Town of Ipswich, MA

Municipal Vulnerability Preparedness Plan

Ipswich, MA. (clockwise), Pavilion Beach & Little Neck Road (March, 2018); dry Ipswich River streambed one mile upstream of downtown (August, 2016); Ipswich River flooding downtown (May, 2006)

Community Resilience Building Workshop Summary of Findings

May 2019
Prepared for the Town of Ipswich
by the Ipswich River Watershed Association

IPSWICH RIVER WATERSHED ASSOCIATION

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1. Overview

In September 2016, Massachusetts Governor Charlie Baker signed Executive Order 569, instructing the state's government to provide assistance to cities and towns to complete climate change vulnerability assessments and resiliency action plans. The goals of the program are for each town and city across the Commonwealth to gather together a diverse group of community stakeholders to:

- Define top local natural and climate-related hazards of concern;
- Identify existing and future strengthen and vulnerabilities;
- Develop prioritized actions for the community;
- Identify immediate opportunities to collaboratively advance actions to increase resilience.

To accomplish these goals, the state's Municipal Vulnerability Preparedness Program (MVP) was launched in 2017. In 2018, the Town of Ipswich applied for and was granted a MVP Planning grant which funded a full day Community Resilience Building (CRB) Workshop on February 5, 2019. The summary of findings from this CRB Workshop and a follow-up Listening Session, held for the public on March 27, 2019, are included within this report.

Background and Need for Workshop

The Town of Ipswich is a unique coastal community on the North Shore of Massachusetts. Approximately 33 square miles in size, Ipswich has approximately 13,175 residents. The Town is predominately forested (41%), while residential, commercial, and industrial development combined make up about 15%. Agriculture in Ipswich also contributes to the town's semi-rural character, and its open fields and farms represent about 10% of the town's land area. The Great Marsh, the largest contiguous salt marsh in New England, includes the barrier beaches of Crane Beach and Plum Island and covers 21% of the town. Downtown Ipswich, which includes the majority of the town's infrastructure, is located along the western bank of the Ipswich River which winds through the town leading to the ocean at Plum Island Sound. The majority of Ipswich's land area (61%) lies within the Ipswich River Watershed, while the northern 39% of the town falls within the Parker River Watershed.

Like many North Shore communities, much of Ipswich is low-lying, leading to high exposure to sea level rise and coastal flooding hazards. During storms and abnormally high tides, water courses through the Ipswich River, smaller streams, and tidal channels, carrying flood waters inland. Culverts and bridges often act as choke points causing tidal creeks to spill out of the marsh into surrounding areas. The natural topography combined with erosion and tidal restrictions lead to regular coastal and riverine flooding.

In 2006, the Town experienced the worst flooding in its history during the Mother's Day flood, but increased impacts from both coastal and inland flooding are becoming more and more common throughout the seasons and the years. Additionally, the Ipswich River watershed suffered its worst drought in the history of the region in 2016. Climate projections, which forecast changes in precipitation patterns and an overall increase in both temperature and stretches of dry days, suggest that these patterns of drought and flooding will only be more problematic for the community in the future.

To address the threats from our changing climate, the Town of Ipswich has taken numerous steps over the last several years to reduce its vulnerability and plan for resilience. Working with the National Wildlife Federation and the Ipswich River Watershed Association, the Town of Ipswich joined the five other coastal towns bordering the Great Marsh (Salisbury, Newburyport, Newbury, Rowley, and Essex) to complete the Great Marsh Resiliency Planning Project in 2015-2018. (These projects were funded by Hurricane Sandy Restoration Funds from the National Fish and Wildlife Foundation.) The final *Great Marsh Coastal Adaption Plan* was completed in December 2017 and includes a town-specific Vulnerability Assessment for Ipswich, as well as specific adaptation strategies and recommendations for the Town and for the region as a whole. (www.nwf.org/greatmarshadaptation).

The Great Marsh project also included a thorough review of culverts, bridges, and dams–both coastal and inland–that are vulnerable to climate hazards. The final *Great Marsh Barriers Report*, with identification of vulnerable barriers throughout the town of Ipswich and 28 other communities, was published by the Ipswich River Watershed Association in February, 2018 (www.pie-rivers.org/id_20/).

Additionally, in 2017 and 2018, the Ipswich Local Hazard Mitigation Planning Team worked with staff from the Metropolitan Area Planning Council to complete an update to its Hazard Mitigation Plan. (https://www.ipswichma.gov/DocumentCenter/View/11106/Hazard-Mitigation-Plan-Draft?bidId=). This effort included discussion of where the impacts of natural hazards most affect the Town, goals for addressing these impacts, updates to the Town's existing mitigation measures, and new or revised hazard mitigation measures that would benefit the Town.

While Ipswich has already completed significant work to assess and plan for its coastal hazards, the State of Massachusetts encouraged the community to participate in the MVP program for several additional reasons:

- To use the Community Resiliency Building (CRB) process (www.communityresiliencebuilding.com), the key element of the MVP program, to engage a new and diverse set of stakeholders across the community;
- To assess and evaluate non-coastal (inland), environmental, public health, and societal vulnerabilities and hazards;
- To identify and prioritize immediate opportunities to collaboratively advance actions to increase resilience.

Workshop Planning Team and Core Partners

The Ipswich CRB Workshop Planning Team included municipal staff from the following departments: Planning and Development, Police/Emergency Management, Public Works, and Water/Wastewater. Regional partners who joined the planning effort included staff from the Ipswich River Watershed Association (IRWA), the Metropolitan Area Planning Council (MAPC), Mass Audubon, and 8 Towns & the Great Marsh Committee (Mass Bays). The facilitation team included staff from The Nature Conservancy (CT) and Woods Hole Group.

See Page 30 for the complete list of the CRB Workshop Project Team.

The Workshop Process

The Town of Ipswich CRB Workshop was held on Tuesday, February 5, 2019, in Ipswich Town Hall. The day's agenda, attached as Appendix A, is more fully described below.

The Project Planning Team developed the list of invited participants in November, 2018, using local knowledge combined with the suggested CRB stakeholder groups as guidance. An invitation flyer was created and invitations were extended by email to the selected group by Town Planner Ethan Parsons in early December, 2018. (See Page 28 for the list of invited guests and workshop attendees).

Registration began at 8am on February 5th, with a formal welcome by Mr. Parsons at 8:30am. Facilitator Kristen Grubbs (IRWA's environmental planner) gave an overview of the workshop and attendees introduced themselves. Ms. Grubbs gave a PowerPoint presentation, focusing on climate science and data relevant to the Town of Ipswich, as well as a summary of past resiliency planning efforts and outcomes, including the 2017 Great Marsh Vulnerability Assessment & Coastal Adaptation Plan and the 2018 Ipswich Hazard Mitigation Plan Update. The presentation included climate change projections and their current and potential future impacts on Ipswich. An overview of general infrastructural, social, and environmental challenges facing the Town due to climate change was provided.

Following the presentation, the full group discussed and answered general questions about the information. Attendees took a short break and then separated into five smaller discussion groups of 8-10 participants, including a small group facilitator and a scribe. Groups were pre-determined by the Planning Team to include a diversity of stakeholders and a gender balance. Following the suggested CRB process, the first task of the small groups was to confirm the Top Hazards for the community and to use a Risk Matrix to identify the vulnerabilities and strengths of the infrastructural, societal, and environmental features of the community.

During the pre-workshop planning, Ms. Grubbs had consulted with the team of facilitators to explore how best to incorporate the extensive vulnerability planning and assessment that the Town of Ipswich had already completed as part of the Great Marsh Resiliency Planning Project and the Hazard Mitigation Planning, which had just completed in the fall of 2018. The team decided that it made sense to pre-identify the four Top Hazards.

Participants of the Ipswich Community Resiliency Building Workshop, Ipswich Town Hall. February 5, 2019

The five small groups each had multiple materials and resources at their tables to help guide their discussion of their community's vulnerabilities, including:

- Ipswich Critical Infrastructure base map (provided by Woods Hole Group)

- Set of Ipswich maps at 11x17 scale (provided by Woods Hole Group), including: orthophoto, water & sewer infrastructure, dynamic inundation modeling maps (2030 and 2070), open space.
- Set of Ipswich 11 x 17 maps from the Ipswich Hazard Mitigation Plan 2018 Update (provided by MAPC), including: population density, flood zones, land use, hurricanes/tornadoes, local hazard areas.
- Ipswich summary of temperature and precipitation projections from the MA Climate Clearinghouse data set;
- "The Town of Ipswich Healthy Aging Community profile" from the Tufts Health Plan Foundation;
- "Ecological Drought in the Northeast United States" compiled by the Northeast Climate Science Center;
- The Town of Ipswich Vulnerability Assessment excerpted from the *Great Marsh Coastal Adaptation Plan*; and
- Excerpts from the *Town of Ipswich Hazard Mitigation Plan Draft 2018 Update, (provided by MAPC),* showing the High Priority Hazard Areas.

After listing the Vulnerabilities and Strengths of the community's features on the Risk Matrix, the groups took a short break and then moved directly into identifying Community Actions to address the vulnerabilities and/or protect the strengths of each feature. Additional resources were used to identify actions, including:

- *"Regional Adaptation Strategies & Recommendations for the Great Marsh Region" excerpted from *the Great Marsh Coastal Adaptation Plan*;
- "Town of Ipswich Adaptation Strategies and Recommendations for Selected Areas of Concern" excerpted from *the Great Marsh Coastal Adaptation Plan*;
- "Potential Mitigation Measures" excerpted from the *Town of Ipswich Hazard Mitigation Plan Draft 2018 Update*;
- *National Wildlife Federation's "Sample Guide to Climate Adaptation Strategies"; and
- *The Nature Conservancy's "Guide to Nature-Based Solutions".

** The asterisked items are included in Appendix D.*

After actions and strategies to address infrastructural, environmental, and societal vulnerabilities had been compiled, groups began the process of prioritizing the actions and choosing their top actions.

Following a lunch break, participants reconvened in a large group and a representative of each small group reported out to the full workshop, presenting a brief summary of their group's discussion and describing the prioritized actions. The workshop facilitators recorded each group's top actions onto posters, grouping like actions with like among the groups' conclusions.

To facilitate further prioritization, participants were then given three sticky dots and asked to "vote" on the highest priority actions by placing dots on their top choices for action. This sticky dot voting resulted in creation of a final prioritized list of actions, with the most dots determining the highest priority.

Finally, the large group discussed the results and concluded with a list of agreed-upon actions that the Town of Ipswich should embark upon to increase the resilience of the community in the face of anticipated climate change impacts. Senior Planner Ethan Parsons concluded the workshop with some remarks summarizing the recommendations and describing next steps for the community, and the workshop was adjourned.

2. Top Hazards

To determine the Top Hazards to be considered during the CRB process, the Town of Ipswich relied heavily on the extensive previous planning it has completed over the past few years: specifically using the assessments of hazards from the *Great Marsh Coastal Adaptation Plan* (December 2017) (https://www.nwf.org/greatmarshadaptation), the *Great Marsh Barriers Report* (February 2018) (http://www.pie-rivers.org/id_20/), and the *Town of Ipswich Hazard Mitigation Plan Draft 2018 Update (*https://www.ipswichma.gov/DocumentCenter/View/11106/Hazard-Mitigation-Plan-Draft?bidId=). These documents extensively explored the following issues:

- What hazards have impacted Ipswich in the past? Where, how often, and in what ways?
- What hazards are impacting the town currently? Where, how often, and in what ways?
- What hazards will impact the town in the future?
- What areas are exposed to hazards and climate threats within your community?

As described within the aforementioned documents, Ipswich is highly exposed and increasingly sensitive to several natural hazards that will be affected by climate change. As is true for most coastal communities in Massachusetts, the hazards are numerous and include coastal flooding from Nor'easters, winter storms, king tides, and sea level rise; damage from hurricanes and heavy wind; beach and riverbank erosion; freshwater flooding caused by severe precipitation events, improperly-sized culverts, and other hydro-barriers; and extreme heat and drought that can cause brush fires, water shortage and stress, and other public health impacts.

The *2018 Ipswich Hazard Mitigation Plan* summarized the Town's highest hazards risks as flooding, Nor'easters, winter storms/blizzards, brush fires/extreme temperatures, and coastal hazards. (See Table 5 in Ipswich 2018 Hazard Mitigation Plan Update).

The Town of Ipswich Vulnerability Assessment, completed as part of the *Great Marsh Coastal Adaptation Plan*, found that approximately 27% of the town is vulnerable to coastal inundation, depending on the severity of the storm. That number climbs to 30% in 2070. That report also concluded that Ipswich has high exposure to coastal flooding, riverine flooding, and erosion due to its topography, hydrology, and geographic location. Plum Island and Crane Beach face the open ocean and are highly exposed to wind, wave action, and sea level rise – with no buffering landmass to diminish these hazards. Interior portions of Ipswich rely on these

barrier beaches to buffer the worst storm effects, however the extensive number of tidal creeks and channels, combined with the overall low topography, can lead to widespread inland flooding – such as what occurred during the now infamous Mother's Day Flood of 2006 and the March 2010 Flood. Both floods set record high peak water flows and caused widespread damage to homes, business, and bridges in Ipswich.

The beaches in Ipswich have high exposure to erosion, particularly Plum Island (the tip of which is in Ipswich) and Crane Beach. The Trustees of Reservations' Crane Beach is one of the town's most important recreational areas and draws over 250,000 users annually—both locals and visitors. These barrier beaches are the first line of defense against storm surge and sea level rise. In their unprotected locations, the continuous impact of waves and wind has led to significant erosion. Large storms can also cause acute erosion events where large sections of beach are completely swept away. Additionally, both Clark Beach and Pavilion Beach, located on Great Neck, have high exposure to sea level rise and storm surge. The headlands of Great Neck and Little Neck are exposed to storms and have significant vulnerability to erosion. Major bank armoring occurred to Great Neck following the "No Name Storm" of 1991, and armoring occurred on Little Neck following erosion in 2013. Armoring of the coastline seems to have impacted Clark Beach and Pavilion Beach by disrupting the natural flow of sediment and by deflecting wave energy towards the beach, exacerbating existing erosion.

In Ipswich, economic sensitivity to climate hazards is intrinsically linked to the sensitivity of the town's natural systems. Ipswich is the largest shellfish producer in Massachusetts. In 2010, a total of 1.5 million pounds of shellfish were commercially produced in Ipswich. This harvest equated to about $2 million in total value and had an estimated economic impact in the area of $8 million. The shellfish industry in Ipswich is directly tied to the health of its coastal areas. For example, since the 1970s red tide has shut down the town's shellfish beds for parts of most years. Shell fishing areas in Ipswich are also known to close after most significant storm events as runoff, carrying fecal coliform and other pollutants, washes into the creeks and marshes.

Over 1,500 acres of intertidal land are contained behind Ipswich's barrier beaches. Together, these habitats make up 39% of the Parker River/Essex Bay's Area of Critical Environmental Concern (ACEC), as designated by the Massachusetts Executive Office of Environmental Affairs.

Barrier beaches in Ipswich are becoming increasingly sensitive to climate hazards, especially erosion. Based on a recent analysis completed by the Coastal Erosion Commission and presented by CZM, Sandy Point Reservation, located on the southern tip of Plum Island in Ipswich, had the highest erosion rates along the North Shore, with an average beach loss of 5.0 feet a year (data collected between 1970 and 2009). During this same time period, Crane Beach experienced the second highest rate of erosion with a loss of 1.4 meters (4.6 ft) a year.274 With rising seas and increased storm activity, erosion and its associated impacts are likely to worsen for this community already sensitive to climate-driven impacts.

In addition to coastal flooding, riverine and inland flooding is a concern for Ipswich. According to the Town's Hazard Mitigation Plan, flooding, caused by hurricanes, northeasters, intense rainstorms and thunderstorms, is the most prevalent and serious natural hazard in the community. Most flooding in Ipswich has historically occurred upstream of the Ipswich Mill Dam located in the Downtown area. However, over the last several decades, development throughout the upper Ipswich River Watershed has resulted in an increase in impervious surfaces. As a result, during large storm events the stormwater storage capacity throughout the Ipswich River Watershed becomes easily overwhelmed and results in more widespread flooding.

