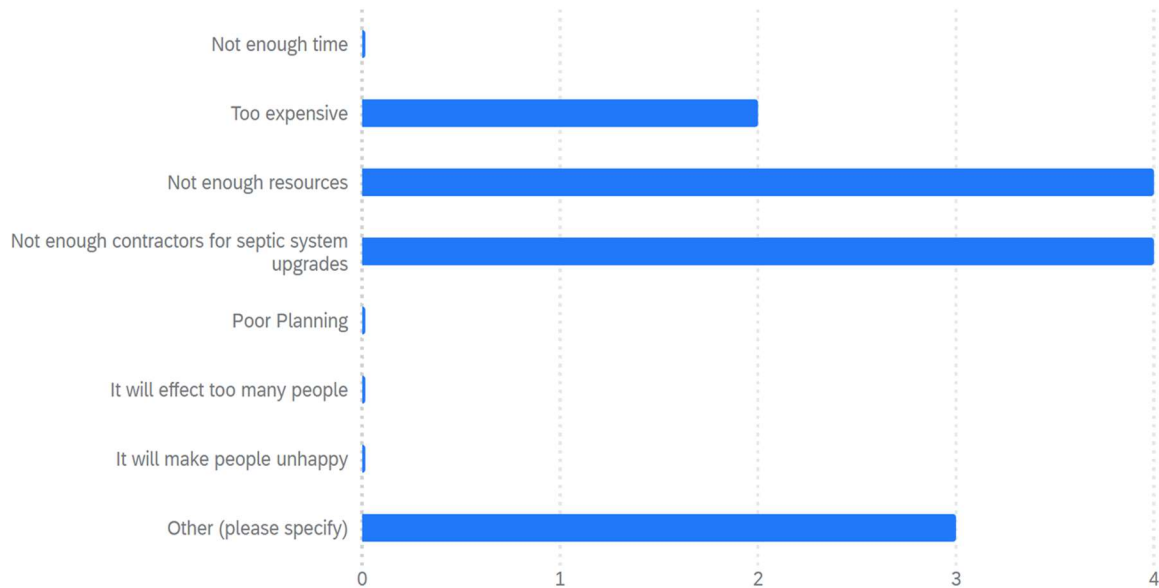


Figure 2: Graphs of NGO responses to the question asking about what concerns they may have about the new regulations.

potentially opting for the Title 5 alternative instead of putting in the necessary effort to combat it.

They are concerned that Title 5 upgrades will result in septic systems still not being managed in the long term, which will not help with the pollution problem. Two NGOs believed that there's not enough information on I/A septic systems, and that using the unproven technology will delay actual effective measures from being taken. These concerns stem from another concern that the problem of nitrogen pollution is so severe that it should have been addressed a long time ago, and that it may even be too late now.



#### **4.1.2: Non-Government Organization (NGO) Interview Results**

Four of the 5 NGO respondents expressed interest in being interviewed. Two of the NGO's, the Buzzards Bay Coalition, and the Association to Preserve Cape Cod, were interviewed to further understand their responses.

##### **4.1.2.1: Association to Preserve Cape Cod Interview Data**

The interviewee from the Association to Preserve Cape Cod was concerned that upgrading all the septic systems would not be good enough for nitrogen reduction and it does not make sense to make the public pay for something that does not work properly. When asked if they believe the regulations would be effective in the long term, they stated that the regulations would not result in wide scale nutrient management until the mid-2040's, and the best course of action would have been to regulate them 3 decades earlier. This, they stated, was due to the vast size of the areas affected and amount of financing and pipes to be put in the ground. When asked about their opinions on the regulations, the interviewee declared that the new regulations were a very thoughtful, intelligent strategy by MassDEP to change the dynamics around how this topic tends to play around town meetings.

##### **4.1.2.2: Buzzards Bay Coalition Interview Data**

The interviewee from the Buzzards Bay Coalition was concerned about the long-term management for every single septic system at once. They stated that most homeowners were not used to managing their septic systems on their own and there needs to be someone in charge that can make sure each individual septic system works properly with an entire management structure. When asked about the new regulations, the interviewee expressed that the biggest fear of the municipalities is being held accountable because violating the permits means they are subjected to lawsuits. They also stated that there is not enough federal money for infrastructure and that parts of

the Cape have been developed without proper infrastructure. These expensive parts desperately need to be reengineered and need much more federal support to offset the cost from municipalities.

## **4.2: Municipality Survey Results**

Thirty-five municipalities were contacted for surveys. Of the municipalities the survey was sent to, 6 people responded. Among the 6 respondents, one expressed interest in an interview, but was unable to participate due to time constraints.

### **4.2.1: Perspectives on Nitrogen Pollution**

Municipalities unanimously agreed that nitrogen pollution is a concern to Cape Cod, with the lowest ranking of the issue on a scale of 0-10 being a 7, the highest (and mode) being a 9, and the average score being an 8.6.

