

Executive Summary for the Town of Duxbury – Climate Resiliency Infrastructure Planning

Introduction

Since 2017, Duxbury has completed several important climate change planning efforts in tandem with the Envision Duxbury Comprehensive Plan. These efforts were led by both critical data analysis on the latest science and projections as well as meaningful public engagement and prioritization. These planning efforts indicate a dire need to protect the community of Duxbury and the barrier Duxbury Beach, a central asset to the community ecologically, recreationally, and economically, from sea level rise and increasing frequency and severity of coastal storms. Sea level rise in the short, immediate 30-year horizon is projected to be +/- 2 feet.

Indeed, even today, the Town is experiencing regular impactful periodic flooding from high wind lunar high tide days degrading critical assets that enable the community to thrive. The long-term vitality of the community of Duxbury is at risk – at least, how we currently experience it – as sea level is expected to continue to rise between 4-5 feet (at least) within 50 years, the recreational marina may sunset its business, and nuisance flooding occurrences here will increase and are projected to cross Washington Street regularly by 2070 (50 year horizon) or sooner. Access to beaches and along certain roadways will become different than they are today. The Town can ensure its longevity by taking incremental steps to enact its protection through the implementation of expert-defined resilience actions outlined in these planning efforts and prioritized by the community. Significant work has also been done by the [Duxbury Beach Reservation](#) under its Coastal Resilience Program in concert with the Duxbury Conservation Administrator, listed below, these and other links reside on the [Planning Department website](#), with prior studies, recorded presentations and other relevant links and plans.

This summary focuses on the 30-year event horizon (which represents the average length of a homeowner mortgage) and because large-scale projects can take several years to phase in public support, funding, design, permitting and construction, this an action-now horizon. The summary is broken into three parts – some commentary, a table on the “bay side” and a table on the “ocean side.”

[Snug Harbor Mini-Grant from MAPC](#) under the Accelerating Climate Resiliency Program (2019)

[Municipal Vulnerability Action Plan](#) (MAPC Technical Assistance funding, 2018)

[Coastal Resiliency studies](#) (2 Coastal Resiliency Grants jointly applied for with the Town of Marshfield, focusing on beach profile management on the ocean-facing locus in front of the public sea walls (2019-present, with special extension due to COVID, Woods Hole Group)

Study of the infrastructure of the bay coastline funded by the MVP Implementation Grant entitled [Duxbury Climate Change Vulnerability and Adaptation Plan](#) (June 2021, Woods Hole Group)

[Natural Hazard Mitigation Plan](#) (MAPC Technical Assistance funding)

[Coastal Processes Study](#), 2017, Woods Hole Group (Coastal Resilience grant)

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A comment on grant-seeking and funding sources

With the costs detailed in the following tables, grants are identified but grants are not likely going to be the sole source of funding to secure implementation of resiliency funding at this time due to scarcity of resources. These programs are already receiving applications for significantly more projects than can be funded. Some of the funding may need to be financed through borrowing, betterments or other funding sources, especially given the size and complexity of some of the construction costs and phasing, including the wall and nourishment, for example. It is critical that the Town continue to identify funding resources, including where it will locate the local match requirements for possible grant applications, in addition to infrastructure investments at the local scale.

Grant criteria are specific, and the grants are competitive – some on a national scale, while others are regionally competitive. Even when a local match is not required, the match provided where exceeding the match minimum will lead to a higher score overall. Almost all grants have migrated to matrix scoring at the state and federal level either last year, this year, or by next year, so that climate readiness is assigned based on the largest possible public benefit in terms of scoring within the matrix – not necessarily whether the application benefits the locality, but more about the population served, the crisis averted, the region served. Almost all grant programs have switched into a portal system, where the state will advise either before you apply, in an earlier round of requests, what programs they want you to apply to and/or a pre-qualification standard – a set of criteria that the applicants must meet to either qualify to apply, or to receive favorable scoring – ranging from policies in place, pre-planning through a publicly transparent process following a format provided and being approved/accepted by the funding agency in advance of any applications. ***Regional grant applications will continue to have better scores in this system.*** (As an example, see the recent report funded in part by the Barr Foundation, for the Mystic River Watershed, released this week, with a hard infrastructure plan for multiple communities).