The *Great Marsh Barriers Report* assessed a total of 103 structures in Ipswich, including 5 dams, 56 non-tidal crossings, 17 tidal crossings, and 25 coastal stabilization structures. The assessment focused on culverts that are barriers to the natural flow of streams and rivers. The screening tools identified those structures that are less likely to function properly during high flows due to being undersized relative to the upstream watershed or mismatched to the natural stream bed. With climate change bringing more extreme precipitation events to the northeastern United States (more frequent storms with larger amounts of rainfall), causing higher and heavier volumes of stormwater runoff, the impact of inland flooding on infrastructure, as well as the society, will become even more significant for Ipswich.

Additionally, predictions of temperature changes resulting from climate change show that both extreme cold in the winter and extreme heat in the summer will be in Ipswich's future. The winter of 2018 brought record cold temperatures in January. Winter Storm Grayson on January 4, 2018, was one of the most intense western Atlantic winter storms in decades, clobbering the East Coast with blizzard conditions and major coastal flooding. High winds

triggered power outages, white-outs, and road closures throughout the North Shore, including Ipswich.

The summer of 2016 saw "extreme drought conditions" for the first time in the Massachusetts Drought Monitor's record. Currently, the Town of Ipswich sees 6.88 days with temperatures over 90 degrees F; by the end of the century there may be as many as 11 to 55 more days over 90 degrees. In addition, the projected change in annual consecutive dry days goes from 16 to nearly 20 days (MA Climate Change Clearinghouse).

Using all of this extensive previous work and current data from the MA Climate Change Clearinghouse to identify the town's past, current, and future hazards, the Core Planning Team determined the following top hazards for the town. These Top Hazards were confirmed and endorsed by the CRB attendees during the workshop.

Top Hazards for the Town of Ipswich:

- **Coastal Storm Surge & Sea Level Rise**
- **Inland Flooding**
- **Extreme Cold/Winter Storms**
- **Heat/Drought/Fire**

3. Top Areas of Concern

During the Ipswich Community Resiliency Building Workshop, participants overwhelmingly agreed that the greatest current concerns and challenges presented by the top hazards included the following areas:

- **Water Supply & Infrastructure**
- **Environmental Resources, especially the Great Marsh**
- **Wastewater Infrastructure**
- **Land Use**
- **Electricity & Communications**
- **Public Safety & Transportation/Roads**
- **Vulnerable Populations**

See below for more detail.

Water Supply & Infrastructure

Concerns related to the Town's water supply and infrastructure specifically included aging infrastructure, deteriorating water quality, vulnerability to sea level rise and flooding, increasing community demand, and lack of drought resiliency.

The Town of Ipswich serves its approximately 13,200 residents with a combination of ground water and surface water sources from the Ipswich and Parker River watersheds. Both the Ipswich and Parker River basins have been studied extensively, as perennial low flow conditions in the summer both challenge the reliability of smaller, primarily groundwater, supply systems that rely on winter and spring replenishment, and also negatively impact the rivers and ecosystem. Water use in town over the past five years averages 370 million gallons/year, supplied by sources in both the Ipswich and Parker watersheds, and is slightly increasing.

Across Massachusetts, the combination of precipitation deficits and high temperatures plus increasing water use and land use change (see below) has caused new record low streamflow and groundwater levels in recent years. These changes have already been documented and more changes are projected. (http://resilientma.org/sectors/water-resources)

In recent years, the Town of Ipswich has faced significant impacts from the persistent low flow and irregular precipitation conditions; in particular, the Town's public drinking water supply

is extremely vulnerable to drought. During the Massachusetts Drought of 2016, the most extreme drought conditions were in the northeast region, including the Ipswich and Parker watersheds. The Town of Ipswich declared an "Emergency" (Stage 5) drought, and the Massachusetts Department of Environment Protection (MassDEP) issued a Declaration of State of Water Supply Emergency to limit all non-essential water usage in the Town and allow for pumping of water sources in excess of permitted levels. This drought exemplified the reality that the greatest concern of drought is typically between June and September–the same time when public water usage is highest.

Over the next 20 years, the population of the Town of Ipswich is estimated to increase by about five percent. Meanwhile, the changing climate brings the threat of more severe impacts in the future, which will affect water supply as well as other natural and community resources. Climate trends are likely to bring longer stretches of dry days and higher summer temperatures, thereby reducing summer flows and bringing more drought conditions. Drought may impact both public water sources and private wells. Sea level rise may cause saltwater intrusion to private and public wells that are located in low-lying coastal areas.

Faced with current and future changes to climate conditions, and in order to fully accommodate future growth and development in the 14 communities that depend on Ipswich river water, it is critical that Ipswich take steps to make existing supplies more sustainable under the threats of climate change, and to reduce existing water use to the maximum extent possible, especially during periods of lower water availability.

Environmental Resources, especially the Great Marsh

As described in the earlier Top Hazards section, The Great Marsh is a critical component of the natural resources of the Town of Ipswich and is under significant threat from climate change, including sea level rise, coastal storm surge, erosion, and non-point source pollution. Marshes provide water filtration services, storm surge reduction, erosion control, and are home to numerous rare and threatened species. However, because this habitat is so low-lying and tidally influenced, the vast majority of critical marsh in Ipswich may become inundated under just one foot of sea level rise, and researchers have already taken notice to areas within the Great Marsh that are being degraded by standing water as a result of excessive flooding and poor drainage. Furthermore, due to coastal development at the marsh's edge, coastal ecosystems may not be able to migrate inland as sea levels rise, leading these important

habitats to disappear under water. These changes will likely impact the community in many ways, including direct impacts on the important commercial and recreation fish populations present in the ocean, estuaries, ponds, and streams of Ipswich.

In particular, the habitat used by shellfish is quite vulnerable. Intertidal mud flats, sandy estuarine environments, and sea grass beds are all likely to suffer under the added strain of climate-driven threats. Sea level rise may permanently inundate clam flats, converting once productive harvesting areas into unsuitable habitat devoid of shellfish. Marsh erosion also threatens to further shrink these estuarine environments so important to shellfish.

Changes in precipitation and sea level rise will also alter the balance between freshwater and saltwater in the Ipswich River and its tributaries. Development combined with an increase in severe storm activity will likely lead to an increase in surface runoff quantities and rates. Storm runoff carrying bacteria, pathogens, and nutrients can be extremely damaging to the diversity of habitats and species found within the Ipswich River Watershed. Currently shellfish harvesters lose millions of dollars annually due to stormwater contamination.

The beaches of Ipswich, including the southern tip of Plum Island, Pavilion Beach, and Crane Beach, are heavily impacted by coastal storms and other dynamic processes.

Pavilion Beach, located between Great and Little Neck, is the only public beach in Ipswich and as such is highly valued by the community. The mixed cobble and sand beach experiences frequent erosion as well as coastal flooding from storms. When tidal surges overtop the beach, the flooding can isolate Little Neck from the mainland, bringing piles of sediment along with the water, across Little Neck Road (see cover photo of March, 2018 storm). The community on Little Neck has historically consisted primarily of summer homes, but recently many of the houses have converted to year-round residences. At a three-meter storm surge, Great Neck Park, located on the north and west side of the access road to the beach (Little Neck Road) becomes beachfront: the public beach will be underwater, homes on Little Neck will have their access to the mainland cut off, and large portions of Little Neck Road will be flooded. Due to the location of Pavilion Beach, just off the southern tip of Plum Island (Sandy Point), it is likely that sand movement from Sandy Point affects sediment on Pavilion Beach–a topic that needs more study. Armoring of the coastline of both Great Neck and Little Neck seems to have impacted Clark Beach and Pavilion Beach by disrupting the natural flow of sediment and by deflecting wave energy towards the beach, exacerbating existing erosion.

Crane Beach is a 5-mile barrier beach that stretches from the Ipswich River southeast to Essex Bay. Ipswich's significant tourism-based economy relies heavily on this beach. Several times a year, flood waters, coming around the back side of the beach through the marshes, can close Argilla Road (the only access to the beach) and flood the beach parking lot. A recent culvert upgrade was designed to alleviate some of this flooding, however problems persist. The beach itself provides significant flood protection to 1,500 acres of salt marsh and nearly 2,000 acres of dunes and beaches. As the beach erodes during storm events, there is reduction of its protective services of the infrastructure located behind it, including Ipswich and the neighboring community of Essex.

Inland wetlands, streams, lakes: Ecosystem services of these important natural resources in Ipswich are being compromised by stormwater pollution from development, improperly-sized culverts, and expansive beaver activity that increases flooding and impacts infrastructure. Climate impacts including heavier and more frequent precipitation and storms will stress inland streams and wetlands, bringing scouring, erosion, and increased pollution. All aspects of the hydrology of the community, including stream flow and below-ground water supplies, will be affected by longer periods of dry days and overall drought.

Wastewater Infrastructure

Workshop participants identified the **Town Wharf Sewage Pumping Station, the sewer interceptor and siphon, and the exposed sewer main** located along the bank of the Ipswich River as areas of major concern.

The sewage pumping station is located in the parking lot of the Town Wharf, and the sewer main runs from downtown along the Riverwalk trail and the bank of the Ipswich River, behind Town Hall, and down Water Street to the pumping station. The pump station handles 100% of the wastewater in the community and is subject to 1% annual chance of flooding according to FEMA flood zones. It is also likely to be completely inundated by a modest sea level rise of one (1) foot. According to the analysis using inundation modeling by Woods Hole Group, the sewage pumping station is likely to suffer significant flooding during storms–both present day and in 2070. A present day 1% or 0.2% storm (roughly equivalent to FEMA's 100 or 500-year storm) would likely flood 63-74% of the area with between 1-20 feet of water. By 2070, a 1% or 0.2% storm would likely flood as much as 91% of the area with between 5-20 feet of water. (See *Great Marsh Adaptation Plan* for more detail.)

Flooding of this site could cause extensive damage to the electrical equipment inside the pumping station. It would be a major health risk if the sewer main and station were to be inundated. Overflow of untreated sewage into the Ipswich River and its associated salt marsh would present an environmental risk to humans and a diversity of natural resources. In addition, workshop attendees raised concern about the location of the wastewater treatment plant outfall. Treated effluent is discharged to Greenwood Creek which is part of the Great Marsh. Increased precipitation and storms could overwhelm the system, potentially leading to contamination of the salt marsh as well as health and safety impacts to nearby neighborhoods.

The exposed sewer interceptor and siphon are located along and beneath the river near the Choate Bridge in downtown. These projects are currently being studied by the Ipswich Water & Wastewater Department.

Land Use

Ecosystem services related to the important natural resources and community environmental strengths identified throughout the workshop are being compromised by current land use trends. Development and redevelopment continues at a regular pace in town, with several recent multi-unit projects before town boards. Stormwater pollution from increased impervious surfaces continues to be a concern.

To address these land use challenges, the Town of Ipswich is engaged in its own discussion of water needs, climate impacts, and resiliency. Recent discussions have extended beyond the municipal Water Department and the Board of Water Commissioners—to Select Board, Planning Board, and Zoning Board meetings, and to town social media discussion boards. Large subdivision and development proposals currently under review by the Boards are shining a light on the town-wide concern about expanding water use. In 2017, the Town took an important step to address community water use by passing a water restriction bylaw, establishing restrictions on private well usage consistent with those on the municipal supply. However, overall water usage in town is up slightly in recent years.

As the Town evaluates the limited opportunities to improve its resiliency, it recognizes that tools and regulations must be reviewed and expanded to better control water use and environmental impacts, so the community can sustain future residential growth and economic development.

Electricity & Communications

The town has its own municipal Electric Light Department which manages distribution lines throughout the town. However, power outages due to winter snow storms and wind events can cause widespread power outages across Ipswich and the region. The workshop discussion drew significant attention to the risks to the power grid from future severe weather events.

Public Safety & Transportation/Roads

Because of the fact that a significant amount of the infrastructure in Ipswich is located in low-lying areas that currently flood, transportation corridors, including roads and bridges, will be even more susceptible to flooding from storm surge, sea level rise, and increased heavy precipitation as the climate changes. Because of this reality, the safety of many areas in town was a significant topic of discussion during the workshop, including but not limited to the following specific locations.

Forty-three percent of Ipswich falls within the FEMA 1% flood zone (the "100-year" flood zone), including the **Ipswich Downtown**, the economic center which includes a major transportation corridor (Route 1A and 133), as well as numerous businesses and restaurants. According to the USGS analysis using inundation modeling by Woods Hole Group, a significant portion of Downtown Ipswich may flood with between 1-20 feet of water during a present-day 1% or 0.2% storm (roughly equivalent to a FEMA 100 year and 500-year storm). By 2070, much of downtown would likely flood during a 1% or 0.2% storm; flood depths would range from 5-20 feet of water.

As mentioned earlier, the Ipswich River originates 35 miles to the west of the town and flows to the downtown area, where it meets the **Ipswich Mills Dam** at the head of the tidal estuary. Currently the dam acts as an impoundment, contributing to upstream flooding by reducing upstream flood storage capacity. The Town and its partners have completed a study (March 2019) to analyze the feasibility, cost, and effects of removing the downtown dam, including any impacts downstream. Removal of the dam may significantly reduce flooding upstream through restoration of floodplain storage capacity and reduce risk of flooding downstream in the event of dam failure.

Also near the downtown is the **Choate Bridge** which carries Route 1A/South Main Street over the Ipswich River. It is the oldest stone arch bridge in the United States, and is one of several

sites in Ipswich with important historic and architectural value. The Choate Bridge carries traffic traveling to and from downtown along Route 1A, and receives an average of 17,000 cars daily. The bridge is subject to 1% annual chance of flooding according to FEMA flood zones and is highly vulnerable to increased storm activity and riverine flooding. (See *Great Marsh Adaptation Plan*.) The narrowing of the river's channel at this site exacerbates flooding around the bridge. The volume and velocity of the river during large storm events can cause significant erosion of the surrounding river bank that supports the bridge foundation.

Jeffrey's Neck Road leads from Ipswich Downtown to the over 1,200 residents who live on Great Neck and Little Neck. The road is extremely susceptible to flooding from coastal storm surge events and white-out closures during blizzards; closure of the road presents a major public safety concern because it isolates those residents. A modest increase in sea level rise of 2 feet will make these residents and nearby developments even more vulnerable to both surface water inundation and saltwater intrusion, which can contaminate private wells and underground freshwater supplies. The Town of Ipswich is already addressing some of these concerns with FEMA funding to support the design phase of raising the portion of Jeffrey's Neck Road from Island Park to Eagle Hill. The DPW staff predicts this work will reduce road flooding to one or two times a year, such that during flood events the road would likely remain passable to emergency vehicles with higher clearance. The design is considering additional safety improvements, including guard rails or a roadside flood gauge.

Vulnerable Populations

Because of the fact that a significant amount of the infrastructure in Ipswich is located in low-lying areas that currently flood, the community will be even more susceptible to flooding from storm surge and sea level rise as the climate changes. The *Great Marsh Adaptation Plan* included an in-depth analysis of the economic and socioeconomic impacts of future climate change in Ipswich. For more detail, view the report at www.nwf.org/greatmarshadaptation. One notable finding of this analysis was that the number of people employed in coastal-hazard zones is 100 currently, but will increase to 457 in 2070, a change of 2% to 9% of the 5,086 employees that presently work in the community. Additional discussion at the CRB Workshop included particular concern about the residents living in coastal hazard zones who are over age 65, as well as seasonal or renter-occupied homes who may have residents unfamiliar with local services and shelters.

Participants agreed that there is a need for the community to enhance its current efforts to educate and communicate about climate-related hazards. Ongoing communications should include information on how to prepare and plan for weather-related hazards, both now and in the future, as well as information provided during an emergency. Systems and communications efforts that are in place now are strengths of the community; however, there will be an enhanced need for improved communications for both residents and businesses, as well as those beyond the town's borders, including tourists and visitors who are travelling to and through the community.

4. Current Strengths and Assets

Among the discussion groups at the workshop, there was consensus about the general overall strength of the community as pertains to climate change. In recent years, Ipswich has been a leader in the region's efforts towards climate resilience and protection of natural resources, driving important regional initiatives and setting examples for its neighboring communities.