### **4.2.2: Watershed Permit Process**

In order to better understand the municipalities feedback, survey results were split up between on-Cape and off-Cape municipalities. Only 3 on-Cape municipalities responded to the survey, and 2 were from the same town. Responses about watershed permits from these 3 respondents are displayed in Table 2. All 3 respondents reported that they plan on applying for a watershed permit, and that their decision is supported by the different communities represented by the municipalities (e.g., residents, boards of health, other select boards). However, despite expressing high confidence in the process, only 1 of the 3 on-Cape municipalities reported to have a good understanding of the process of applying for the watershed permit, and only 1 was fully comfortable with the timeline provided.

Table 2: Municipalities plans, understanding, and comfort with watershed permit applications

On-Cape Municipality	Applying for watershed permit	Supported decision	Understanding of process	Comfortable with timeline
Falmouth	yes	yes	yes	Only for Notice of Intent, not for implementation
Chatham	yes	yes	no	Yes, but confused on what happens if NOI is not issues by Jan. 7, 2024
Chatham	yes	yes	no	Yes

#### 4.2.3: Municipality Concerns

Aside from the timeline for implementation, another large concern voiced by the municipalities was a worry of meeting the requirements set forth by MassDEP. One respondent noted that they felt added pressure to sewer the entire town and another respondent felt like the push for these regulations was rushed and that there was not enough time or desire to implement the best technology for nitrogen reduction. The municipalities also shared a common interest in wanting more funding for the projects since cost is still a high concern. Other concerns that were mentioned were watersheds not being bounded to town borders, causing there to be a reliance on town interaction and finding a common agreement on how to handle their respective watershed permit, the lack of workforce to both handle the amount of legal work needed to create their watershed permits and to carry out the implementation of their watershed permits, and the concern of other sources of nitrogen pollution such as fertilizer not being included in the new regulations.

### 4.3: Boards of Health (BOH)

Boards of Health (BOH) provided 4 survey responses, with one respondent agreeing to be interviewed. This section separately summarizes the surveys and interviews.

#### 4.3.1: Boards of Health (BOH) Survey Results

Out of the 35 Boards of Health (BOH) that were contacted, 4 people responded to the survey. However, one of the respondents only answered one question about their concern towards nitrogen pollution.

##### 4.3.1.1: Perspectives on Nitrogen Pollution

The BOH members showed a high level of worry about nitrogen pollution along the coast. When asked to rate how much of a concern they believe nitrogen pollution is on a scale of 0-10, 0 being not concerned and 10 being a large concern, the average rating was a 7.25 with a minimum of 5 from an off-Cape board, and a maximum of 9. As displayed in Figure 3, when asked about the borders of the new

regulations, 2 responded saying that the area of coverage should stay the same, with 1 saying it should be expanded.

None of the respondents voiced the idea of reducing the area covered.

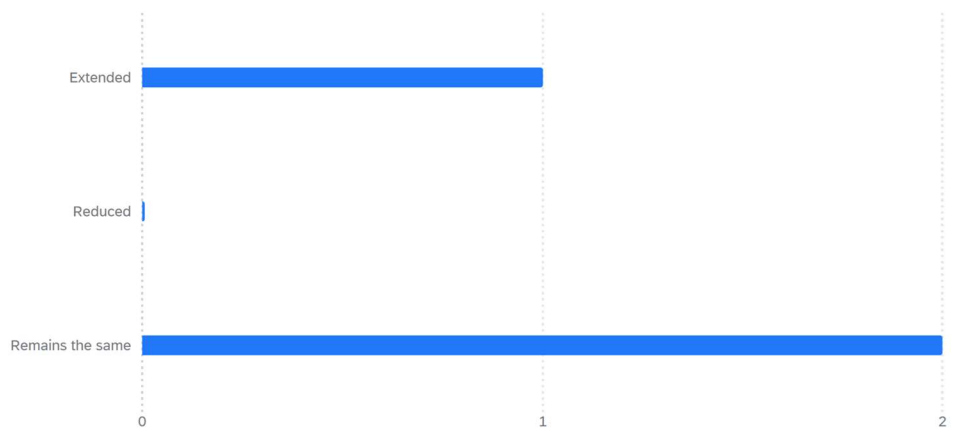


Figure 3: BOH responses to the question asking if the Nitrogen Sensitive Areas should be extended

#### **4.3.1.2: General Feelings Towards New Regulations**

Opinions towards the new regulations were quite mixed within the boards of health, as displayed in Table 3. Despite this mix, the boards of health had the least support and most amount of concerns towards the regulations out of all the stakeholder groups. When BOH members were asked to rate how they feel about the Title 5 revisions on a scale of 0-10, with 0 being unhappy and 10 being very happy, the average score out of the 3 respondents was a 5.33. Similarly, when asked to rate how much they felt that the new regulations would help with reducing nitrogen pollution, the average ranking was 5.66. For the final 0-10 scale ranking on the survey, the BOH members were asked how well they felt that MassDEP addressed their initial concerns with the final draft of the new regulations, and the average rank was a 4.