Projects for construction need to be “shovel ready,” for the most part, which typically means: having all public ownership/rights of way and permits secured in advance of the application (although in some cases within 120 days of award), the project is already locally vetted and supported by all local stakeholders, project design is at least 25% complete, with all due diligence complete and construction to begin in the coming construction season, all match or other funding commitments secured prior to the application (or prior to the start of construction with supporting documentations showing the same), and a defined turnaround, which is usually 1 year but in limited circumstances can be 2-3 years.

Staffing is limited in terms of the number of projects that can be matched with in-kind services, and usually the only kind of work that can be matched in-kind by staff is design/public outreach, since these are tracked must be reported by hour, date and activity for all match. Reporting quarterly or monthly is a requirement, and federal grants require federal procurement be followed from engineering and design through construction, which are stricter than state procurement regulations. Annual updates are also part of the qualification process once engaged (such as, Complete Streets, MVP, or less frequently, Natural Hazard Mitigation Plans).

The town, as a whole, needs to identify which grants and projects it wishes to prioritize, and then fund the match and/or provide capital. A Resiliency Committee has been recommended, see tables following.

A comment on long-range decision-making and the 30-year (immediate) horizon

- Inland flooding relative to culvert sizing, combined with the impacts of high rainfall with storm surge, have not yet been modeled with the exception of culverts in the sea level rise threat horizon and the possibility of road closures associated with their inability to discharge into the sea. This needs to be further explored and prioritized.

Access to the barrier beach in the 30-year horizon is just as critical as the sea wall/nourishment:

- The Powder Point Bridge is being repaired annually for several hundred thousand dollars in order to extend its lifespan by about ten years, with an anticipated reconstruction cost of \$40,000,000, funding for which is not yet identified. Infrastructure funding just announced by the federal awards to the USACE and through the bridge infrastructure bill in recent weeks do not include the Powder Point Bridge. The other two barrier beach access points are the Canal Street Bridge, recently reconstructed on an emergency basis at its prior elevation, and the Beach Street Bridge, recently reconstructed by the state at a slightly higher, but still within the flood stage, elevation. Roads to the Powder Point Bridge, and the Gurnet Road itself on the barrier beach, are listed as action items in the 30-year horizon due to flooding events and the need for road elevation.
- At this time, the Duxbury Beach Reservation is considering what to do in the event of another breach, after years of repairing breaches and placing sand to maintain the access road at great cost and with significant grants from FEMA and CZM (FEMA funding has been out of the picture for quite some time due to a change in federal definitions, but this could change in the future) using private resources to fund local match. The cost to continue to repair the breaches is exceeding the capacity of the non-profit organization to sustain the connection of the beach throughout the extent of its reach. The Town must consider that a breach, depending on its location, will change tidal and wave action within the Bay, affecting water flows and flood protection along the bay side landscape currently enjoying the protection offered by the intact barrier beach. Whether or not the public fleet of boats can provide emergency response at this location once the breach occurs is not known at this time; however, there are no piers or docking facilities in Gurnet Saquish, and there are no temporary bridges available locally to provide even temporary driveable access across the future breach.
- It would be a dis-service not to mention that the Town needs to weigh the horizon for which it will want to invest in preserving and maintaining public infrastructure access to the barrier beach and the current residential neighborhoods. As we have previously discussed in some of our public outreach with the sea walls in Marshfield and Duxbury for example, and as is being contemplated in Hull and some other locales, and in several states in the United States, managed retreat (as opposed to emergency retreat or catastrophic loss) may become an option that rises to a more prominent position as time, and sea level rise, progresses. There is very little political desire, or funding, to consider this option at the present time, but it cannot be left out of the discussion. It is not listed on the Tables due to the lack of will and lack of funding at this time, but perhaps should be added by the town as time passes. There are legal implications associated with not maintaining public assets, and as stated at the Selectmen's meeting recently, funding for such legal research has been offered by Coastal Zone Management, as these issues are being addressed in other states at this time in the coastal, and other, areas of the United States.

The Table below summarizes present day and 2030 the highest vulnerability infrastructure and priority recommendations from the *2021 Duxbury Climate Vulnerability Assessment*. It serves as a roadmap to begin essential resilience strategies to protect the community's businesses, transportation, and natural assets. Additionally, Significant increase in Impactful Periodic Flooding ("IPF") – recurring flooding, causing immediate public safety issues, road closures, isolated neighborhoods, emergency services interruptions while degrading infrastructure (road and bridge) damage and integrity issues, property and structure damage, etc.