A number of specific strengths were also identified among the infrastructural, societal, and environmental assets of the town. These include:

Infrastructural: The town has taken many strides forward over recent years to address infrastructural vulnerabilities to climate change. The *Great Marsh Barriers Assessment*, completed in 2018, identified and prioritized road-stream crossings that are barriers to flow and that will be more vulnerable as storms and precipitation events become more severe. The Town is currently working with partners to replace and improve culverts and bridges in several locations, including Argilla Road (near Crane Beach) and Topsfield Road (near the Ipswich River). The Town and its partners investigated the environmental, technical, logistical and economic factors surrounding the removal of the Ipswich Mills Dam and completed the Ipswich Mills Dam Removal Feasibility Study in March 2019.

The Workshop identified its own municipal Electric Light Department (ELD) as a strength of the community. The ELD manages distribution lines throughout the town, seeking to provide reliable electric service at a reasonable price in a sustainable way. As a community-owned, not-for-profit utility, it operates in service to its Ipswich customers and the Town. It is continuously exploring new ways to anticipate and adapt to future challenges including those brought by climate change.

Societal: As mentioned earlier, the Town of Ipswich has many systems in place now that are important in addressing its societal needs. Specific societal strengths identified by the Workshop participants include:

- **Overall Economy** which thrives on the town's extensive natural and historic assets.
- **Council on Aging:** Strong and engaged organization to support the elderly population.
- **Schools:** Two elementary schools, middle school, and high school are well-supported and highly-performing

- **YMCA**: Community-focused nonprofit with strong recreational programs and services for all ages.
- **The Open Door Ipswich Community Food Pantry:** a multi-service nutrition resource center, centrally located and handicapped accessible in the Agawam Housing Neighborhood of Ipswich, serving the region, including residents of Ipswich, Essex, Hamilton, Rowley, Boxford, Topsfield, and Wenham.
- **Local farms:** vibrant local farms and farming families providing local food, and a strong community-supported Agricultural Commission
- **Regional Partners:** A strong network of regional non-profit and governmental partners who are prepared and engaged in helping the community of Ipswich with climate resiliency initiatives, including but not limited to: The Trustees of Reservations, Parker-Ipswich-Essex Rivers (PIE-Rivers) Partnership, the Great Marsh Coalition, MassBays/8 Towns and the Great Marsh Committee, MA Office of Coastal Zone Management, Greenscapes North Shore Coalition, Ipswich River Watershed Association, Metropolitan Area Planning Council, Mass Audubon, and more.

Environmental: As mentioned earlier, the Town of Ipswich has many natural resource assets that define and sustain its vibrancy. These strengths include:

- **The Great Marsh** – The Great Marsh Area of Critical Environmental Concern (ACEC), originally designated in 1979 as the Parker River/Essex Bay ACEC, includes approximately 20,000 acres of barrier beach, dunes, saltmarsh, mudflats, and water bodies, and makes up 22% of the Town's land area. The marsh provides protection to the community from storm surge by absorbing wave energy, and also traps and stores carbon. It also provides habitat for the town's economically important fish and shellfish economy. Ipswich has one of the region's most significant shellfish industries, with 930,500 pounds of landings in 2016, valued at $1,775,000 (*Ipswich Hazard Mitigation Plan 2018 Update*). Crane Beach is one of the state's most popular beaches.

- **Protected Open Space** – Throughout the community, multiple areas are permanently protected as conservation land, including some wetland areas (both coastal and inland) which help absorb storm flooding and may allow for marsh migration as sea level rises. The town runs its own Open Space Program as well as benefitting from significant lands protected by state and federal agencies and regional land trusts.

5. Top Recommendations to Support Resilience

The participants in the Ipswich CRB Workshop, held on February 5, 2019, determined these Community Actions to be the top priorities for the community to take in order to lessen the impacts of climate hazards and to build resilience. General categories are listed in order of priority according to voting completed by workshop participants in a facilitated sticky dot voting exercise. For more detail see *Appendix E: Top Priority Posters with Sticky Dot Votes*. Please note: bulleted items in each category are not listed in priority order.

Water Supply

- complete supply & demand study
- consider options for supply development
- water conservation outreach & education
- explore water use mitigation programs ("water bank") and other strategies to reduce water use in new and redevelopment projects
- explore adoption of a "water neutral growth" or "net zero" policy
- work regionally & seek support from State to solve water supply issues/needs
- advocate upstream communities and seek equitable water restrictions across watershed and among all water suppliers
- protect & enhance water storage
- study desalination
- pursue strategies for infiltration & low impact development
- study strategies for greater water retention through nature-based solutions (slow the flow, pervious concrete on new sidewalks and parking lots, strategically placed swales and vegetated buffers/depressions/rain gardens - e.g. bottom of Spring Street and other like locations)
- pilot and demonstrate these solutions to other towns in the Watershed and in the Commonwealth

The Great Marsh and natural resources, including Crane Beach and Pavilion Beach

- address erosion of degraded marsh and other riverine and coastal bank through protection and restoration
- work with partners to study the movement of sand and sediment throughout the region, including at the mouth of the Ipswich River and throughout Plus Island Sound

and Essex Bay, including analyses of channel and creek hydrology, marsh platform elevation changes and response to sea level rise, marsh bank stability, and the erosion of the protective tip of Crane Beach
- land protection/acquisition to allow for marsh migration
- invasive species control, including continuing to support Green Crab trapping and removal program
- use green infrastructure to reduce stormwater pollution so as to keep shellfish beds open and healthy
- restore, stabilize and protect beach & dunes - encourage natural processes, plant grasses to stabilize sediment, explore other solutions

Water & Wastewater Infrastructure

- where possible/ feasible, remove infrastructure that will be adversely impacted by climate change & extreme weather to limit town's future liability
- elevate or otherwise protect infrastructure that can't be moved (e.g. wharf pump station)
- replace sewer interceptor & siphon running under and along the Ipswich River
- evaluate Ipswich Mills dam removal and opportunities to restore or create natural floodplains so as to mitigate upstream flooding/property risk and to increase buffer against floods
- protect and restore Ipswich river bank so as to protect sewer trunk line, through living shorelines and other green infrastructure strategies, including outreach & education

Land Use & Regulatory Issues

- Include climate change and sea level rise considerations in all local regulation, bylaws, policies, and planning including: zoning, building, health, wetlands, stormwater management, open space, economic development, climate action plan, and community development plan
- add a floodplain overlay district
- strengthen the stormwater management bylaw to address stronger storms
- use low impact development regulations and innovative natural resource protection zoning tools
- track and advocate for changes to state regulations that allow for innovative environmental protection strategies

Electricity & Communication

- expand energy source & decentralize
- loop networks for redundancy
- put power lines underground where feasible
- tree trimming to address transmission outages
- backup radio system
- improving communication procedures for emergencies
- alternating energy sources

Transportation/Public Works Safety - roads, culverts & bridges

- use results of the 2018 Great Marsh Barriers Report and the 2019 IRWA/MassBays/CZM projects to upgrade or replace vulnerable culverts throughout the Town (both coastal and inland)
- use updated sea level rise modeling to monitor erosion and scouring and to ensure stability of roads
- regularly remove debris caught in culverts
- restore natural water movement under Jeffrey's Neck Road
- study and explore dune creation or other solutions at Pavilion Beach

Vulnerable Populations including elderly citizens and residents of all neighborhoods vulnerable to inland & coastal flooding and sea level rise

- maintain and constantly improve emergency shelters (heating & cooling) & response, evacuation plans, notifications, and alarm system
- needs assessment of vulnerable elderly & disabled citizens
- develop contact lists & improve communications with (tracking of) vulnerable populations
- address health impacts such as insects, waterborne illnesses

6. Conclusion and Next Steps

The Town of Ipswich presented the recommendations of the MVP Workshop at a public Listening Session held on March 27, 2019, in Ipswich Town Hall. Publicly posted and advertised, residents of Ipswich were invited to attend the meeting to learn more about coastal resilience and to learn, ask questions, and provide feedback about the February 5th MVP Workshop and the recommended highest priority actions that emerged from that workshop.

Priorities identified during the February 5, 2019 MVP Workshop will be integrated into existing and near future municipal planning efforts, including applying for funding through the MVP Action Grants.

The Town of Ipswich will continue to improve the Town's resilience to climate change by implementing other top priority strategies in the months and years to come.

CRB Workshop Participants

Feb 5, 2019 CRB Workshop - Invited Participants (* = attended)

Interest/Group	Organization	Name	Attended
facilitator	Woods Hole Group	Joseph Famely	*
facilitator	The Nature Conservancy	Adam Whelchel	*
facilitator	Ipswich River Watershed Association	Kristen Grubbs	*
facilitator	Metropolitan Area Planning Council	Martin Pillsbury	*
facilitator	8 Towns & Great Marsh/Mass Bays	Peter Phippen	*
facilitator	Mass Audubon	Liz Duff	*
Non-profits	Ipswich River Watershed Association	Wayne Castonguay	*
Non-profits	Greenbelt	Kate Bowditch	*
Non-profits	Mass Audubon	Amy Weidensaul	*
Non-profits	Trustees	Peter Pinciaro	
Non-profits	Trustees	Tom O'Shea	*
Non-profits	Trustees	Russ Hopping	
Non-profits	Mass Audubon	Malarie McGillivray	*
Businesses	EBSCO	Alex Lawner	*
Businesses	Realtor	Binni Hacket	*
Community members		Jay Stanbury	*
Community members		Anne Reynolds	*
Historic	Ipswich Museum	Kerry Mackin	*
Community members	Construction	Marc Simon	*
Developers/engineers	Civil Engineer	Larry Graham	*
Elderly	Council on Aging	Lillian Riley	*
Elderly	Council on Aging Director	Shelia Taylor	*
Housing	Ipswich Housing Partnership	Jim Warner	*
Public Safety	MEMA	Allen Phillips	*
Schools	School Superintendent	Brian Blake	
Schools	Student	Tess Devoe	*
Schools	Teacher	Lori Lafrance	*
State Agency	MA Coastal Zone Management	Kathryn Glenn	*
Town Committee	Sustainability Committee	Mike Johnson	*
Town Committee	Open Space Committee	Andrew Brengle	*
Town Committee	Planning Board	Carolyn Britt	*
Town Committee	School	Pavica Kneedler	*
Town Committee	Planning Board	Heidi Paek, Chair	*
Town Committee	Conservation Commission	Sissy ffolliot	*
Town Committee	Water Subcommittee	Jim Engel	*
Town Committee	Selectboard	Bill Craft	

Town Committee	Board of Health	Susan Hubbard	*
Town Staff	Emergency Management	Lt. Jon Hubbard	*
Town Staff	Fire	Deputy Chief Jeff French	*
Town Staff	Public Works	Frank Ventimiglia	*
Town Staff	Conservation Agent	Alicia Geilen	*
Town Staff	Senior Planner	Ethan Parsons	*
Town Staff	Shellfish Constable	Scott LaPreste	
Town Staff	Town Library Director	Patty DiTullio	*
Town Staff	Open Space Administrator	Beth O'Connor	*
Town Staff	Open Space Manager	Hannah Wilbur	*

Citation

Town of Ipswich. March 2019. Community Resiliency Building Workshop Summary of Findings. Prepared by the Ipswich River Watershed Association. Ipswich, MA.

CRB Workshop Project Team

- Town of Ipswich, Ipswich Senior Planner Ethan Parsons, Core Team Member, Project Coordinator
- Ipswich River Watershed Association, Environmental Planner Kristen Grubbs, Lead facilitator
- Town of Ipswich, Alicia Geilen, Ipswich Conservation Administrator, Core Team Member
- Town of Ipswich, Lieutenant Jonathan Hubbard, Ipswich Hazard Mitigation Officer, Core Team Member
- The Nature Conservancy (CT), CRB Founder Dr. Adam Whelchel, Facilitator
- Woods Hole Group, Senior Environmental Scientist Joseph Famely, Facilitator & GIS
- Metropolitan Area Planning Council, Planner Martin Pillsbury, Facilitator
- Mass Audubon, North Shore Education Coordinator Liz Duff, Facilitator
- 8 Towns & the Great Marsh/Mass Bays, Coastal Coordinator Peter Phippen, Facilitator
- Mass Audubon, Malarie McGillivray, Scribe

Acknowledgements

Funding to support the Ipswich Municipal Vulnerability Preparedness (MVP) Program Community Resiliency Building Workshop was provided by the Massachusetts Executive Office of Energy and Environmental Affairs through a MVP Planning Grant, issued to the Town of Ipswich during the fiscal year of July 2018 through June 2019.

The Town of Ipswich contracted with the Ipswich River Watershed Association to provide MVP-certified staff to support the Town in planning and facilitating the CRB Workshop.

Thanks to the Town of Ipswich for providing the Ipswich Town Hall as the workshop meeting location and for providing lunch.

Thanks to the entire Ipswich CRB Workshop Project Team listed above, including facilitators Joe Famely of Woods Hole Group, Adam Whelchel of The Nature Conservancy, and Martin Pillsbury of MAPC, who travelled to Ipswich from a distance to participate.

Town of Ipswich, MA
Community Resilience Building Workshop

Appendices

Municipal Vulnerability Preparedness Workshop
Town of Ipswich, MA

Tuesday, February 5, 2019, 8:00am–3:00pm
Ipswich Town Hall
AGENDA

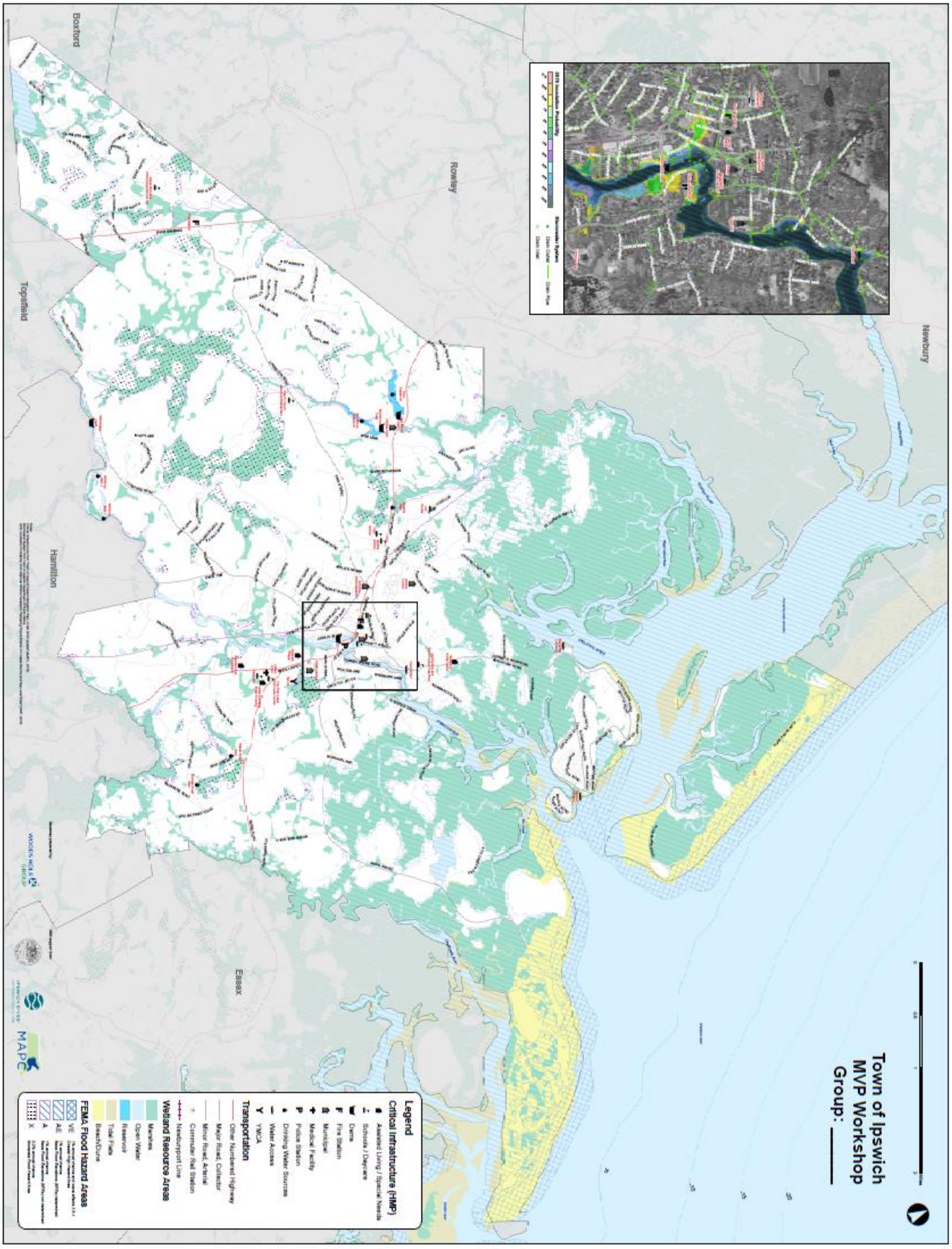
The Massachusetts **Municipal Vulnerability Preparedness Program** provides support for cities and towns in Massachusetts to plan for climate resiliency and prepare immediate action steps.