Table 3: BOH scores on new regulations, nitrogen reduction, and concerns

BOH	Rank on new regulations (0-10)	Rank on effectiveness of nitrogen reduction (0-10)	Rank on how well concerns were addressed (0-10)
Nantucket	5	7	0
Aquinnah	8	5	5
Brewster	3	5	7

#### **4.3.1.3: BOH Concerns**

When the BOH members were asked about the new regulations, they voiced many challenges and concerns. One area of great concern regarded funding. When asked to express what could help with the funding issue, the two of the BOH members agreed that the government should provide more funding for the town projects. One respondent believed that programs like SAPHE, a governmental grant program, were beneficial but did not provide enough funding for the proposed projects.

Another great area of concern is regarding the efficacy of the proposed technologies, as two different respondents had mentioned efficacy in multiple survey sections. They believed that implementation of the new regulations would not be effective enough and that MassDEP needs to establish realistic benchmarks in order to achieve measured improvements. The two respondents also voiced that there is not enough evidence for them to believe that the amount of money asked to spend will be worth what the output is of these watershed projects.

Two respondents were concerned that there are not enough workers and staff to be able to handle the workload that is being created by this project. They believe that MassDEP is overloading them with tasks that they have to resolve on their own. Solutions like helping them with drafting watershed permits and being clearer on the guidelines would be helpful in burdening the workload. On top of wanting clearer guidelines, the respondent expressed wanting a clearer definition on BANRT, the technology that is approved by MassDEP in the new Title 5 amendment.

Another respondent was highly concerned about the jurisdiction regarding other nitrogen sources, including fertilizer and pesticide usage. They felt that MassDEP needs to allow them to have more power to regulate it for their town's specific needs when asked if they feel that these regulations would help reduce nitrogen pollution.

#### **4.3.2: Boards of Health (BOH) Interview Results**

Of the 4 Board of Health members who responded to the survey, 2 expressed interest in being interviewed. One member of an off-Cape BOH was reached out to and interviewed for more information.

The off-Cape BOH interviewee expressed concern over funding for the homeowners if they were required to upgrade their individual septic system. They believed that there should be more

programs to help them be able to afford the upgrades, like the tax reduction or low-rate loans that are being fought for. This concern compounded with their shared worry that there is not enough evidence to be spending this much money on these solutions shows that the cost is a high concern of theirs. Money, however, was not the only resource they were concerned about not having enough of. They shared that there are not many workers at BOHs, and that there is a lot being asked of them to do in regard to the new regulations.

The final main topic expressed by the interviewee was that other sources of nitrogen pollution are too difficult to regulate. They felt that fertilizer and pesticide usage is a big contributor to the overall nitrogen pollution and that it being omitted from the watershed permits is a detriment to the setup. They would prefer them to be included in order to give more jurisdiction to the BOH when it comes to regulating fertilizer and pesticide usage.

#### **4.4: General Public Survey Results**

The general public survey received 16 responses. Out of the 16 respondents, 1 expressed interest in being interviewed, but they were not contacted due to their lack of knowledge on the subject.

##### **4.4.1: General Perspective on Nitrogen Pollution**

When it comes to the public's general concerns towards Cape Cod's environmental health, all survey respondents expressed some level of concern, as shown in Figure 4. All respondents similarly agreed that they believe the environmental health of Cape Cod can also impact its economic and overall well-being.

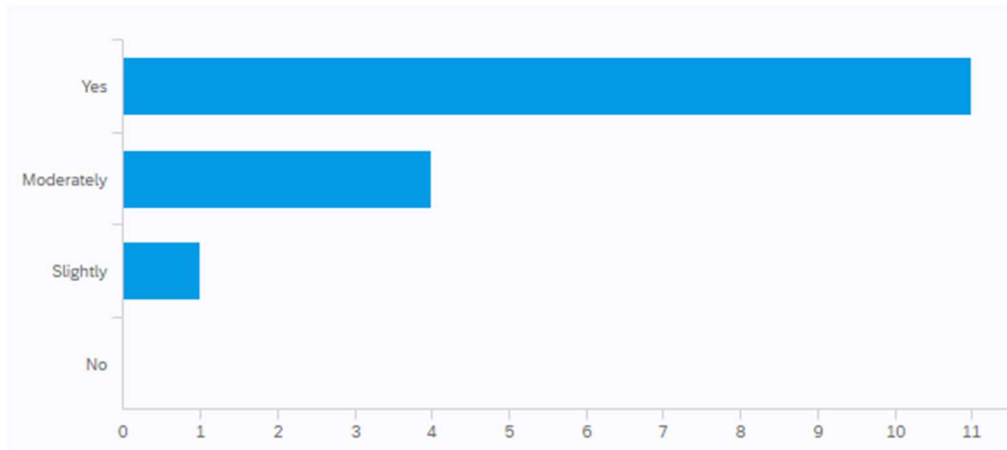


Figure 4: General public’s survey responses to whether or not they are concerned about the environmental health of Cape Cod.