Project Type	Location	Threats to Community	Flood Risk Probability Present Day (PD) & 2030*	<u>WH 2018 Duxbury Climate Change Vulnerability Plan & Design Solution</u>	Estimated Cost	Funding Opportunities
Road Elevation	Powder Point Ave at Washington St. to King Caesar	Repeated flooding at lunar high tide	100% PD and 100% 2030	p. 61	Design - \$140,000 Permitting - \$110,000 Construction - 1million	MVP or CZM CR Grants; FEMA BRIC Grant, State and Federal Transportation Funds (TIP), Chapter 90
	Gurnet Rd.	Duxbury Bay inundation flooding and beach side over wash. Risk to Gurnet Community.	5-75% PD and 95% 2030	pp. 57-59	Design - \$160,000 Permitting - \$140,000 Construction - \$1.2 million	MVP or CZM CR Grants; FEMA BRIC Grant, State and Federal Transportation Funds (TIP), Chapter 90
Bridge Elevation	Marshall Street Bridge	Structural degradation from repeated flooding.	30% PD and 100% 2030	pp. 59-61	Design - \$200,000 Permitting - \$160,000 Construction - \$4.5-\$8.7 million	MVP or CZM CR Grants; FEMA BRIC Grant, State and Federal Transportation Funds (TIP); small bridge funding from MassDOT
Culvert Replacement (in process)	Island Creek Culvert (Bay Road west of Wirt Way)	undersized, tidally restricted and partially collapsed culvert	N/A	p. 48 and 71	\$50,000-\$100,000	Chapter 90 funds; state Culvert Replacement Grant Program
Land Use Regulations	Revise land use regulations for flood protection according to Woods Hole recommendations	community-wide	N/A	pp. 65-68	Staff Time	Planning staff time, MAPC Technical Assistance Grant, Town Meeting

Curate Marsh Migration	Acquire and/or protect land around marshes to allow for salt marsh migration.	Landing Road, Goose Point, Eagles Nest Point, Snug Harbor, Long Point Marine, Southern Powder Point neighborhood.	N/A	Chapter 4, pp. 46-53, and p. 68	Land use regulations revisions to >\$3-\$5 million	LAND Grant, Land use regulations, CZM Coastal Resiliency Grant
	Support Duxbury Beach Reservation's to maintain and restore coastal beach, dune, and bank habitats.	Loss of Dune and Barrier Break throughs opens Duxbury Bay to ocean. Changes oyster habitat increases wave energy and flood risk to Duxbury Bay shoreline.	N/A	p.48 and 71		Leverage grant-writing and match sources to improve scoring on grant applications for both the Town and DBR, share information
Other Urgent Actions	Develop Coastal Resiliency Committee	Dedicated staff and community volunteers essential to implement plans and protect Duxbury	N/A	p. 71	Municipal Staff Time	Municipal Staff Time; explore regional partnerships and representatives on the committee
	Hire Coastal Resilience or Sustainability Staff	Dedicated staff and community volunteers essential to implement plans and protect Duxbury	N/A	p. 71	\$65,000-\$85,000	Municipal Funds
Powder Point Bridge	Find funding or consider other alternatives			Separate from Woods Hole Group study but in the 10-year time horizon for possible failure	\$40,000,000	Possibly the state, private financing, public financing

Sea Wall and Nourishment at the Public Sea Wall – no action and action alternatives are detailed in the following table. Access to the barrier beach is addressed in the previous table.

STATUS QUO	Permitting	Time frame	Costs Projected	Funding
Intermittent repair of damaged shoreline protection structures with repetitive loss claims and storm cleanup costs at public sea wall as it happens – wall only – no bridges or roads – this is a separate section.	Emergency permitting only; USACE and Conservation Commission; may involve MEPA, Chapter 91 and other agencies depending on damage	through 2050 (30 years)	<p>\$27 million; includes Repetitive Loss Claims to FEMA by property owners in this area – assumes \$5 million in Repetitive Loss Claims based on prior claims, \$15.9 million in sea wall repairs, \$5.5 million in storm-related public services based on known costs and this cost excludes maintenance, as damages vary from storm to storm</p> <p>With the wall only partially repaired, if only partially reconstructed, unreplaced areas will continue to need work until replaced at intervals due to the damage that can and will occur as old sections fail, overtopping and incursion of wave action behind the wall will cause scouring and other damage.</p>	<p>Federal declarations of disaster may allow for up to 75% recovery of costs through FEMA, this is an unknown and cannot be relied upon as a funding source; and is very staff intensive. 25% local match is required to be in place PRIOR to application for funding to FEMA (such as a state grant where again, a local match must be in place).</p> <p>BRIC; Dam and Seawall, Coastal Resiliency grants</p>