TIME	ACTIVITIES	WHO
8:00 AM	Registration and Refreshments	
8:30 AM	Welcome	Anthony Marino Ethan Parsons
8:35 AM	Overview of the Workshop Introductions	Kristen Grubbs All
9:00 AM	Presentation on Science, Resources, & Previous Planning Confirm Major Hazards	K. Grubbs
9:30 AM	Instructions for Small Group Work	
9:40 AM	Small Group Exercise #1: Review & Discuss Vulnerabilities & Strengths of Features (Infrastructure, Society, & Environment)	Small groups & facilitators
10:40 AM	10 MINUTE STRETCH	
10:50 AM	Small Group Exercise #2: Identify Actions to Address Vulnerabilities or Protect Strengths	Small groups & facilitators
11:50 AM	Small Group Exercise #3: Determine Priority (Hi, M, Lo) and Urgency (short/long-term) of Actions; Discuss & Identify Top 3 Priority Actions	Small groups & facilitators
12:00 PM	LUNCH	
12:45 PM	Small Groups Reconvene & Prepare to Report Out Write Top Priority Actions on Cards	Small groups & facilitators
1:00 PM	Small Group Report Outs: Sharing Top Priorities	Adam Whelchel Spokespersons & large group
1:30 PM	Large Group Activity & Discussion Determine Overall Priority Actions (sticky dot activity) Collectively discuss identified opportunities to reduce current and future hazard risks and improve resilience.	A. Whelchel & facilitators
2:30 PM	Closing Remarks & Next Steps How will Ipswich use the recommendations/outcomes from the MVP workshop?	K. Grubbs E. Parsons
3:00 PM	Adjourn	

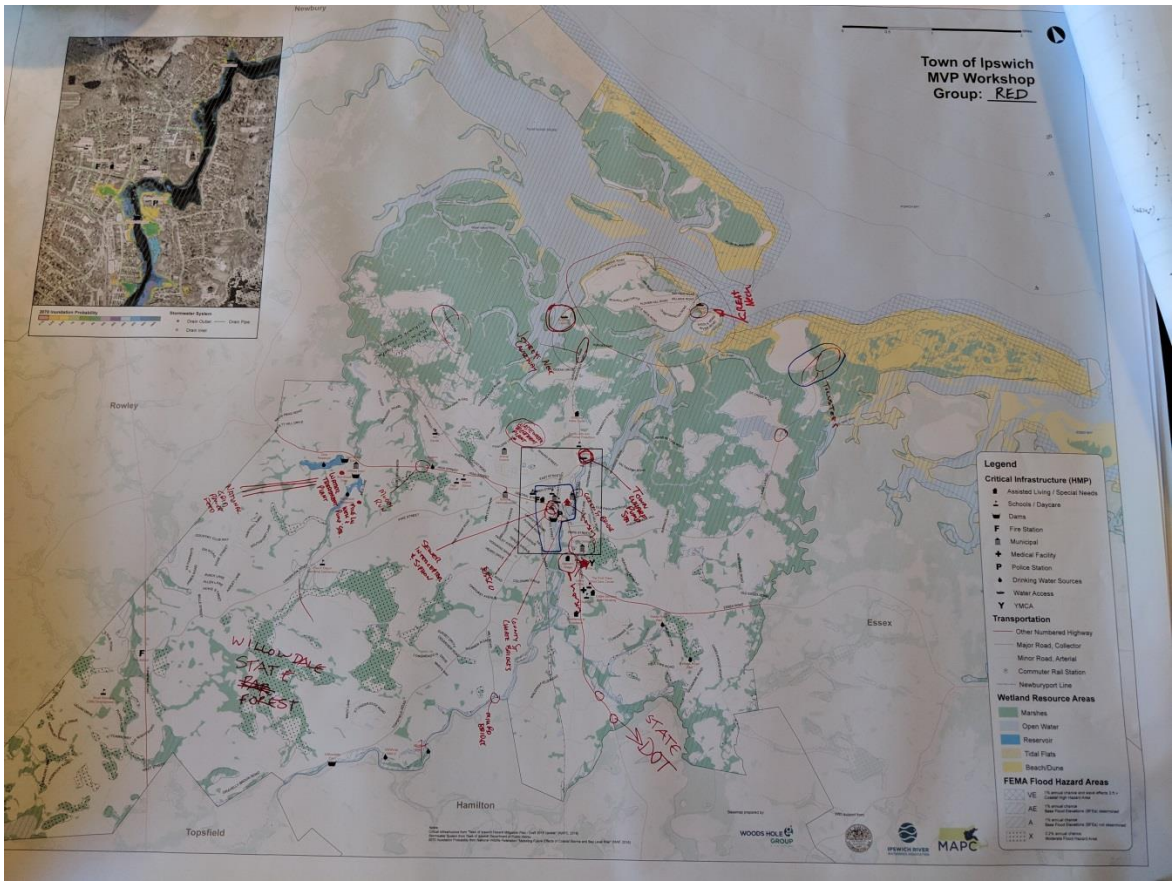
For more information about the Ipswich MVP Workshop, please contact Kristen Grubbs, Environmental Planner, Ipswich River Watershed Association (kgrubbs@ipswichriver.org, 978-412-8200)

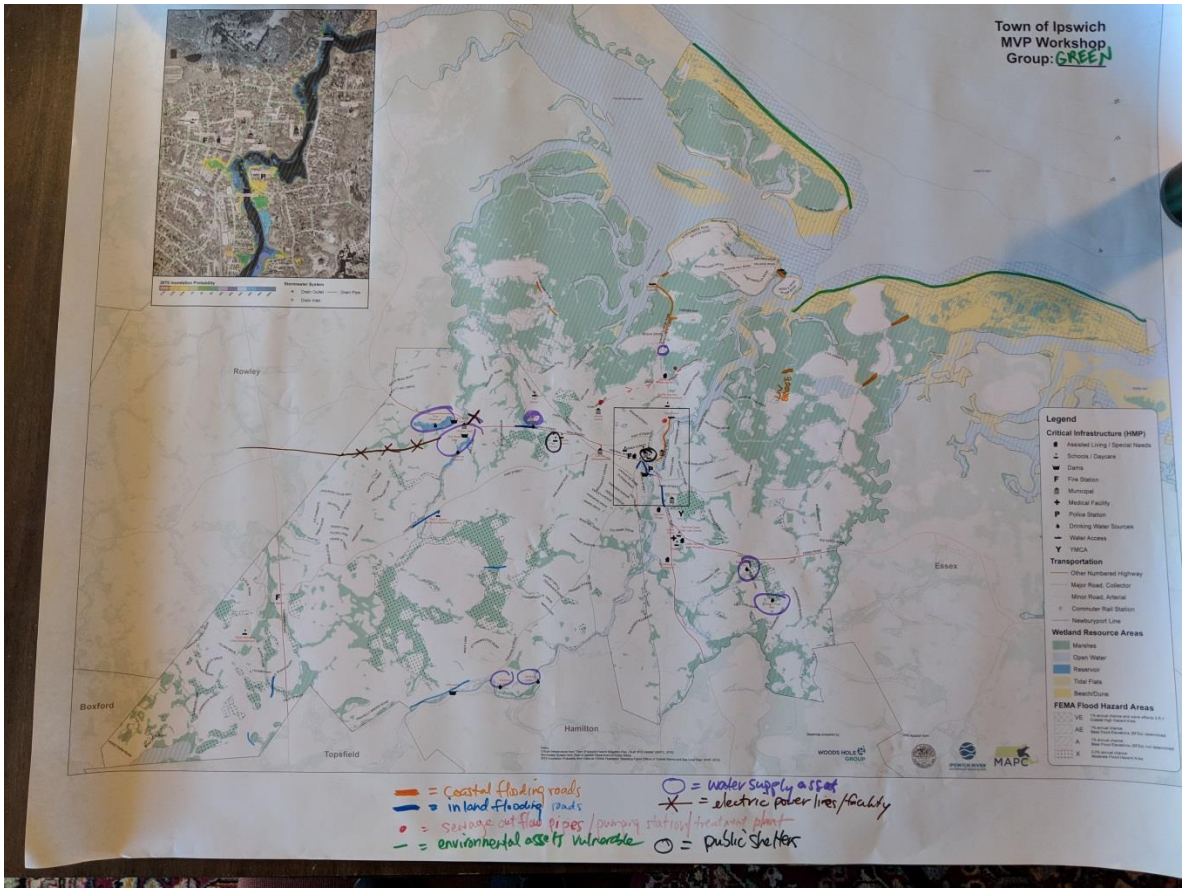
IPSWICH RIVER WATERSHED ASSOCIATION

Appendix A: CRB Workshop Agenda



Appendix B: Base Map





Appendix C: Participatory Table Maps

Box 4.1-1. Regional Adaptation Strategies & Recommendations for the Great Marsh Region

Best Practices *(see also page 126-130)*

- Establish and maintain a permanent Municipal Resiliency Task Force or committee
- Set clear goals for addressing existing and projected vulnerability
- Collaborate across municipal departments
- Collaborate across municipal boundaries
- Protect and enhance biodiversity
- Reduce non-climate stressors
- Evaluate effectiveness of adaptation strategies at regular intervals
- Monitor coastal hazards and maintain strong research initiatives
- Promote economic diversity
- Incorporate climate change adaptation planning and climate projections into all relevant local and regional plans as well as capital investment projects

Natural and Nature-Based Strategies *(see also page 130-137)*

- Ensure and restore connectivity of river and coastal systems
- Use living shorelines to stabilize shoreline edges, where appropriate
- Explore construction of offshore shellfish reefs and beds to attenuate wave energy, reduce erosion, and improve water quality
- Protect and restore barrier beaches and dunes through renourishment and revegetation
- Explore opportunities to beneficially reuse dredged material
- Restore sub-aquatic vegetation
- Restore degraded salt marshes
- Facilitate marsh migration
- Enhance land conservation efforts

Gray Infrastructure and Retrofits *(see also page 138-139)*

- Remove unnecessary dams
- Upgrade road-stream crossings
- Retrofit buildings to be more flood resilient
- Elevate roadways to prevent nuisance flooding and to withstand projected sea level rise
- Pursue retrofits and planning for Massachusetts Bay Transportation Authority (MBTA) railroad

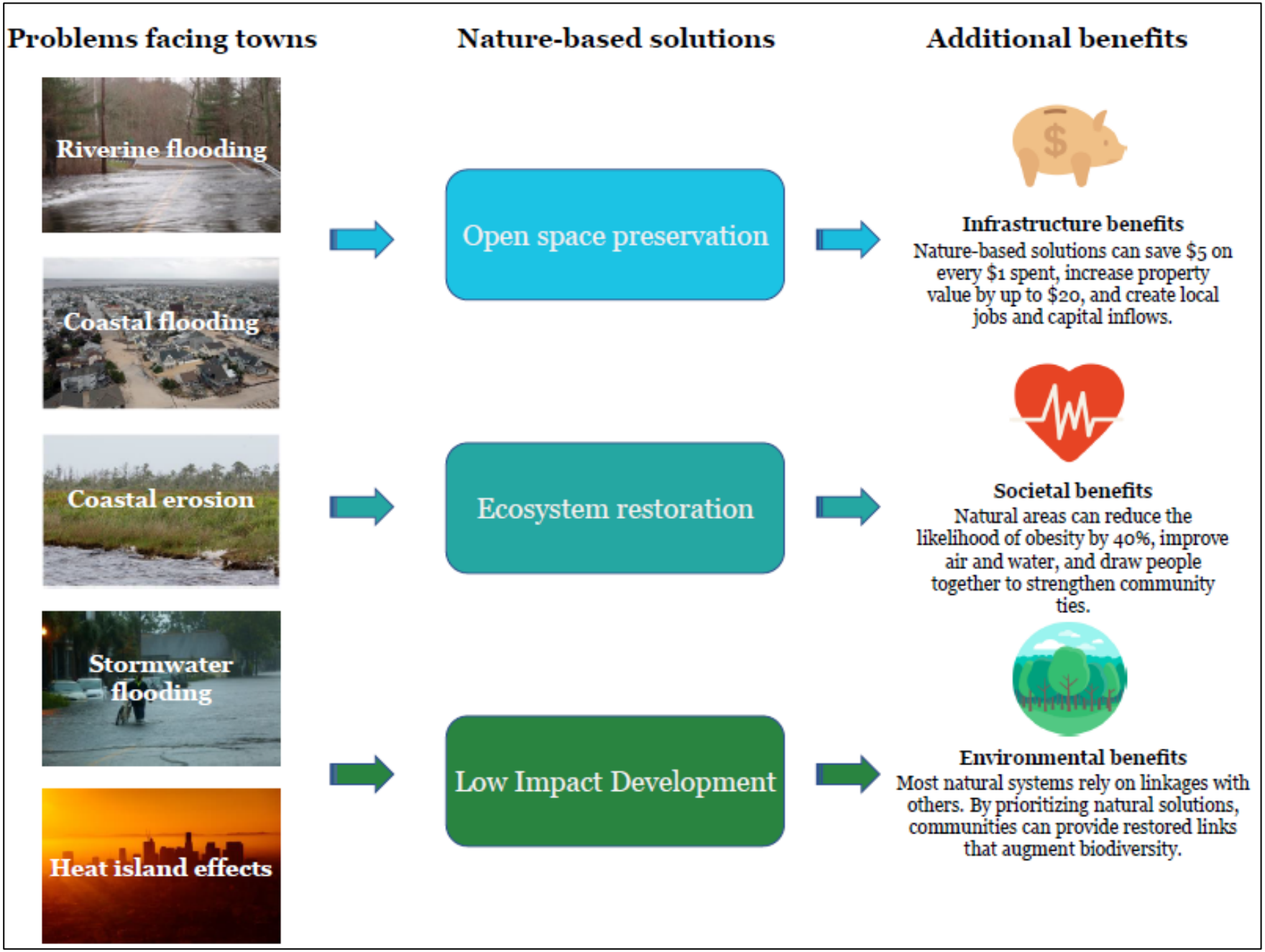
Land-use Planning and Policy *(see also page 140-144)*

- Update municipal policies
- Prioritize low-impact development (LID) practices
- Revise local wetlands protection bylaws and regulations
- Move development away from the coast and from wetlands
- Create "freeboard incentive" for residential and commercial buildings
- Use transferable development credits (TDCs) to reduce risky coastal development
- Institute comprehensive water resources management, including strategies for stormwater, waste water, and public drinking water

Outreach and Engagement *(see also page 144-146)*

- Develop municipal strategies for enhanced outreach and education
- Strengthen existing regional outreach and education programs
- Support and develop opportunities for citizen science

Appendix D: Great Marsh Coastal Adaptation Plan – Regional Strategies


Problems facing towns
Nature-based solutions
Additional benefits
Riverine flooding
Coastal flooding
Coastal erosion
Stormwater flooding
Heat island effects
Open space preservation
Ecosystem restoration
Low Impact Development
Infrastructure benefits
Nature-based solutions can save $5 on every $1 spent, increase property value by up to $20, and create local jobs and capital inflows.
Societal benefits
Natural areas can reduce the likelihood of obesity by 40%, improve air and water, and draw people together to strengthen community ties.
Environmental benefits
Most natural systems rely on linkages with others. By prioritizing natural solutions, communities can provide restored links that augment biodiversity.