**4.4.1.1: General Support for Regulations**

When the general public was asked if they support the new regulations, 18.75% of respondents answered no, 18.75% answered yes, 12.5% said somewhat, and 50% either didn’t know, or didn’t answer. However, the general public had the least knowledge out of all the groups surveyed. On a scale of 0-10, 1 being none, and 10 being expert, only 3 out of 16 people ranked their knowledge about the new regulations as a 5, or “somewhat,” or above, and 50% of respondents reported to have never even heard of the new regulations prior to taking the survey. The mean rating of knowledge was a mere 2.86, with a minimum of 0 and maximum of 7.

To get a better understanding of the public’s support (or lack thereof), based on their knowledge level, data was split up between those who ranked their knowledge above the average and those who ranked below the average. No correlation was found between higher vs lower knowledge of the regulations and their support (or lack thereof) for the regulations. Ten out of the 16 people who took the survey ranked their knowledge below the average. Despite their lack of knowledge, 1 of those 10 people said they did not support the new regulations, 2 said that they



somewhat supported them, and 7 said they were unsure. Out of the 6 people whose knowledge rating was above the mean, 3 said that they support the regulations, 2 said they do not, and 1 was not sure.

#### **4.4.1.2: Public Concerns**

The general public's responses were very split regarding their cost concerns. As displayed in Figure 5, although levels of concern were mixed, 6 people expressed at least some concern about their out-of-pocket costs. However, when asked about their concern about watershed permits affecting local taxes, only 1 person said they were concerned, while 5 people said they were not concerned, and 5 people said they were unsure.

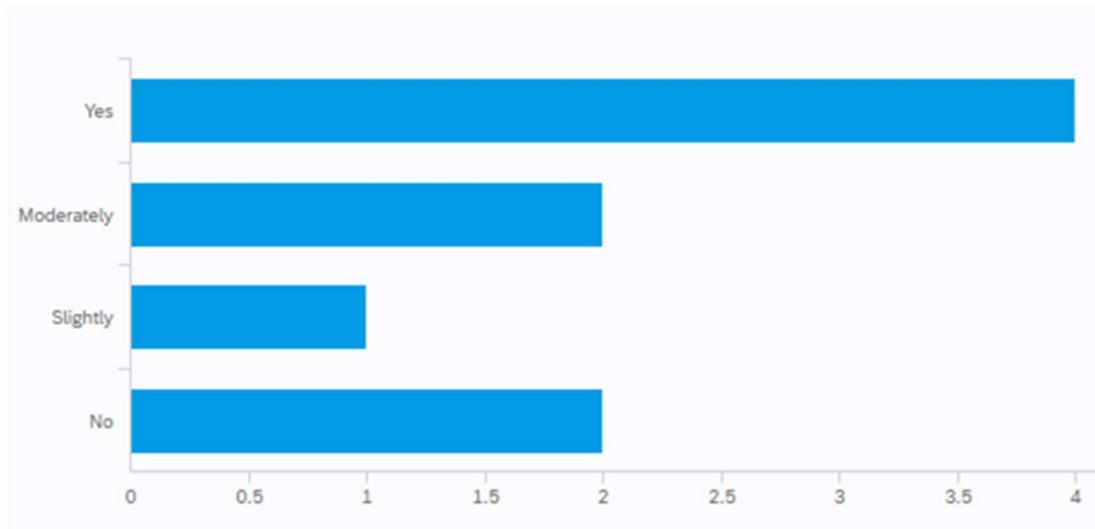


Figure 5: General public's responses when asked if they are concerned with out-of-pocket costs

As a potential by-product of the public not wanting to spend money out of pocket, responses indicated a clear public preference for towns to upgrade water treatment systems over mandating septic system upgrades. When asked about their preference between town-mandated septic system upgrades and town-wide water treatment system upgrades, 1 person opted for septic (6.25%) while 12 people favored sewage (75%) and 3 people had no preference (18.75%).

## **4.5: Common Feedback**

Although the 4 groups of stakeholders may have different focuses regarding the new regulations, there are a lot of shared common themes and opinions between all of them, which are helpful to summarize.

### **4.5.1: Nitrogen Pollution**

An overwhelming majority of respondents expressed great concerns about nitrogen pollution impacting Cape Cod. Not a single person expressed no concern at all, with a minimum concern rating of 5 (or neutral) between all the respondents. When asked how well they believed the new regulations would help minimize the amount of nitrogen pollution, an overwhelming majority of respondents expressed positive responses.

### **4.5.2: Funding**

One of the most common concerns throughout all respondents was funding. Every single group of stakeholders had a considerable amount of worry regarding how implementation of the new regulations will be affordable. The groups, however, did not exclusively focus on one area of funding needed. The general public and certain NGOs were concerned how homeowners would be able to afford their own septic system upgrades if their town opted to enforce the Title 5 amendments. They believe that there is not enough tax incentive or low risk loans available for them to confidently be able to afford the upgrades. Other NGOs, municipalities, and BOHs were more focused on the funding for the watershed permit projects. They were concerned that if a town were to opt for a watershed permit, they would have to create a project that is too costly. Some

recognized that there are already federal grants and low interest loans in place but they do not feel that it's enough funding for such a large project.

