

Developing Adaptation Strategies for the Massachusetts South Shore

Project Summary/Overview

In 2011, the towns of Marshfield, Duxbury, and Scituate, along with the Metropolitan Area Planning Council and the Massachusetts Office of Coastal Zone Management (CZM), saw a need to cooperate and complete a climate change adaptation study before a natural disaster occurred. The four main goals for the study were:

- Identify current and potential future coastal hazards;
- Identify adaptation strategies;
- Identify funding options to support adaptation; and
- Hold a public workshop to report the findings and receive public feedback.

Project Background

The towns of Marshfield, Duxbury, and Scituate are located south of Boston along Massachusetts Bay. In the aggregate, they span across twenty-five miles of the shoreline. At present, each of the towns has some form of coastal protection structures along its shoreline, such as bulkheads, seawalls, revetments, or jetties. The purpose of the structures is to protect public and private property along, and in the vicinity of, the coastline. However, due to weather impacts and natural processes, the structures are in varying states of decline. In 2006, it was estimated that to bring the structures up to “excellent condition” from “fair/poor condition,” it would cost 57.8 million dollars.

Climate change is predicted to not only have an impact on sea level rise, but also on stronger and more frequent storms, such as hurricanes and nor’easters. As a result, sea level rise in the towns of Duxbury, Marshfield, and Scituate is estimated to increase by one to three feet by the end of this century.

Project Implementation

The climate change adaptation study was completed and published in 2011.

Coastal Hazards

The study identified the coastal hazards that could occur as a result of climate change. One of the coastal hazards identified as highly likely to occur was coastal flooding and storm surges. The study found that changes in the shoreline width and erosion are more likely to occur. Additionally, the study found rising sea level will lead to the potential loss of critical habitat coastal marsh because adjacent human land uses and coastal structures may prevent the coastal marsh from naturally moving inland.

Adaptation Strategies

In identifying adaptation strategies, the strategies were classified into three major categories: protect, accommodate, or retreat. Adaptation strategies were further evaluated for the built environment, infrastructure protection, natural resources, and outreach and education.

Built Environment

Concerning the built environment, the towns focused on protecting existing development and infrastructure, enabling safe access for homeowners and emergency response, and minimizing the loss of life, destruction of property, and environmental damage. The towns further broke the adaptation strategies into four options: land acquisition, regulation, building guidelines, and flood proofing.

First, the towns could acquire land that is vulnerable to sea level rise by through purchasing it from private property owners. Once purchased, the land would be cleared and development on the property would no longer be allowed. However, the land could be used for a public park or wildlife refuge.

Next, regulations were identified as a good means to impose more stringent setback requirements, designed to allow natural erosion and accretion of beaches to occur, and to protect the built environment. Setbacks assist in protecting the built environment because they allow sediments and nutrients to be effectively removed and for waterbodies to adjust and maintain equilibrium.

Third, development and building guidelines in the towns could be amended to require redevelopment proposals that consider possible climate change impacts. Additionally, changes to zoning maps and existing floodplain zones were also identified as a means to protect the built environment.

Lastly, establishing minimum building design standards for development in floodplain zones that are consistent with Federal Emergency Management Agency (FEMA) guidelines is an accommodation method that may be adopted. Examples of standards include: raising the elevation of the lowest floor by two feet above the base flood elevation; walls that are impermeable to flood waters; and all utilities and sanitary facilities are located above the base flood elevation and are enclosed by watertight walls.

Infrastructure Protection

Adaptation strategies to protect infrastructure such as septic systems, sewer lines, waste water treatment facilities, and transportation systems were also identified. Concerns were discussed regarding allowing new coastal engineered structures that armor shorelines because the structures, such as sea walls, restrict the movement of sand and causes beach erosion. However, the study pointed out that there is a need to repair existing structures to protect existing buildings and public infrastructures such as roads, water mains, and sewer lines.