Sample Guide to Climate Adaptation Strategies

What are Your Project Goals?

Flood Protection · Water Quality · Habitat Restoration · Wave Attenuation · Erosion Control · Scenic/Recreational Value

Natural Solutions

Remove Invasives

Advantages:
- Supports marsh ecosystem health & function. A healthy marsh provides storm protection, erosion control, and supports wildlife habitat.

Disadvantages
- May not be ecologically appropriate
- Requires maintenance

Vegetated Shoreline

Advantages:
- Provides shoreline stability, reduces erosion, and buffers upland areas from small waves.

Disadvantages:
- Limited flood protection depending on site features
- Plant growth not guaranteed

Land Acquisition

Advantages:
- Strategic protection of land adjacent to salt marshes can help facilitate marsh migration and reduce damage from flooding.

Disadvantages:
- Can be expensive
- Not always politically expedient

Nature-Based & Hybrid Strategies

Shellfish Reef

Advantages:
- Offshore living structures that enhance water quality, reduce erosion, and act as a submerged breakwater to reduce wave energy.

Disadvantages:
- Overtopped by major storms
- Easily damaged by debris and ice

Edging/Sills

Advantages:
- Natural vegetation combined with engineered structures parallel to coastline; reduces erosion and wave energy, and enhances wildlife habitat

Disadvantages:
- Limited storm surge reduction
- Requires more land area to implement

Thin-layer Deposition

Advantages:
- Raises the marsh platform by spraying sediment onto the marsh surface; mostly applied in sediment starved environments

Disadvantages:
- Impacts not fully understood
- Unknown utility in marshes that aren't highly degraded

Gray Infrastructure

Revetment

Advantages:
- Rocks or other material placed on a sloping shoreline to stabilize the shore and to mitigate wave energy.

Disadvantages:
- No major flood protection
- Prevents upland sediment transport to estuarine habitats

Bulkhead

Advantages:
- Vertical wall suitable in high-energy settings; stabilizes shoreline and reduces flooding.

Disadvantages:
- Can erode adjacent areas
- Prevents upland sediment transport to estuarine habitats

Road Flood Barriers

Advantages:
- Various designs exist, but all are meant to prevent flood waters from entering the roadway.

Disadvantages:
- Short-term/temporary solution
- Limited/no co-benefits

Policy Strategies

Zoning

Advantages:
- Utilizes zoning overlays to limit development in flood-prone areas (legal precedent exists in MA).

Disadvantages:
- Can impact property tax base
- May lead to legal challenges

Climate-smart Development

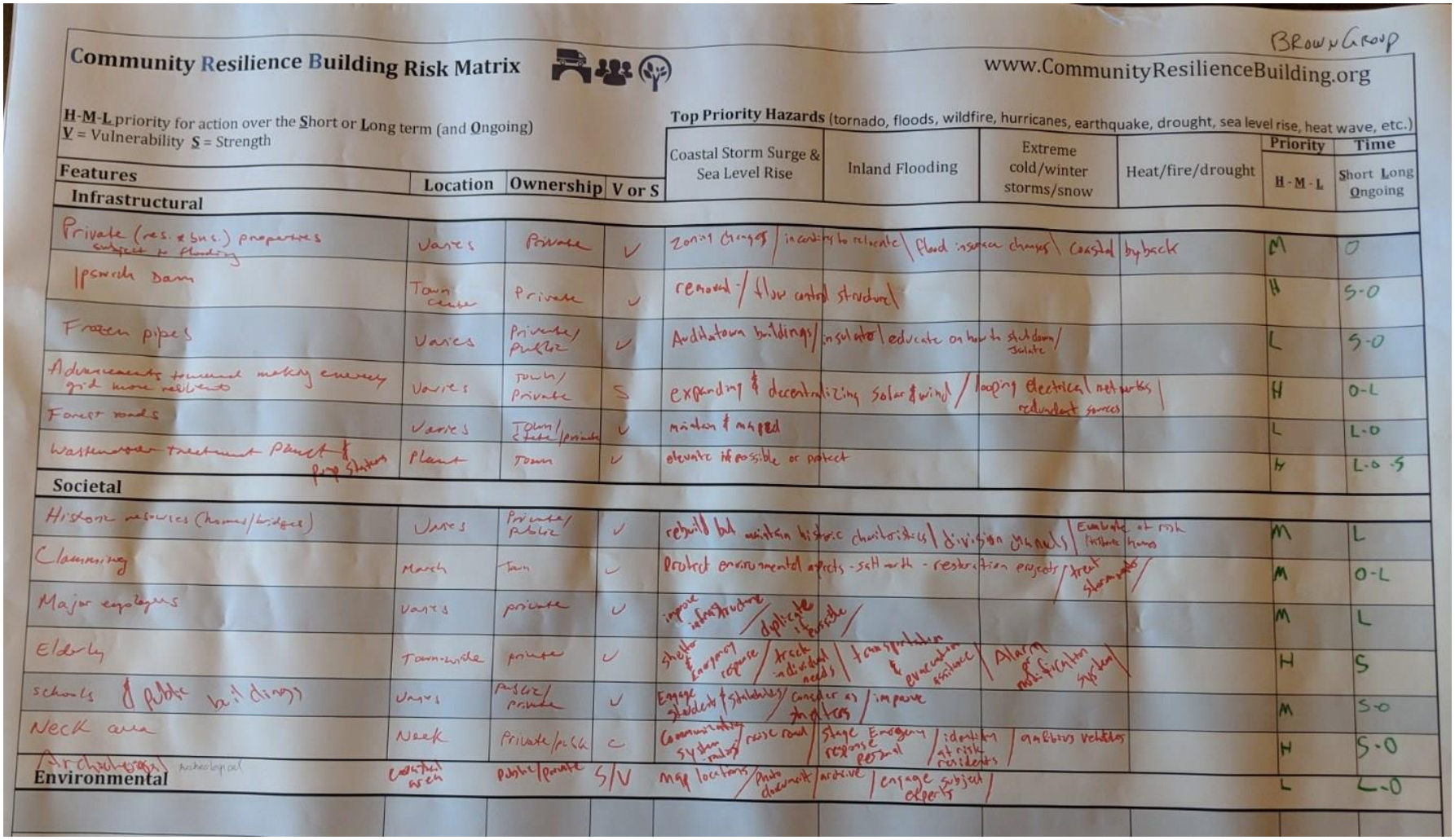
Advantages:
- Requires SLR to be considered in development proposals. Promotes open spaces to increase flood resiliency.

Disadvantages:
- Creates additional work for developers up front
- Doesn't require action

Transferable Development Credits

Advantages:
- Market-based approach (with existing MA guidelines) that incentivizes development away from flood prone areas.

Disadvantages:
- Can be costly and complex to implement
- Requires calibrated market



Brown Group

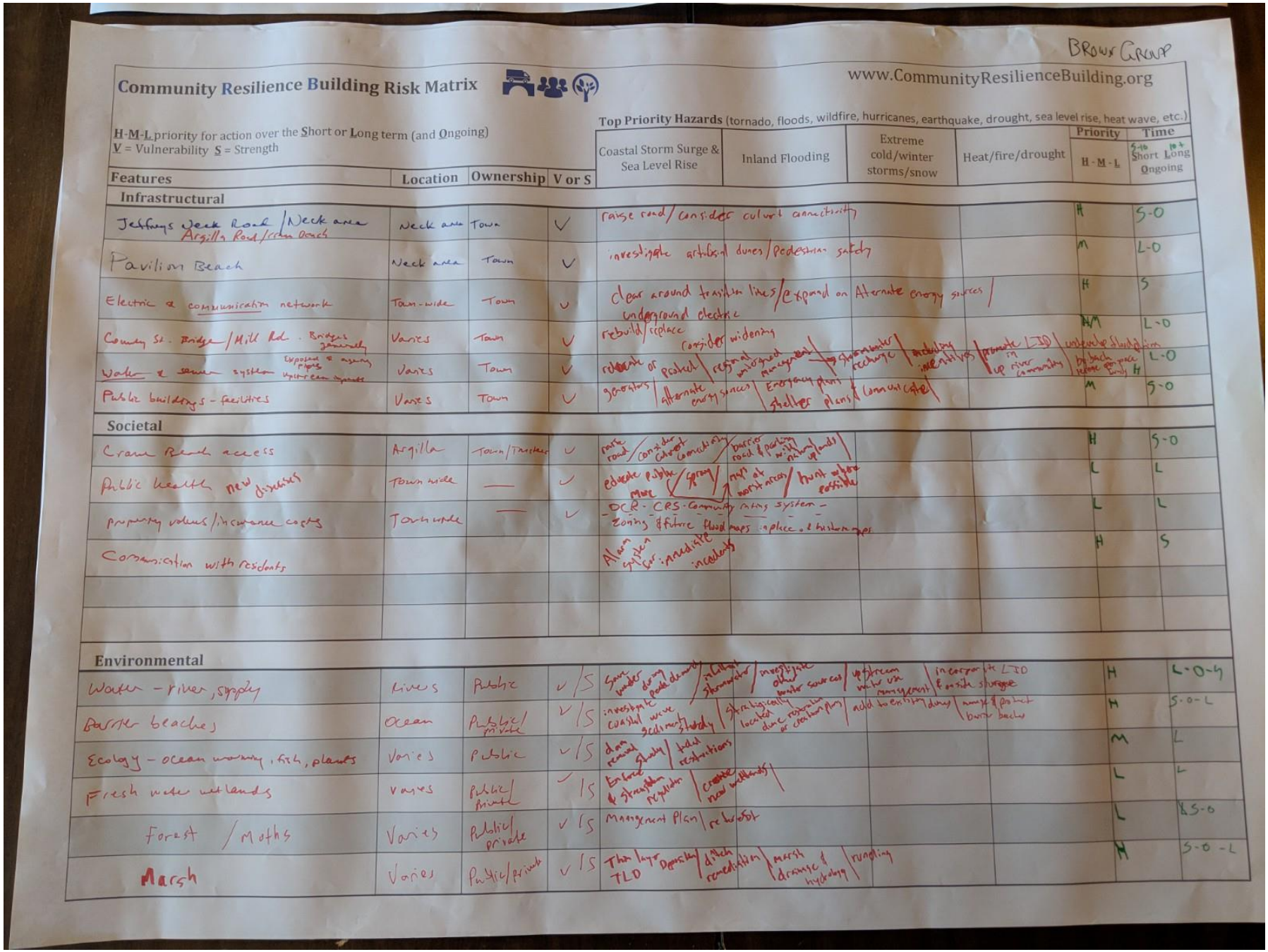
Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.org

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Coastal Storm Surge & Sea Level Rise	Inland Flooding	Extreme cold/winter storms/snow	Heat/fire/drought	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Private (res. & bus.) properties subject to flooding	Varies	Private	V	Zoning changes / incentives to relocate	Flood insurance changes	Coastal buyback		M	O
Ipswich Dam	Town Center	Private	V	removal / flow control structure				H	S-O
Frozen pipes	Varies	Private/ Public	V	Audit town buildings / insulate / educate on how to shutdown/ isolate				L	S-O
Advancements to manual meter energy grid more resilient to	Varies	Town/ Private	S	expanding & decentralizing Solar & wind / looping electrical / net meters / redundant sources				H	O-L
Forest roads	Varies	Town/ State/ private	V	maintain & mapped				L	L-O
Wastewater treatment Plants & Pump Stations	Plants	Town	V	elevate if possible or protect				H	L-O-S
Societal									
Historic resources (homes/bridges)	Varies	Private/ Public	V	rebuild but maintain historic characteristics / diversion channels / Evaluate at risk historic homes				M	L
Clamming	Marsh	Town	V	Protect environmental aspects - salt marsh - restoration projects / treat stormwater				M	O-L
Major employers	Varies	private	V	improve infrastructure / duplicate if possible /				M	L
Elderly	Town-wide	private	V	shelter & emergency response / track individual needs / transportation & evacuation assistance / Alarm or notification system				H	S
schools & public buildings	Varies	Public/ Private	V	Engage students / Stakeholders / Consider as shelters / improve				M	S-O
Neck area	Neck	Private/public	V	Communication system redesign / rescue route / Stage Emergency response personal / identify at risk residents / mobilize vehicles				H	S-O
Archeological	coastal area	Public/ Private	S/V	map locations / Photo document / archive / engage subject experts				L	L-O
Environmental									



BROWN GROUP

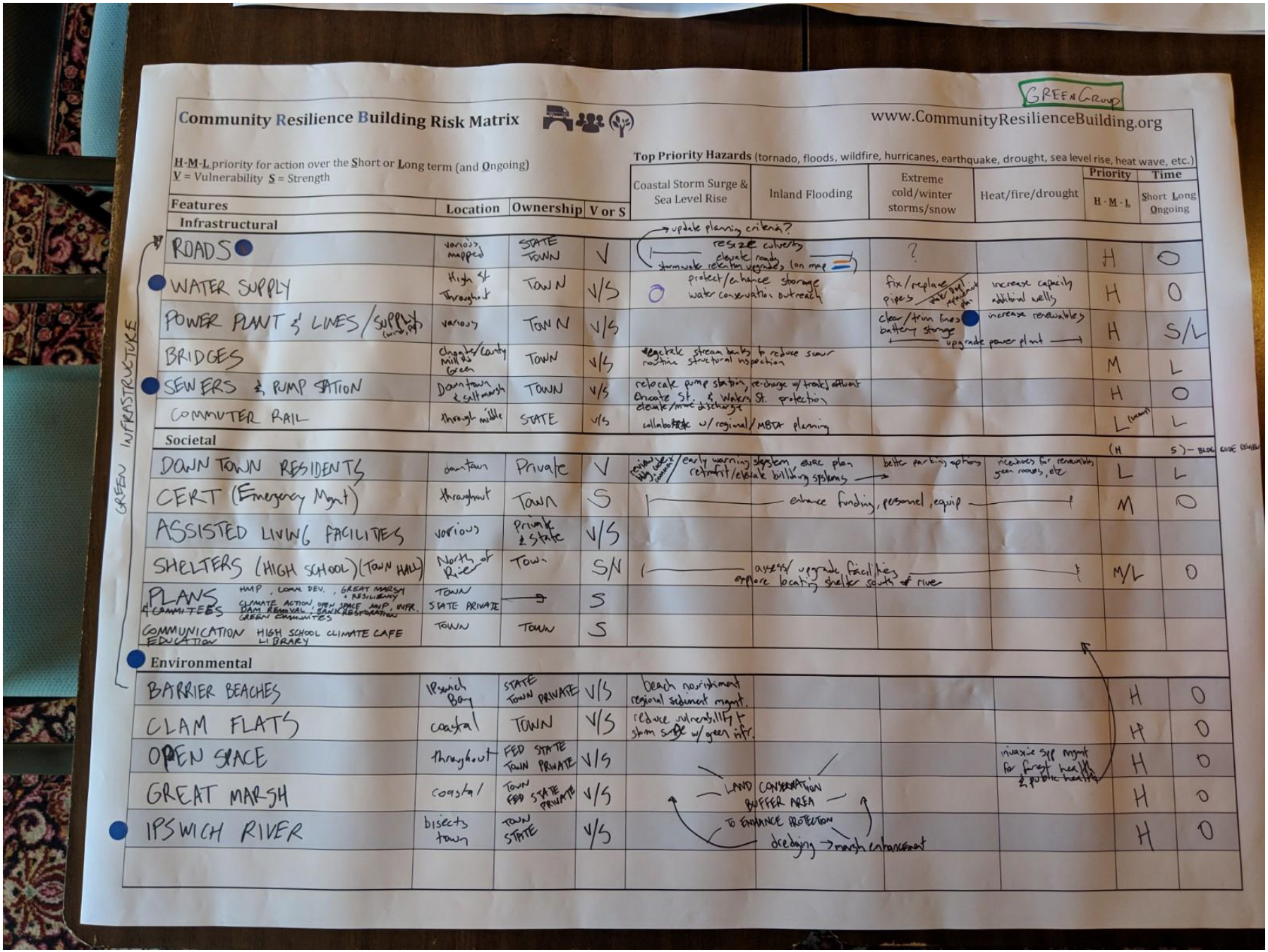
Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.org