#### **4.5.3: Watershed Permits**

One common concern amongst the municipalities and BOHs was understanding the requirements for obtaining a watershed permit. Some municipalities and BOHs considered the new regulations too vague to understand what was required of them. This would create difficulty in their pursuit of a watershed permit, especially since watersheds are not confined to town borders. There was also concern about the timeline regarding implementation of these watershed permits considering how big and costly of a project it would be.

#### **4.5.4: Awareness**

NGOs were concerned about the lack of general public awareness of the new regulations. If residents are uneducated about what decision the municipality is making regarding their wastewater system, residents would not be able to voice their opinion on a matter that will affect them both physically and monetarily. The general public that was surveyed corroborated the notion that most of the general public are unaware of the new regulations. With half of the respondents not aware of the new regulations, it only bolsters the NGOs concerns about general public knowledge. Not only the general public, but municipalities also displayed general unawareness by expressing confusion around what MassDEP is specifically asking from them with watershed permits.

#### **4.5.5: Workforce**

An additional common concern found between the various stakeholders is the lack of workers to implement, enforce and maintain the new regulations. A key worry of the stakeholders is that there would not be enough engineers to aid in the implementation process regardless of which option is chosen by the municipalities. There is also a concern that there would not be enough workers or inspectors to ensure that the regulations are being enforced in the affected areas and still complied with in the long term.

#### **4.6: Summary**

The results of the surveys and interviews that are presented in Chapter 4 showed that the stakeholders want nitrogen pollution to be decreased in the Cape Cod area. The interviews were generally consistent with the surveys and provided additional insights into the concerns of the stakeholders. Overall, stakeholders still have some confusion regarding what the requirements are to meet the new regulations, they have concerns regarding the costs, and implementation of actions to meet the regulations. The results provide a basis for considering some next steps in advancing the regulations.

## **Chapter 5: Conclusion and Recommendations**

The goal of this project was to discover concerns from stakeholders and obstacles with implementing new nitrogen-reducing regulations. To achieve this goal, we surveyed and interviewed with stakeholders from four groups, non-government organizations, municipalities, boards of health, and the residents on and around Cape Cod. The results of the surveys and interviews that are presented in Chapter 4 showed that the stakeholders want nitrogen pollution to be decreased in the Cape Cod area; they just feel that they need help with implementing the solution. Their feedback was then consolidated based on their common themes to create the basis of these recommendations. These recommendations were developed to help facilitate the implementation process and the recommendations were split into both shorter-term and longer-term recommendations which are presented below.

### **5.1: Shorter-Term Recommendations for Implementation**

The shorter-term recommendations are the recommendations that we believe are more practical, as they could be advanced immediately. The shorter-term recommendations promoting implementation of the new regulations include assisting in garnering funding to afford the projects and upgrades, developing more efforts for public outreach, and creating clearer guidelines for the application of a watershed permit.

#### **Assisting in Funding Efforts for Projects**

Whether the town with an affected watershed decides to sewer their area or have the homeowners upgrade their individual septic systems, there will be a burden of additional costs to mitigate the amount of nitrogen entering their watershed. This fact of the new regulations has caused there to be a lot of concern regarding how the towns or the homeowners will be able to

afford these projects and upgrades. Our recommendation to help reduce the financial concern is to help assist in garnering more funding for towns and homeowners in order to help support the efforts to initiate the new watershed projects and septic system upgrades. Government assistance in funding like the SAPHE program were mentioned and appreciated by the stakeholders. However, they voiced their opinion that they would like programs like SPAHE to be expanded to provide extra funding for these projects. Other funding options also include expanding the low-rate loans, and increasing the amount of tax-break provided to homeowners who upgrade their septic system. By giving support to better funding, the new regulations would gain more support by all stakeholders and more support for watershed permits if the projects had better funding.

### **Developing More Efforts for Public Outreach**

A common theme that kept appearing in the surveys from the general public was that they did not know much if anything about the new nitrogen reducing regulations. With 50% of respondents not even knowing about the new regulations prior to filling out our survey, it is clear that more can be done when it comes to educating the general public about the new regulations. Our recommendation to address the common feedback is to create and develop more efforts to introduce and educate the general public about the new regulations. This could be accomplished via informative platforms such as pamphlets, a website, or a poster pdf, that could explain the more general ideas of the new Title 5 amendments and new Watershed Permit regulations. This product could then be shared with the affected towns and NGOs to help them with their own public outreach efforts. Providing this resource would be highly beneficial since it would lessen the workload of the local municipalities, a common theme that appeared in their survey responses, and it would increase the number of citizens who are informed on the issue which would help them be able to voice their opinion about the implementation phase. This would help drive the push for

watershed permits, as citizens who were informed of the new regulations preferred the option over having to pay for the upgrades individually.

### **Clearer Guidelines for the Application Process**

With the advent of new regulations made effective July 7th, 2023, it seems there is a disparity in knowledge among stakeholders about the inner workings of these new regulations. While those who worked closer with the formation of the new regulations have a clear understanding of what is being asked of them, those who were not as involved indicated that they were left feeling confused. A common theme that popped up when analyzing the survey answers was that some stakeholders felt confused on what the new regulations are directly asking them to do. Some things were confused on were what the requirements are to apply for a watershed permit, when the notice of intent must be submitted and why there is a harsh deadline, and what are the Best Available Technologies that are the new standard in the Title 5 amendment.