To protect sewer and septic systems, planning and monitoring of the systems should occur. To protect drinking water, the adoption of a long-term integrated water management plan that entails additional filtering and treatment systems and building protection walls around treatment facilities was identified as critical. Additionally, protection of low lying transportation facilities was also identified as an important aspect of adaptation planning. Adapting these facilities will likely include changes that maintain their function as access points while reducing their impacts on nearby water resources, like marshes, that are assets during storm events.

Natural Resources

The study recommended preserving green space and protecting water resources such as wetlands and the shoreline. Some ways to achieve this preservation and protection is for towns to amend their Wetland Bylaws to take into account rising sea-level and climate change, and restore wetlands by removing structures and redesigning impediments to tidal flow.

Furthermore, shoreline management strategies to accept an increase in sea level elevation and storm surges including beach nourishment, planting dune grasses, marsh creation, and planting submerged aquatic vegetation. Lastly, town regulations can also be changed to create a conservancy district, rolling easements, and land acquisition opportunities.

Outreach and Education

Education and outreach is important, and one approach is through stakeholder meetings. Groups that should be invited to the meetings include municipal groups, residents, local businesses, real estate agents, developers/engineers, and neighboring cities and towns.

Funding

Several sources of funding for the town projects were identified, including FEMA and state grants, and other state funding. Additionally, by reviewing and improving their floodplain management program activities, towns will help lower flood insurance premium rates for both public and private property.

Public Workshop

In October 2011, a public workshop about climate change adaptation was held for town officials and residents of the Massachusetts' towns of Marshfield, Duxbury, and Scituate. Those that attended included local citizens, conservation agents from the three towns, a conservation agent from a neighboring town that was also implementing climate change adaptation policies, and a coastal resilience specialist from CZM. The workshop was held to:

- Report the findings of a climate change adaptation study completed by the Metropolitan Area Planning Council;
- Improve awareness about climate change and its potential current and future impacts; and
- Receive community feedback about the planning process.

Along with reviewing the study findings, a survey about participant knowledge was taken. Nearly all the participants reported to have observed changes in the beach profile (90%) and high tide (70%). Similarly, 71% of attendees were very familiar with potential coastal impacts of climate change and 73 % responded that a combination of adaptation measures were the most appropriate approach to address the coastal impacts climate change could cause. Overall, 61 % of participants reported that the workshop increased their understanding of how climate change could impact coastlines in their towns.

Project Outcomes and Conclusions

The study helped to trigger further efforts to adapt to climate change in coastal locations. For example, each of the three towns has taken steps to amend regulations to reflect climate change adaptation. For example, Scituate has included a 100-year flood elevation plus an additional one-foot of free board in its Wetlands Regulations. Duxbury's wetlands regulations now include performance standards for Land Subject to Coastal Storm Flowage (LSCSF). The performance standards include preventing adverse or cumulative effects, protecting wildlife habitat, and preventing pollution. The regulations prohibit new construction or placement of new structures and septic systems within defined "Resource Areas," including any freshwater or coastal wetland areas. Additionally, the public workshop that was held not only further informed the public about climate change adaptation, but it also educated the towns about the level of public knowledge about the issue.

Part of the Northeast Climate Change Adaptation Project

*In 2011, the [Northeast Regional Ocean Council \(NROC\)](#) and the [Gulf of Maine Council on the Marine Environment \(GOMC\)](#) received funding from the [National Oceanic and Atmospheric Administration's \(NOAA's\) Climate and Societal Interactions Program \(CSI\)](#) to examine innovative municipal approaches to climate change adaptation in the coastal zone of the Northeast and Bay of Fundy. The two-year project, *Stimulate Innovation and Increase the Pace of Municipal Responses to a Changing Climate in the Coastal Zone of the Northeast and Bay of Fundy*, was completed in June, 2013. The research and outreach for the project was conducted by the following partners: the [Marine Affairs Institute](#), a partnership of [Roger Williams University School of Law](#), [Rhode Island Sea Grant Legal Program](#), and [University of Rhode Island](#); [Blue Urchin](#); [StormSmart Coasts Network](#); and [Clean Air-Cool Planet](#).*

Read more about the Northeast Climate Change Adaptation Project on our website:
<http://necca.stormsmart.org/>