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Coastal Storm Surge & Sea Level Rise	Inland Flooding	Extreme cold/winter storms/snow	Heat/fire/drought	Priority H-M-L	Time 5-10 Short 10+ Long Ongoing
Infrastructural									
Jetfrys Neck Road / Neck area Argilla Road / Cedar Beach	Neck area	Town	V	raise road / consider culvert connectivity				H	S-O
Pavilion Beach	Neck area	Town	V	investigate artificial dunes / Pedestrian safety				M	L-O
Electric & communication network	Town-wide	Town	V	clear around transition lines / expand on Alternate energy sources / underground electric				H	S
County St. Bridge / Mill Rd. Bridges generally	Varies	Town	V	rebuild / replace consider widening				H/M	L-O
Water & sewer system Exposed & aging pipes upstream upgrades	Varies	Town	V	relocate or protect / regional watershed management / stormwater recharge / retaining infiltration / promote LID in up river communities / underside flood plain by back volume emergency H				H	L-O
Public buildings - facilities	Varies	Town	V	generators / alternate energy sources / Emergency plans / shelter plans / communication				M	S-O
Societal									
Cranberry Beach access	Argilla	Town/Trustees	V	route road / consider Culvert Connectivity / Barrier road & parking with natural uplands				H	S-O
Public health new diseases	Town wide	—	V	educate public / spray / trap at worst areas / hunt where possible move				L	L
property values / insurance costs	Town wide	—	V	-DCR - CRS - Community rating system - Zoning & future flood maps - replace & relocate				L	L
Communication with residents				Alarm system for immediate incidents				H	S
Environmental									
Water - river, supply	Rivers	Public	V/S	Sewer under during peak demand / inflow / stormwater / investigate other water sources / upstream water use management / in concert for LID & onsite storage				H	L-O-S
Barrier beaches	Ocean	Public/ private	V/S	investigate coastal wave sediment study / strategically located dune restoration or creation plans / add to existing dunes / manage & protect barrier beaches				H	S-O-L
Ecology - ocean warming, fish, plants	Varies	Public	V/S	clam removal study / oyster restorations				M	L
Fresh water wetlands	Varies	Public/ Private	V/S	Enforce & strengthen regulation / create new wetlands				L	L
Forest / Moths	Varies	Public/ private	V/S	Management Plan / reforest				L	LS-O
Marsh	Varies	Public/private	V/S	Thin layer TLD / Deposits / ditch remediation / marsh drainage & hydrology / ranging				M	S-O-L



GREEN GROUP

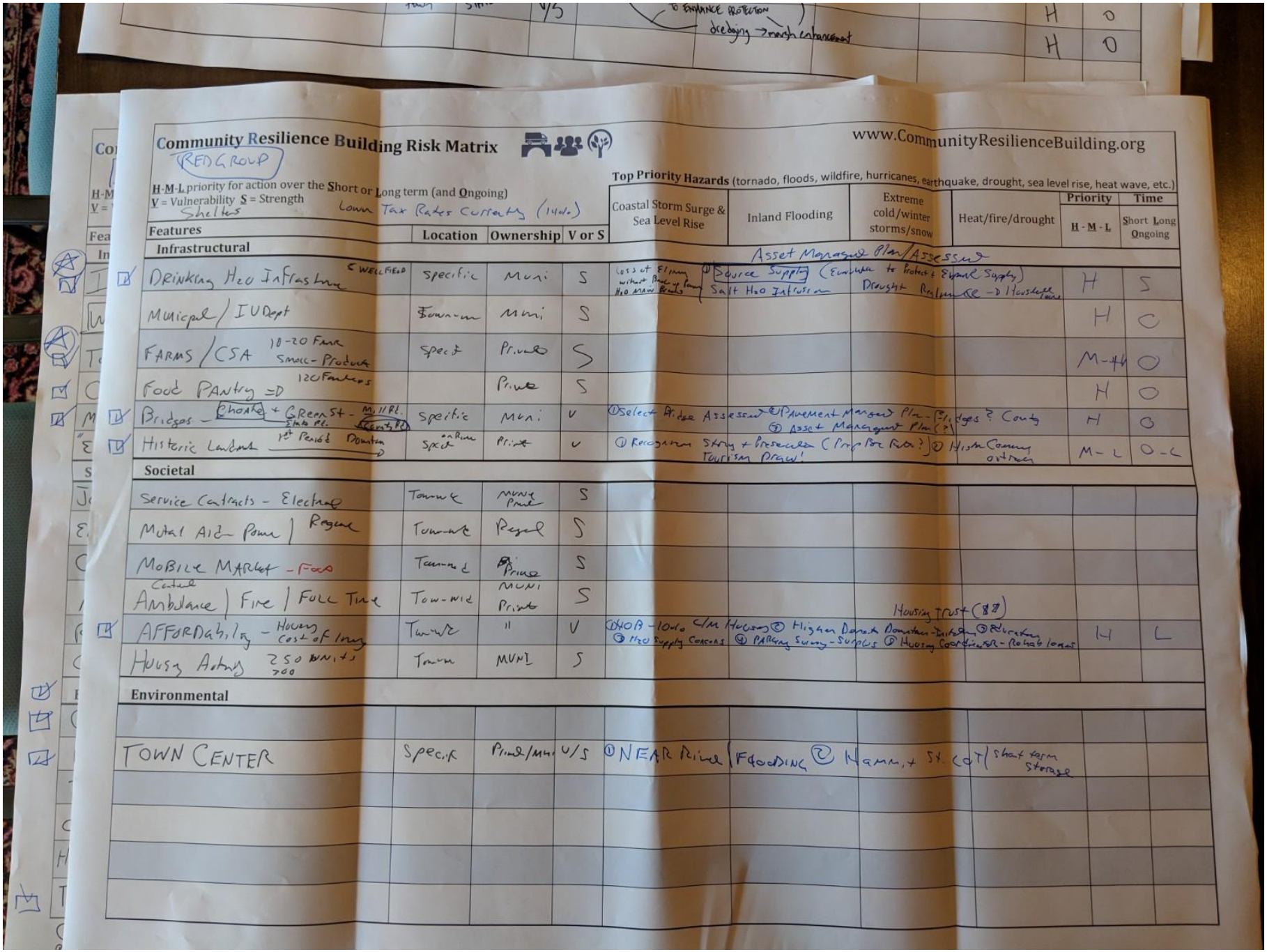
Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Coastal Storm Surge & Sea Level Rise	Inland Flooding	Extreme cold/winter storms/snow	Heat/fire/drought	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
ROADS	various mapped	STATE TOWN	V	update planning criteria? resize culverts, elevate roads, stormwater retention upgrades (on map)		?		H	O
WATER SUPPLY	High St Throughout	TOWN	V/S	protect/enhance storage water conservation outreach		fix/replace pipes (early detection)	increase capacity additional wells	H	O
POWER PLANT & LINES/SUPPLY (various)	various	TOWN	V/S			clear/trim lines battery storage ← upgrade power plant →	increase renewables	H	S/L
BRIDGES	Choate/County Mills Green	TOWN	V/S	vegetate stream banks to reduce scour routine structural inspection				M	L
SEWERS & PUMP STATION	Downtown & saltmarsh	TOWN	V/S	relocate pump station, re-charge w/ treated effluent Choate St. & Waters St. protection elevate/move discharge				H	O
COMMUTER RAIL	through middle	STATE	V/S	collaborate w/ regional/MBTA planning				L (vulnerable)	L
Societal								(H M S) – BLDG CODE REVIEW	
DOWN TOWN RESIDENTS	downtown	Private	V	revised bldg. codes / early warning system, evac plan retrofit/elevate building systems →		better parking options	incentives for renewables, green roofs, etc	L	L
CERT (Emergency Mgmt)	throughout	TOWN	S	← enhance funding, personel, equip →				M	O
ASSISTED LIVING FACILITIES	various	private & state	V/S						
SHELTERS (HIGH SCHOOL)(TOWN HALL)	North of River	TOWN	S/N	← assess/ upgrade facilities explore locating shelter south of river →				M/L	O
PLANS & COMMITTEES: HMP, COMM DEV., GREAT MARSH RESILIENCY, CLIMATE ACTION, OPEN SPACE, MVP, INFR., DAM REMOVAL, BANK RESTORATION, GREEN COMMUNITIES	TOWN STATE PRIVATE	→	S						
COMMUNICATION EDUCATION: HIGH SCHOOL CLIMATE CAFE, LIBRARY	TOWN	TOWN	S						
Environmental									
BARRIER BEACHES	Ipswich Bay	STATE TOWN PRIVATE	V/S	beach nourishment regional sediment mgmt.				H	O
CLAM FLATS	coastal	TOWN	V/S	reduce nutrients, IIP & storm surge w/ green infr.				H	O
OPEN SPACE	throughout	FED STATE TOWN PRIVATE	V/S				invasive spp mgmt for forest health & public health	H	O
GREAT MARSH	coastal	TOWN FED STATE PRIVATE	V/S	LAND CONSERVATION BUFFER AREA TO ENHANCE PROTECTION dredging → marsh enhancement				H	O
IPSWICH RIVER	bisects town	TOWN STATE	V/S					H	O

GREEN INFRASTRUCTURE



Community Resilience Building Risk Matrix

(RED GROUP)

www.CommunityResilienceBuilding.org

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

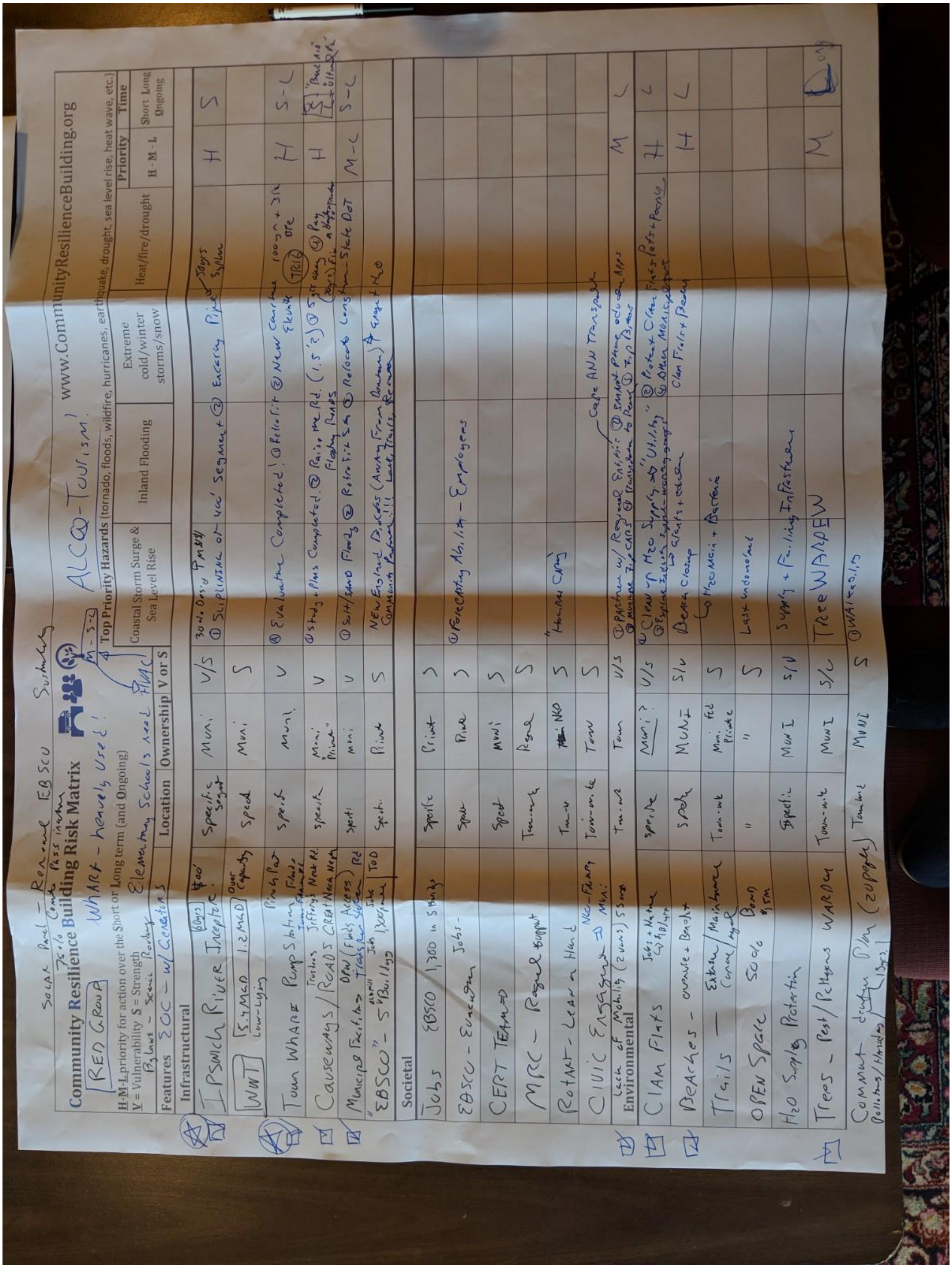
Shelters — Town Tax Rates Currently (14th)

Features	Location	Ownership	V or S	Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.): Coastal Storm Surge & Sea Level Rise	Inland Flooding	Extreme cold/winter storms/snow	Heat/fire/drought	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
DRINKING H2O INFRASTRUCTURE (WELLFIELD)	Specific	Muni	S	Loss of Elmm without Back-up Power H2O MAIN Breaks	① Source Supply (Evaluate to Protect + Expand Supply) Salt H2O Intrusion	Drought Resilience → ① Housekeeping		H	S
Municipal / IT Dept	Townwide	Muni	S					H	C
FARMS / CSA (10-20 Farm Small-Producer)	Specific	Private	S					M-H	O
Food PANTRY → (12 Farmers)		Private	S					H	O
Bridges – Choate + Green St – Mill Pl. Essex Pl. Liberty Pl.	Specific	Muni	V	① Select Bridge Assessment ② Pavement Management Plan (?) Hoges ? County ③ Asset Management Plan (?)				H	O
Historic Landmark – 1st Period Downtown	Specific on River	Private	V	① Recognition Story + Preservation (Prop Box Rock?) ② Historic Commission Outreach Tourism Draw!				M-L	O-L
Societal									
Service Contracts – Electrical	Townwide	Muni + Private	S						
Mutual Aid – Power (Regional)	Townwide	Regional	S						
MOBILE MARKET – FOOD	Townwide	Private	S						
Ambulance (Central) / FIRE / FULL TIME	Town-Wide	MUNI Private	S						
AFFORDABILITY – Housing Cost of Living	Townwide	"	V	① NOB – 10+0 C/M Housing ② Higher Density Downtown-Infill ③ Elevation ③ H2O Supply Concerns ④ PARKING Survey – Surplus ⑤ Housing Coordinator – Rehabilitation				H	L
HOUSING AUTHORITY 250 UNITS 700	Townwide	MUNI	S						
Environmental									
TOWN CENTER	Specific	Private/Muni	U/S	① NEAR River/Flooding ② Hamm, St. Cat/ Short term Storage					

Asset Management Plan/Assessment

Housing Trust ($$)