Our recommendation is to help create more information accessibility to the municipalities. One solution to create more information accessibility would be to create a new document that clearly states what the requirements are to be accepted for a watershed permit. Another solution would be to increase sessions where towns can continue to coordinate with MassDEP directly and ask about the likelihood of whether their proposal will be accepted. Having these requirements become clearer to the municipalities would greatly help the implementation process as towns would be able to better formulate their watershed permits, making the process continue forward. The clearer guidelines would also foster an environment where towns are less intimidated by the process to apply for a watershed permit leading to more watershed permits being applied for.

## **5.2: Longer-term Recommendations for Implementation**

The longer-term recommendations are the recommendations that we believe are more optimistic, as they would be harder to implement, yet still encompass common feedback given about the new regulations. The longer-term recommendations include expanding the amount of watersheds deemed nitrogen sensitive and including other sources of nitrogen pollution in the watershed permits.

### **Expansion of Nitrogen Sensitive Areas**

Coastal nitrogen pollution is not a localized issue on Cape Cod, as many of the other surrounding coastal towns along eastern Massachusetts are facing the similar issues. Although they are not included in the affected area by the new regulations, their coastline is still feeling the effect of nitrogen pollution. Our recommendation would be to continue the process of adding new watersheds to the area impacted by the new regulations as it would eventually lead to cleaner waters throughout Massachusetts. This could also be done by supporting the infrastructure needed to create more testing to be able to find the TMDL said watershed needs to reach in order to be considered clean. The expansion of the area considered nitrogen sensitive is also supported by the respondents as a majority expressed, they would like to see the area expanded as opposed to remaining as it is. This would help improve water quality throughout eastern Massachusetts, the main goal of these new regulations.

### **Inclusion of Other Sources of Nitrogen**

Although studies have shown that around 80% of homeowners use a septic system to dispose of their wastewater, which contributes significant nitrogen loads into the environment, there are still other sources of nitrogen pollution that could be addressed in a watershed permit that are not. A common theme that appeared amongst the respondents was a want to include other sources



of nitrogen pollution such as fertilizer to the watershed permits. This would allow the municipalities more ability to regulate the usage of fertilizers, which are also a contributor to nitrogen pollution, recognizing that different towns may have different needs. The Nature Conservatory also called out cranberry bogs as another source of nitrogen pollution needing to be addressed. The implementation of this recommendation would increase the amount of support for the new watershed permits since it would address a critique stakeholders had about the new regulations. This would ultimately lead to less nitrogen pollution and healthier waters, the outcome that every respondent is hoping for.

### **5.3: Areas of Future Exploration**

There are a number of future topic areas that are worth considering for follow up projects. First, it is recognized that there were a limited number of responses for the various stakeholders for this project. Another project could focus on gathering more opinions from the municipalities and BOHs, perhaps focusing solely on reaching out to these municipalities and going to the town halls for the respective groups. This would help gather more of the opinions of those who are in the phase of implementing a watershed project, applying for a watershed permit, and even those who are still deciding whether or not to give a notice of intent.

Another future project that could be conducted in the future is completing a similar project to this one but at a future time (e.g., one year) from now. Since this project was done still early in the implementation phase, given that the new regulations were just released on July 7th, 2023, this means that there was a lot of general confusion as information is still making its way to all of the on and off Cape Cod communities. This means that a project from a year from now could benefit from there being more general information understood and be able to gather any new concerns that have been realized after these towns have gained a better understanding of the new regulation. It could

also allow opportunities to work with the community to investigate in more detail the process and technical considerations involved in meeting the regulations.

#### **5.4: Conclusion**

The goal of this project was to discover concerns from stakeholders and obstacles with implementing new nitrogen-reducing regulations. By providing MassDEP the perspectives of those with the most at stake, we hope to enable their cooperation with stakeholders and homeowners, facilitating acceptance of the newly proposed regulations. With such an accord, there would be more progress in the implementation of the new regulations which would then lead to a higher chance that the nitrogen pollution levels will reduce over time. Although it is a resource intensive project, costing people their money, time, and workforce, it is for the betterment of the Cape Cod area and the state of Massachusetts as a whole, which is the motivation for this project and the main goal of the Massachusetts Department of Environmental Protection.

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## **Appendix:**

### **Appendix A: Interview Consent Form**

Do you consent to your responses being quoted?

YES                      NO

Do you consent to your interview being recorded with software such as otter.ai?