The town has been working diligently since the wall failure to secure funding, design and permitting for the wall replacement, focused first on what was funded- the emergency declaration by the president enabled FEMA funding to be directed to cover 75% of the costs to replace the failed section, and the town secured nearly 25% of the local match from state grants. During the damage assessment and exploration of repairs, it was determined that the entire public sea wall has exceeded its design life and needs to be completely replaced. The town has secured grants to do the design and permitting of the nourishment necessary to permit the wall replacement as well, and has done emergency repairs, with permits, for storm damages within the past two years as un-replaced sections have experienced storm damage. This work has never ceased since the 2018 storm events, and continues through today, using staff time and leveraging public monies available from Marshfield, grants that qualify as match, and technical assistance from the regional planning agencies where available and relevant.

ELIGIBLE PROJECTS – sea wall and accompanying beach nourishment only

By 2050, work to continue the viability of the sea wall and beach profile infrastructure will begin to exceed the cost of the ongoing repairs to the homes behind the wall, using the moderate projections of 2 feet of sea level rise by 2050. Even though the design life of the sea wall replacement (if done end-to-end at one time) is 75 years, and if the nourishment is ideally placed as one large project at the design recommendation immediately with or after the reconstruction, the overtopping damages will keep the overtopping at bay until about 30 years, when the cost to continue to do the nourishment begins to fade in comparison the costs to maintain what is behind the wall by continuing to nourish the beach for the remaining life span of the sea wall, and retreat is a less costly alternative. The cost to renourish will be dependent on storm events, and will likely be required every few years, extending beyond into the 75 year life span of the sea wall, in theory.

	Permitting	Time frame	Costs Projected	Funding
Sea wall replacement	Environmental Impact Review with MEPA, USACE which includes review and consensus from National and State Marine Fisheries, Chapter 91 Waterways, CZM Federal Consistency Determination, Conservation Commission at town level	permits to reconstruct the wall not yet issued, once issued, state/federal are good for 10 years	<p>With the wall only partially repaired, if only partially reconstructed, unreplaced areas will continue to need work until replaced at intervals</p> <p>\$18-25,000,000 depending on timing and phasing in today's dollars</p> <p>Wall has 75-year life span but if it is built in phases could be subject to damage. With the wall only partially repaired, if only partially reconstructed, unreplaced areas will continue to need work until replaced at intervals due to the damage that can and will occur as old sections fail, overtopping and incursion of wave action behind the wall will cause scouring and other damage.</p>	<p>Emergency declaration with state grants allowed town to redesign and start the permitting for the entire wall to be replaced, staff time was also hundreds of hours at a value of tens of thousands of dollars</p> <p>BRIC; Dam and Seawall, Coastal Resiliency grants</p>

	Permitting	Time frame	Costs Projected	Funding
Beach and dune nourishment in front of public sea walls	Environmental Impact Review with MEPA, USACE which includes review and consensus from National and State Marine Fisheries, Chapter 91 Waterways, CZM Federal Consistency Determination, Conservation Commission at town level	permits to place material expected by June 2023, state/fed. are good for 10 years; ADDITIONAL permitting for source materials from dredging will be required and may include coordination with other state, local and federal dredging projects; no additional permitting required for source materials trucked from the upland	IF done jointly with Marshfield, initial fully recommended nourishment would be \$10.87 million for the initial placement of sand and cobble, with repeated placement of material every 3.5 to 8 years, for a total cost of \$52.89 million over the next 30-years This project MUST be done with the wall – the permitting of the wall will require the nourishment – permits have not yet been issued for this reason on the wall.	Already received: 2 shared grant awards with Marshfield as the lead from Coastal Resiliency Program within CZM for \$175,000+ for engineering design and permitting with in-kind services from Duxbury, relying on Marshfield’s in-kind and cash match to accomplish the work for Duxbury. BRIC; Dam and Seawall, Coastal Resiliency grants