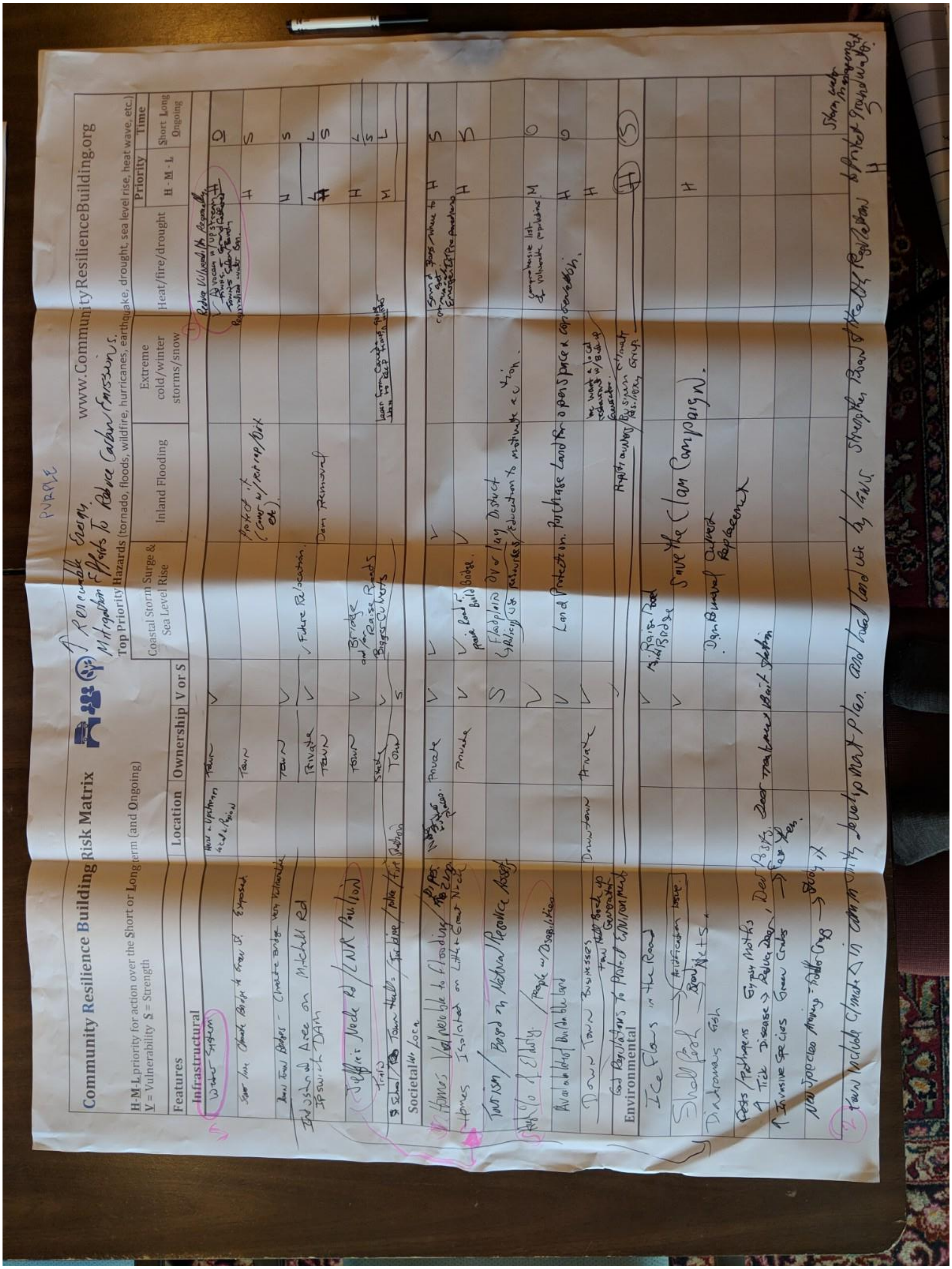
Appendix E: Small Group Matrix: Red Group


SOLAR Panel – Renewable EBSCO Sustainability
75% Commuter Pass incentive
Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org
RED GROUP
WHARF – heavily used!
ALCQ – Tourism!
Elementary Schools need HVAC

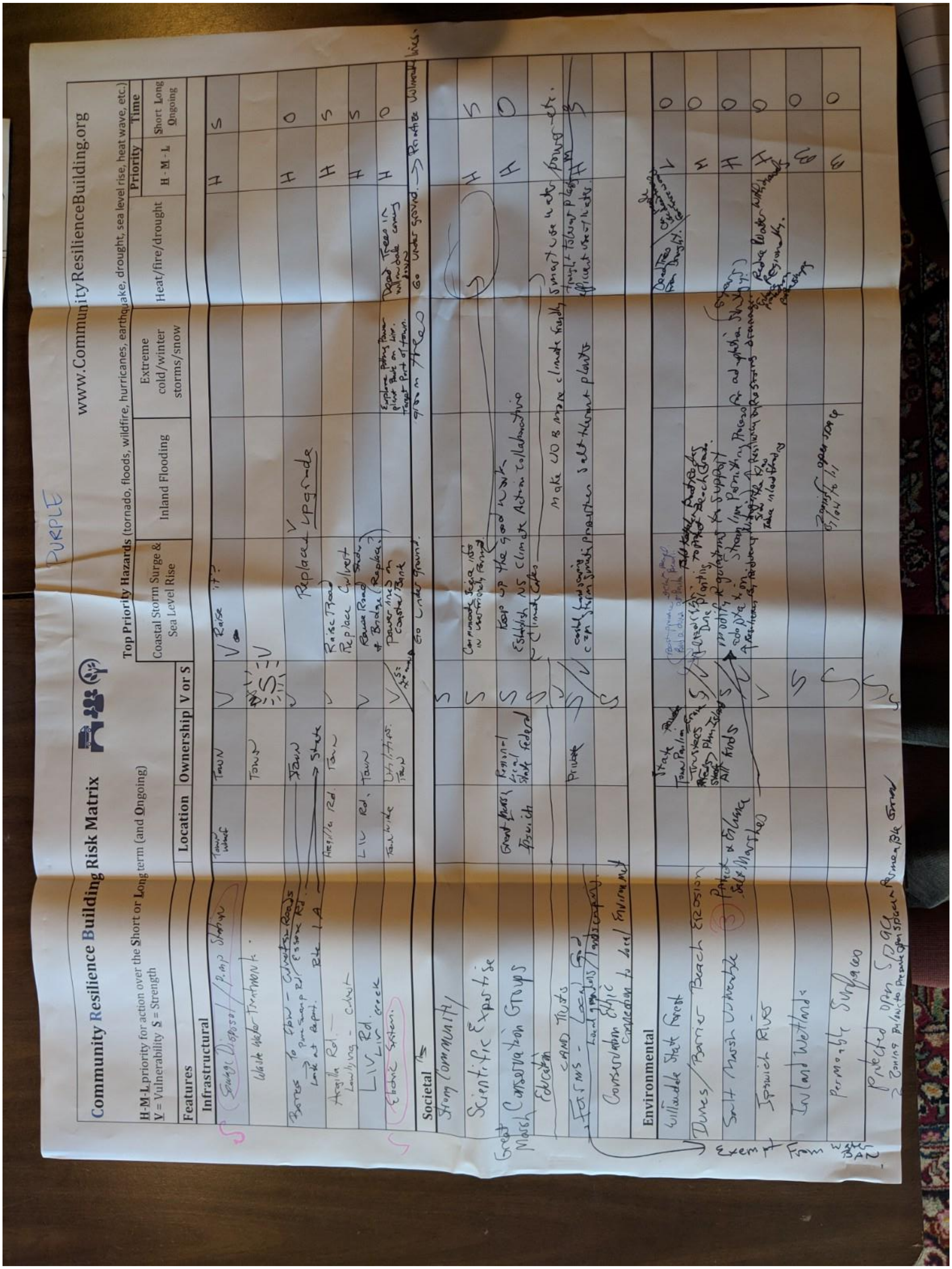
H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength
By-laws – Scenic Roadway

Features	Location	Ownership	V or S	Coastal Storm Surge & Sea Level Rise	Inland Flooding	Extreme cold/winter storms/snow	Heat/fire/drought	Priority H-M-L	Time Short Long Ongoing
EOC – w/ Generators									
Infrastructural									
Ipswich River Interceptor: 60yrs, 400'	Specific segment	Muni	V/S	30% Design ↑ M$$ ① SLIPLINING of 400' segment + ② Excess Pipe			30yrs Sypline	H	S
WWT 5.4 MGD 1.2 MGD Over capacity, Low-Lying	Specific	Muni	S						
Town Wharf Pump Station, Ping Pier, Floats, Town Hall	Specific	Muni	V	④ Evaluation Completed! ① Retrofit ② New Caisson Elevate			100yr + 3ft DFE (TRIG)	H	S–L
Causeways/Roads – Trustees, Jeffreys Neck Rd., Great Neck Neck	Specific	Muni, Private	V	① Study + Plans Completed ② Raise the Rd. (1.5'?) ③ 5yr Study (20yrs) ④ Pay a Highground Fix				H	S – "Beach Rd." – L – "Ultimate Rd."
Municipal Facilities – DPW (Fluids Access) Rd, Transfer Station	Specific	Muni	V	① Salt/Sand Flooding ② Retrofit Site ③ Relocate Long-term – State DOT				M–L	S–L
"EBSCO" – 5 Buildings, Jobs 1,300 people, TOD	Specific	Private	S	NEW England Biolabs (Away From Downtown) ↑ Garage + H₂O Community Partners!!! Land, Trails, Rec.					
Societal									
Jobs – EBSCO 1,300 in 5 Bldgs	Specific	Private	S	① Forecasting Ability – Employees					
EBSCO – Evacuation Jobs	Specific	Private	S						
CERT TEAM	Specific	Muni	S						
MRC – Regional Support	Town-wide	Regional	S						
Rotary – Lean a Hand	Town-wide	NPO	S	"Holiday Cares"					
Civic Engagement ⇒ NPO-Faith, Muni	Town-wide	Town	S						
Lack of Mobility (2 vans) SS only	Town-wide	Town	V/S	① Partner w/ Regional Entities ② Smart Phone education Apps ③ Municipal Zip Cars ④ Transportation to Peers ⑤ Trip Brokers – Cape Ann Transport				M	L
Environmental									
Clam Flats – Jobs + Nature $ [illegible]/yr	Specific	Muni?	V/S	① Clean up H₂O Supply ⇒ "Utility" ② Protect Clam Flats + Pets + Poop ③ Existing Industry support – working groups ④ Other Municipalities ↳ Clients + Education				H	L
Beaches – ownership + Beachfront	Specific	MUNI	S/V	Beach Closings ↳ H₂O Main + Bacteria – Clean Floats + Beaches				H	L
Trails – Extension/Maintenance, Conservation/Agriculture	Town-wide	Muni, Fed, Private	S						
Open Space – 50%, Bond $ 5M	"	"	S	Lost undone/unused					
H₂O Supply Protection	Specific	MUNI	S/V	Supply + Failing Infrastructure					
Trees – Pest/Pathogens, WARDEN	Town-wide	MUNI	S/V	Tree WARDEN				M	L
Community Plan (20 people) 15yrs! Pollinators/Hazardous	Town-wide	MUNI	S	① WAI [illegible]					

Appendix E: Small Group Matrix: Red Group



Appendix E: Small Group Matrix: Purple Group


PURPLE

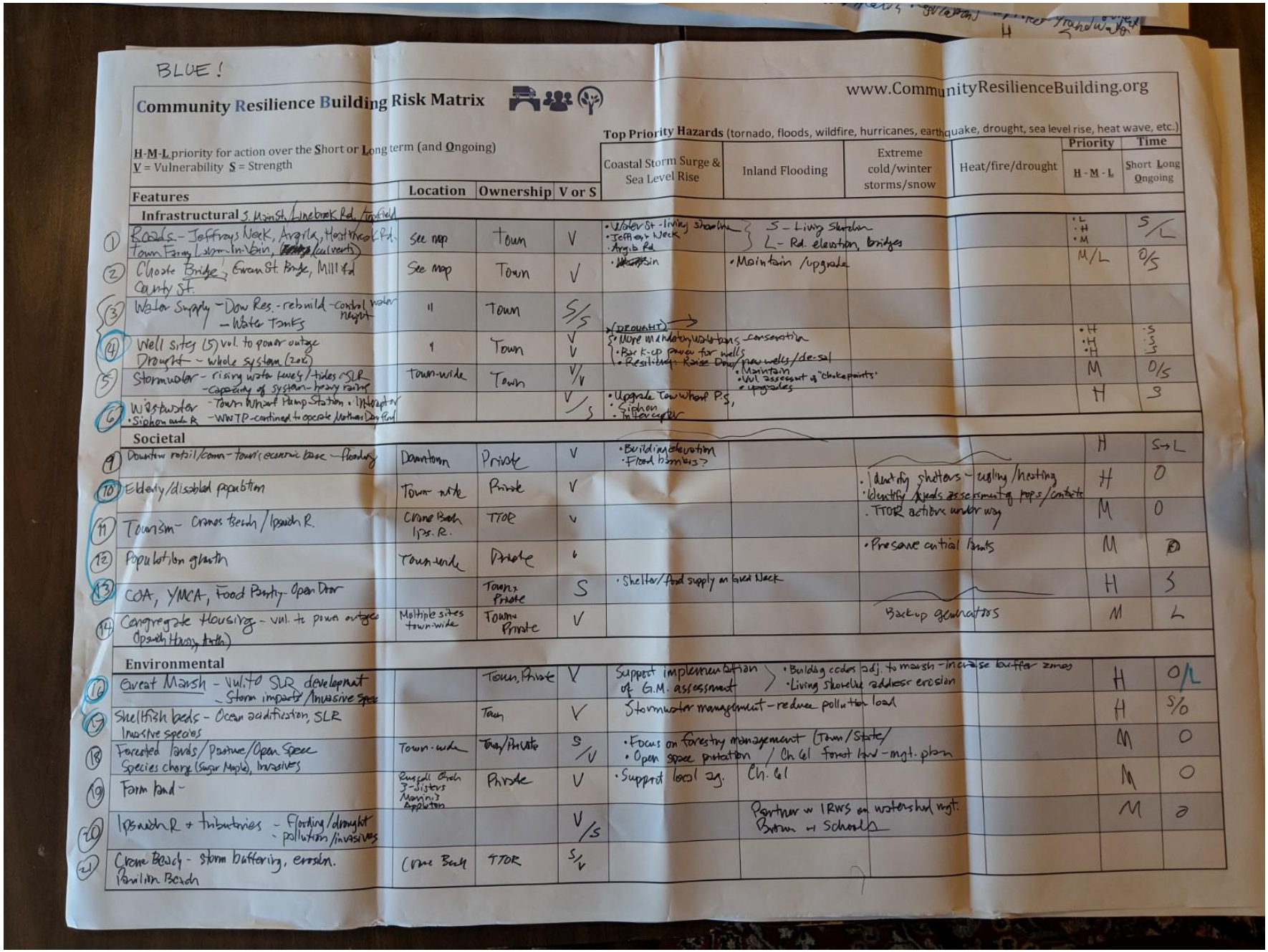
Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Features	Location	Ownership	V or S	Coastal Storm Surge & Sea Level Rise	Inland Flooding	Extreme cold/winter storms/snow	Heat/fire/drought	Priority H-M-L	Time Short Long Ongoing
Infrastructural									
Sewage Disposal / Pump Station	Town wharf	Town	V	V Raise it?				H	S
Waste Water Treatment		Town	S	V					
Barriers to flow – Culverts Roads → Pine Swamp Rd, Essex Rd. Look at depot. Rte 1A		Town → State	V	Replace/Upgrade				H	O
Argilla Rd. — Lowlying – culvert	Argilla Rd.	Town	V	Raise Road, Replace Culvert				H	S
LIV Rd. LIV creek	LIV Rd.	Town	V	Raise Road & Bridge (Replace?)				H	S
Electric System	Town wide	Utilities, Town	V / S: [illegible]	Power lines in Coastal Bank. Go Under ground.		Explore putting power plant back on line. Target part of town. Go Under ground.	Dead Trees in Willowdale coming down. Go under ground. → Prioritize Willowdale lines.	H	O
Societal									
Strong Community			S						
Scientific Expertise			S	Communicate science into in user-friendly format				H	S
Great Marsh Conservation Groups	Great Marsh, Ipswich	Regional, Local, State, Federal	S	Keep up the good work. Establish NS Climate Action Collaborative				H	O
Education			S	Climate Cafes	Make UOB more climate friendly		Smart use water, power etc.		
Land Trusts			S						
Farms – Local Food; Local gardens/landscaping		Private	V/S	Coastal landscaping; Salt-tolerant plants	Salt-tolerant plants		Drought tolerant plants; efficient use of water	M/H	S
Conservation Ethic; Connection to local Environment			S						
Environmental									
Willowdale State Forest		State, Town, Private					Dead Trees from Drought	L	O
Dunes/Barrier Beach Erosion		Town, Pavilion, Crane, Trustees, State, Plum Island	S	Dune plantings; protect beach grass				M	O
Salt Marsh Vulnerable (3) Protect & Enhance Salt Marshes		All kinds	S / V	Modify guidelines to support adaptation; Strong line permitting process for adaptation strategies				H	O
Ipswich River			V				Reduce water withdrawals regionally	H	O
Inland Wetlands			S					M	O
Permeable Surfaces			S	Zoning open space 1:1				M	O
Protected Open Space; Zoning bylaws to preserve open space, permeable cover			S						

Exempt from water BAN.