YES                      NO

EMAIL\*: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

\*only required if answered yes to both previous questions

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### **Appendix B: Survey Introduction and Consent Form**

To address nitrogen pollution, the Massachusetts Department of Environmental Protection (MassDEP) recently updated regulations (310 CMR 15.000) concerning septic systems, and introduced a new regulation (314 CMR 21.00) for watershed permits. These amendments mandate Best Available Nitrogen Reducing Technology (BANRT) in either watersheds or septic systems in Nitrogen Sensitive Areas (NSA). Following public feedback, MassDEP made its final revisions and the regulations went into effect July 7th, 2023. While MassDEP encourages watershed permits, some homeowners still may be required to upgrade their septic system. Implementation of these new regulations will take a great deal of time, effort, planning, money, and resources, and will

affect tens of thousands of residents of NSA regions of Cape Cod. MassDEP seeks input from the public regarding concerns.

We are students from Worcester Polytechnic Institute (WPI) asking you to partake in our project titled “Considerations for Implementing Regulations to Reduce Nitrogen Pollution”. The students conducting this research are; Josephine Fazio, Ashley Hutchings, Chad Nguyen, and David Buitrago, and our sponsor is the Massachusetts Department of Environmental Protection (MassDEP). Our purpose is to gather public opinion on implementation of the new regulations and deliver recommendations to MassDEP. This is a survey to collect data on said public opinion. Your participation is completely voluntary and may be withdrawn at any time. We anticipate this survey to take no more than 10 minutes and responses are completely anonymous. We anticipate minimal, if not zero, risk posed to you for participating in our project. Thank you for your time and input. If you have any questions or concerns, please feel free to reach out to us via email at [gr-bos-madep-jacd@wpi.edu](mailto:gr-bos-madep-jacd@wpi.edu), or our faculty advisor at [mathisen@wpi.edu](mailto:mathisen@wpi.edu).

Would you like to be considered for an interview to discuss your opinions further?

- Yes
- No

If you said yes to the previous question, please provide your email address and/or phone number to contact you.

---

I understand that my responses will be recorded and used by WPI Students for their project. My individual responses may be quoted in their final deliverables anonymously. I also understand every question is voluntary and I am able to skip any.

Signature: \_\_\_\_\_

### **Appendix C: Survey Questions for Non-Government Organizations**

What is the name of the organization you are affiliated with?

- Association to Preserve Cape Cod
- Buzzards Bay Coalition
- Barnstable Clean Water Coalition
- Pleasant Bay Alliance
- Cape Cod Municipal Managers Association
- Buzzards Bay Action Committee
- Housing Assistance Commission
- Cape Cod Realtors Association
- Cape Cod Commission
- Cape Cod Health Agents Coalition
- The Nature Conservancy

What is your role in your organization?

How big of a concern do you believe nitrogen pollution is to Cape Cod?

Not a concern to Cape Cod

A huge concern to Cape Cod

0 1 2 3 4 5 6 7 8 9 10

What data or research does your organization rely on to inform its positions and recommendations regarding nitrogen reduction and water quality improvement? Check all that apply.

- TMDL
- Third party data collection
- Town data collection
- Mdp reports
- Collecting our own data
- Other (please specify)

Please rank how you feel about the recent revisions to Title 5 and the introduction of watershed permits?

Very unhappy with the new regulations

Neutral

Very happy with the new regulations

0 1 2 3 4 5 6 7 8 9 10

How has or how will your organization be involved in the development or implementation of these new regulations and permits?

How will your organization be affected by the implementation of the new regulations and permits?

What challenges or concerns does your organization have regarding the practicality or feasibility of the implementation of these regulations and permits? Check all that apply.

- Not enough time
- Too expensive
- Not enough resources
- Not enough contractors for septic system upgrades
- Poor Planning
- It will effect too many people
- It will make people unhappy
- Other (please specify)

Are there any potential unintended consequences or negative impacts your organization is worried about in relation to these measures?

Please rank how sufficient you believe the new regulations and permits will be at mitigating concerns of nitrogen pollution (after full implementation).

Nitrogen will still be a big concern					The environment will be well protected from nitrogen					
0	1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If you believe nitrogen will still be a concern after the implementation of the new regulations, what else do you believe could be done to better address nitrogen pollution?

Do you believe the area of coverage of the new regulations and permits should be extended or reduced?

- Extended
- Remain how it is
- Reduced

Does your organization have any concerns or ideas regarding funding strategies for implementation of the new regulation?

Q13 How well do you feel MassDEP addressed initial concerns within the final revisions and responses to public comments and concerns?

Concerns weren't really addressed at all

Concerns were very well addressed

0	1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q14 What concerns do you feel still need to be addressed in order to make implementation as efficient and effective as possible?

Q15 Does your organization believe that watershed permits or septic system upgrades are the better option for municipalities and why? Do you have any concerns about municipalities choosing your less favorable option?

Q16 Is there anything else you would like to add, or any additional questions?

#### **Appendix D: Survey Questions for Municipalities**

What town in the Cape Cod area do you work for?

- On the Cape
- Off the Cape
- Both

What town in the Cape Cod area do you work for?

On Cape:

- Barnstable
- Bourne
- Brewster
- Chatham
- Dennis
- Eastham
- Falmouth
- Harwich
- Mashpee
- Orleans
- Provincetown
- Sandwich
- Truro
- Wellfleet
- Yarmouth

Off Cape:

- Acushnet
- Aquinnah
- Chilmark
- Dartmouth
- Duxbury
- Edgartown
- Fairhaven
- Gosnold
- Kingston
- Marion
- Mattapoisett
- Nantucket
- New Bedford
- Oak Bluffs
- Plymouth
- Tisbury
- Wareham
- West Tisbury
- Westport

In your town, how big of an issue do you believe nitrogen pollution is?



Not an issue

A severe issue

- 0    1    2    3    4    5    6    7    8    9    10
- 

Does your town plan on applying for a watershed permit?

- Yes  
 No

Is this decision supported by the different communities represented by your municipality (residents, boards of health, and select boards)?

Do you have a good understanding of the process for applying for a watershed permit?

- Yes  
 No

Municipalities will be given 2 years to give a Notice of Intent of applying for a watershed permit or to apply for a watershed permit directly. Are you comfortable with the timeline of the deadlines proposed in the new regulations?

What actions are in motion for obtaining a watershed permit?

How confident do you feel in the town's process for obtaining a watershed permit?

No Confidence

Somewhat Confident

Extremely Confident



What difficulties do you foresee in obtaining a watershed permit?

What are the biggest concerns for the implementation of the new regulations regarding Title 5 and watershed permits?

How well do you feel MassDEP addressed initial concerns within the final revisions and responses to public comments and concerns?

Concerns weren't really addressed at all

Concerns were very well addressed



Do you believe MassDEP’s efforts with the new regulations and permits are sufficient at mitigating concerns of nitrogen pollution, or do you believe more can be done? If so, what else do you believe could be done to address nitrogen pollution?

Is there anything else you would like to add or go more in-depth about?

**Appendix E: Survey Questions for Boards of Health**

What town in the Cape Cod area does your Board represent?

- On the Cape
- Off the Cape

In your board, how big of an issue do you believe nitrogen pollution is?

Not an issue at all

A severe issue

- |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 0                     | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     | 8                     | 9                     | 10                    |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Does your board have concerns regarding nitrogen pollution in Cape Cod? If so, what are/have been some events, projects, or initiatives related to nitrogen reduction and water quality improvement that your organization is currently working on or planning to undertake?

What data or research does your organization rely on to inform its positions and recommendations regarding nitrogen reduction and water quality improvement? Check all that apply.

- TMDL
- Third party data collection
- Town data collection
- MDP reports
- Collecting our own data
- Other (please specify)

Please rank how you feel about the recent revisions to Title 5 and the introduction of watershed permits?



How will your board be affected by the implementation of the new regulations and permits?

What challenges or concerns does your organization have regarding the practicality or feasibility of the implementation of these regulations and permits? Check all that apply.

- Not enough time
- Too expensive
- Not enough resources
- Not enough contractors for septic system upgrades
- Poor planning
- It would make people unhappy
- Other (please specify)

Are there any potential unintended consequences or negative impacts your board is worried about in relation to these measures?

Please rank how sufficient you believe the new regulations and permits will be at mitigating concerns of nitrogen pollution (after full implementation).



If you believe nitrogen will still be a concern after the implementation of the new regulations, what else do you believe could be done to better address nitrogen pollution?

Do you believe the area of coverage of the new regulations and permits should be extended or reduced?

- Extended
- Reduced
- Remains the same

Does your board have any concerns or ideas regarding funding strategies for implementation of the new regulation? If so, please list them here.

How well do you feel MassDEP addressed initial concerns within the final revisions and responses to public comments and concerns?

Not at all addressed

Extremely well addressed

- |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 0                     | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     | 8                     | 9                     | 10                    |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

What concerns do you feel still need to be addressed in order to make implementation as efficient and effective as possible?

Is there anything else you would like to add, or any additional questions?

## Appendix F: Survey Questions for the General Public

Are you concerned with the environmental health of Cape Cod?

- Yes
- Moderately
- Slightly
- No

Do you believe the environmental health of Cape Cod can affect the general health of Cape Cod?

- Yes
- Moderately
- Slightly
- No

Do you believe the environmental health of Cape Cod can affect the economic health of Cape Cod?

- Yes
- Moderately
- Slightly
- No





Would you rather your town mandate homeowners upgrade their septic system upgrades or upgrade the town's water treatment systems

- Septic System upgrades
- No preference
- Water treatment systems

What are your concerns when it comes to changes in Title 5 and Watershed permits?

If you are a homeowner with a septic system or have had a septic system, we would appreciate it if you take this portion of the survey. If you do not own a septic system, please skip this section.

Would you rather have a septic tank or public sewage?

- Septic tank
- No preference
- Public Sewage

Q20 How much money do you spend on septic system maintenance?

Q21 How much time do you spend on septic system maintenance?

Q22 With the implementation of new Title 5 and Watershed Permits coming up, are you concerned about out of pocket costs?

- Yes
- Moderately
- Slightly
- No

**NITROGEN  
POLLUTION  
REGULATIONS  
ON THE CAPE**

**PLEASE  
HELP US**

*WE WANT  
YOUR  
OPINION*

We're looking for people on the Cape to partake in our survey on new regulations from MassDEP



*Scan this QR code*