Appendix E: Small Group Matrix: Purple Group



BLUE!

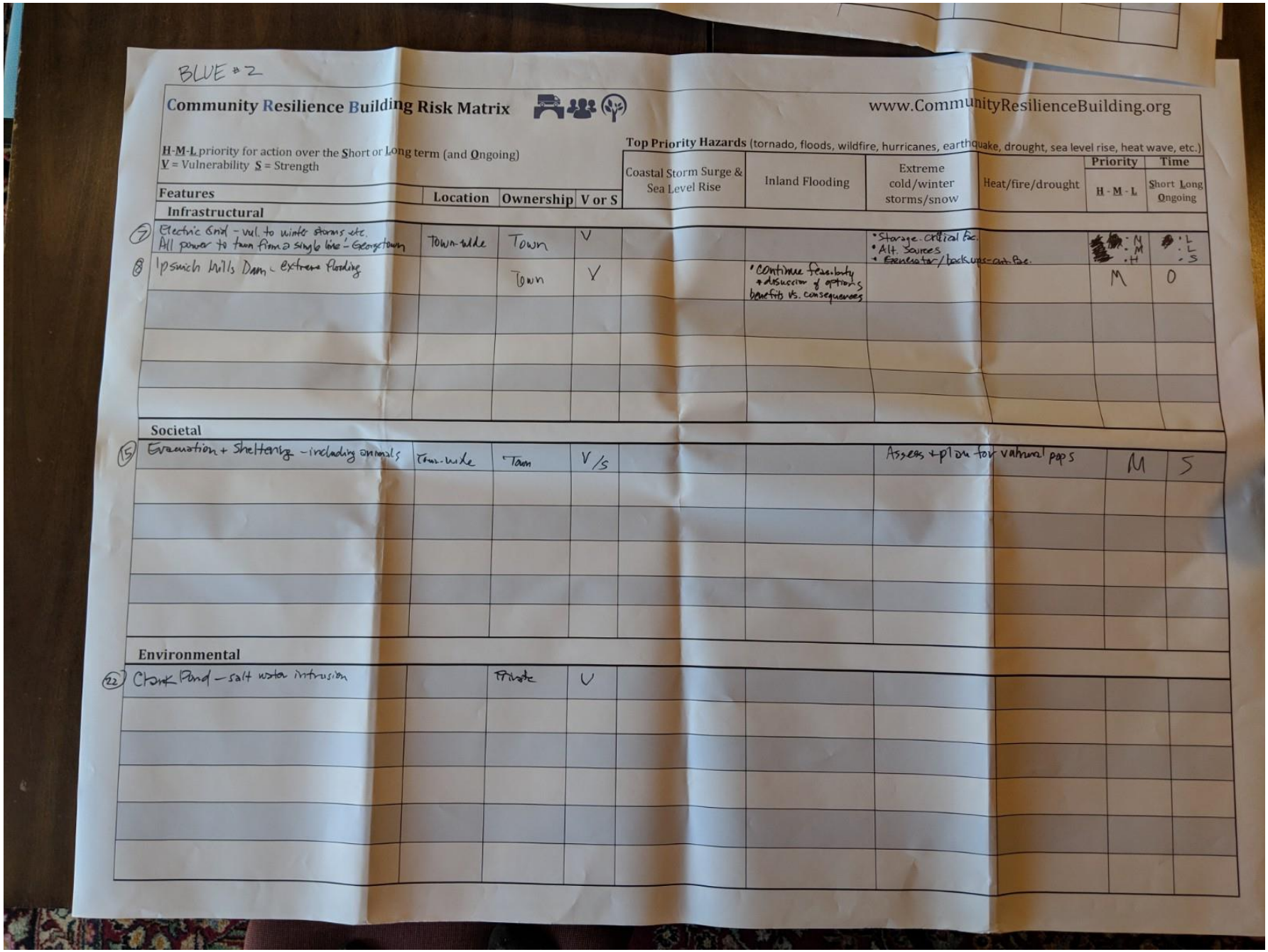
Community Resilience Building Risk Matrix

www.CommunityResilienceBuilding.org

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

Features	Location	Ownership	V or S	Coastal Storm Surge & Sea Level Rise	Inland Flooding	Extreme cold/winter storms/snow	Heat/fire/drought	Priority H-M-L	Time Short Long Ongoing
Infrastructural S. Main St. Linebrook Rd. Topsfield									
1 Roads - Jeffrays Neck, Argilla, Heathcock Rd. Town Farm Lane, Linebrook Rd. (culverts)	See map	Town	V	• Water St - living shoreline • Jeffrey's Neck • Argilla Rd	S - Living Shoreline L - Rd. elevation, bridges			• L • H • M	S/L
2 Choate Bridge, Ewan St. Bridge, Mill Rd County St.	See map	Town	V	• [illegible] in	• Maintain / upgrade			M/L	O/S
3 Water Supply - Dow Res. - rebuild - control water height - Water Tanks	"	Town	S/S						
4 Well sites (5) vol. to power outage Drought - whole system (2016)	"	Town	V V	(DROUGHT) • More monitoring/restrictions, conservation • Back-up power for wells • Resiliency - Raise Dow, new wells/de-sal				• H • H • H	S S S
5 Stormwater - rising water levels / tides / SLR - capacity of system - heavy rains	Town-wide	Town	V/V		• Maintain • Vul. assessment of "choke points" • upgrades			M	O/S
6 Wastewater - Town Wharf Pump Station • Interceptor • Siphon and R - WWTP - continued to operate Nathan Dorman Pond			V/S	• Upgrade Town Wharf PS, • Siphon • Interceptor				H	S
Societal									
9 Downtown retail/comm - town's economic base - flooding	Downtown	Private	V	• Building elevation • Flood barriers?				H	S→L
10 Elderly/disabled population	Town-wide	Private	V				• Identify shelters - cooling/heating • Identify needs assessment of pops/contacts	H	O
11 Tourism - Crane Beach / Ipswich R.	Crane Beach Ipsw. R.	TTOR	V				• TTOR actions under way	M	O
12 Population growth	Town-wide	Private	V				• Preserve critical lands	M	O
13 COA, YMCA, Food Pantry - Open Door		Town, Private	S	• Shelter/food supply on Great Neck				H	S
14 Congregate housing - vul. to power outage (Ipswich Haven, Parkview)	Multiple sites town-wide	Town, Private	V				Backup generators	M	L
Environmental									
15 Great Marsh - Vul. to SLR development - Storm impact / Invasive spec		Town, Private	V	Support implementation of G.M. assessment	• Building codes adj. to marsh - increase buffer zones • Living shoreline address erosion			H	O/L
16 Shellfish beds - Ocean acidification, SLR Invasive species		Town	V	Stormwater management - reduce pollution load				H	S/O
18 Forested lands / Pasture / Open Space Species change (Sugar Maple), invasives	Town-wide	Town/Private	S/V	• Focus on forestry management (Town/State/ • Open space protection / Ch. 61 forest land - mgt. plan				M	O
19 Farm land -	Rustfall Orchard, 3 Sisters Manning's Appleton	Private	V	• Support local ag. Ch. 61				M	O
20 Ipswich R. + tributaries - Flooding/drought - pollution/invasives			V/S		Partner w IRWS on watershed mgt. Brown w Schools			M	O
21 Crane Beach - storm buffering, erosion. Pavilion Beach	Crane Beach	TTOR	S/V						



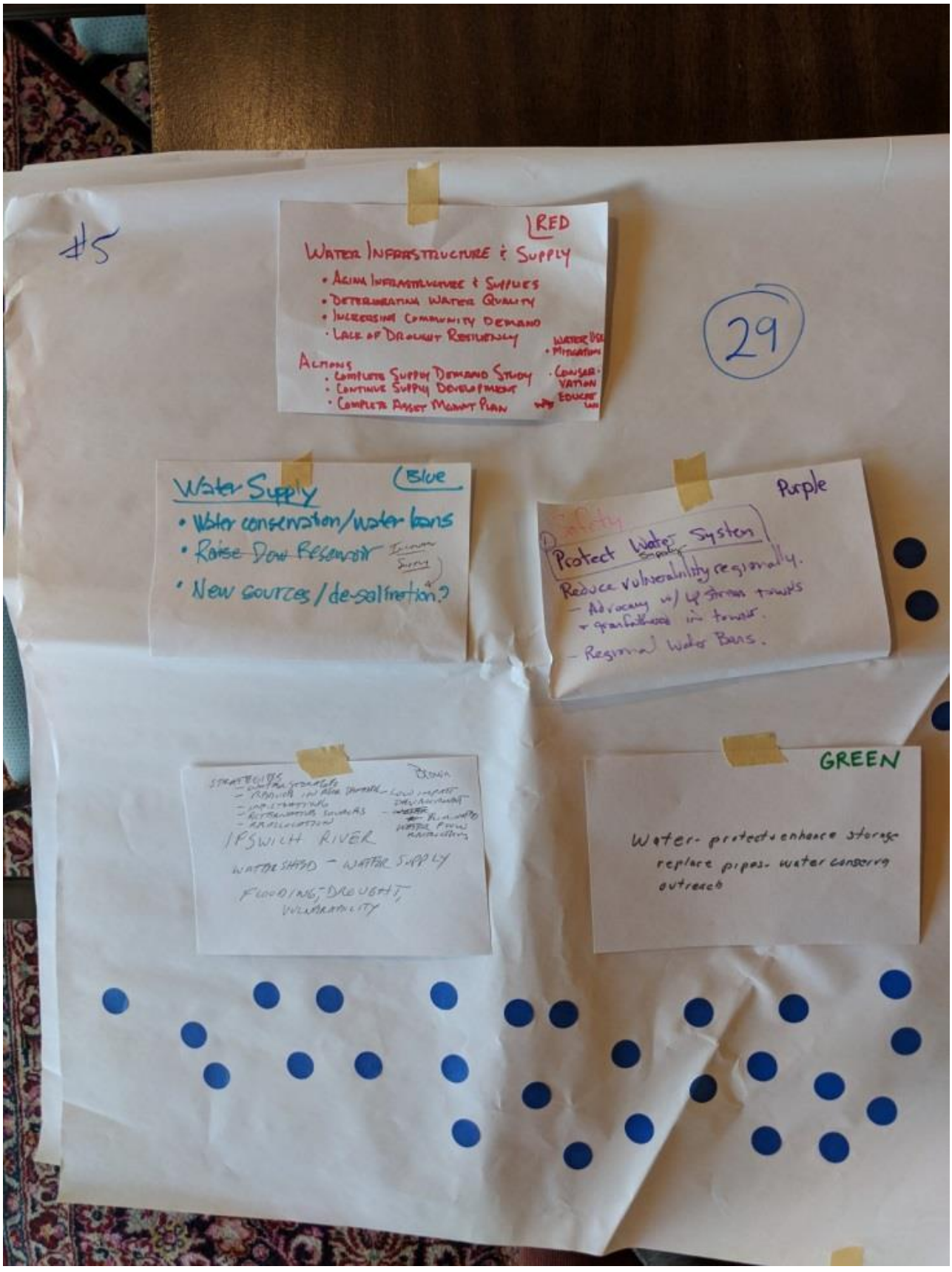
BLUE #2

Community Resilience Building Risk Matrix www.CommunityResilienceBuilding.org

H-M-L priority for action over the Short or Long term (and Ongoing)
V = Vulnerability S = Strength

	Features	Location	Ownership	V or S	Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.) Coastal Storm Surge & Sea Level Rise	Inland Flooding	Extreme cold/winter storms/snow	Heat/fire/drought	Priority H-M-L	Time Short Long Ongoing
	Infrastructural									
7	Electric Grid - vul. to winter storms, etc. All power to town from a single line - Georgetown	Town-wide	Town	V			• Storage - critical fac. • Alt. Sources • Generator/backups - crit. fac.		H	L
8	Ipswich Mills Dam - extreme flooding		Town	V		• Continue feasibility + discussion of options benefits vs. consequences			M	O
	Societal									
15	Evacuation + Sheltering - including animals	Town-wide	Town	V/S			Assess + plan for vulnerable pops		M	S
	Environmental									
22	Clark Pond - salt water intrusion		Private	V						

Appendix E: Small Group Matrix: Blue Group



Appendix F: Top Priority Posters with Sticky Dot Votes

#4

GREEN

Environment - shoreup existing natural resources - nourishment - vegetation - areas designated protected reduce

27

Brown

RESTORE/PROTECT BARRIER BEACH & MARSH SYSTEMS

- CONSIDER MARSH/SEDIMENT SUPPLY
- STRATEGICALLY SITING DUNE RESTORATION
- RESTORING MARSH HYDROLOGY THROUGH DITCH REMEDIATION & RUNNELLING
- IMPROVE EXISTING DUNES THIN LAYER DEPOSITION

Blue

Great Marsh/ Shellfish Beds

- Implement GM
- Bldg codes - adjust buffer zones
- Living shoreline
- Stormwater management

3

Purple

Protect the salt marshes.

- Modify state regulations to support adaptation. Stream line permitting process
- ↑ Resiliency by reducing Nitrogen and restoring drainage.
- Land protection to allow salt Marsh migration.

#3

GREEN

#1

Sewers - rehab. pump station
Recharge water - Protect
Choate St + Water St. Lines

(RED)

WASTEWATER INFRASTRUCTURE
- INTERCEPTOR & SIPHON
- TOWN WHARF PUMP STATION

ACTION:
- EVALUATIONS COMPLETE
- COMPLETE DESIGN & PERMITTING
- REHAB AND/OR REPLACE PIPING & PUMP STA.
- COMPLETE ASSET MANAGMT PLAN

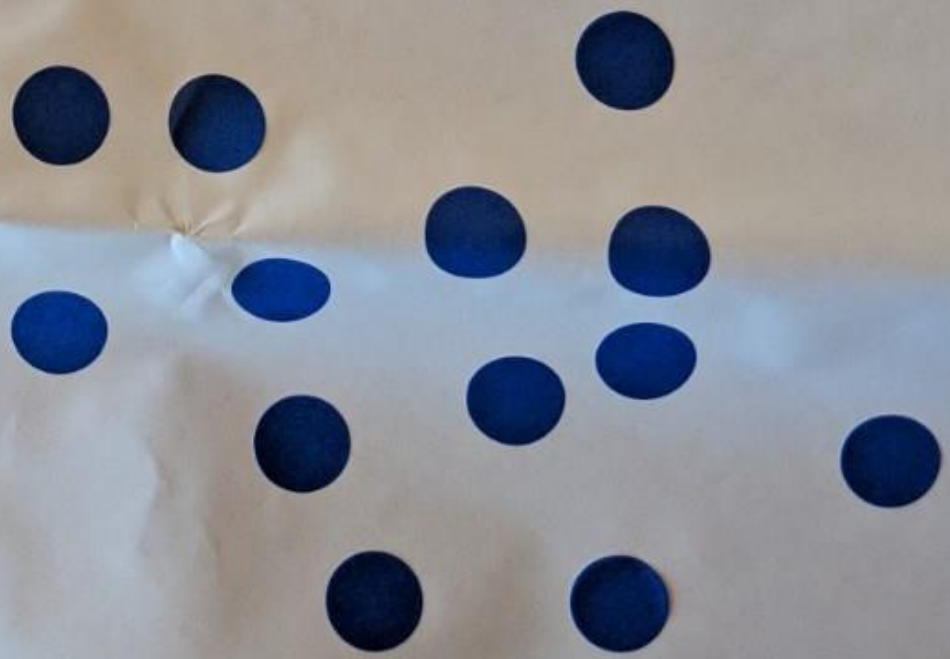
14

Wastewater (Blue

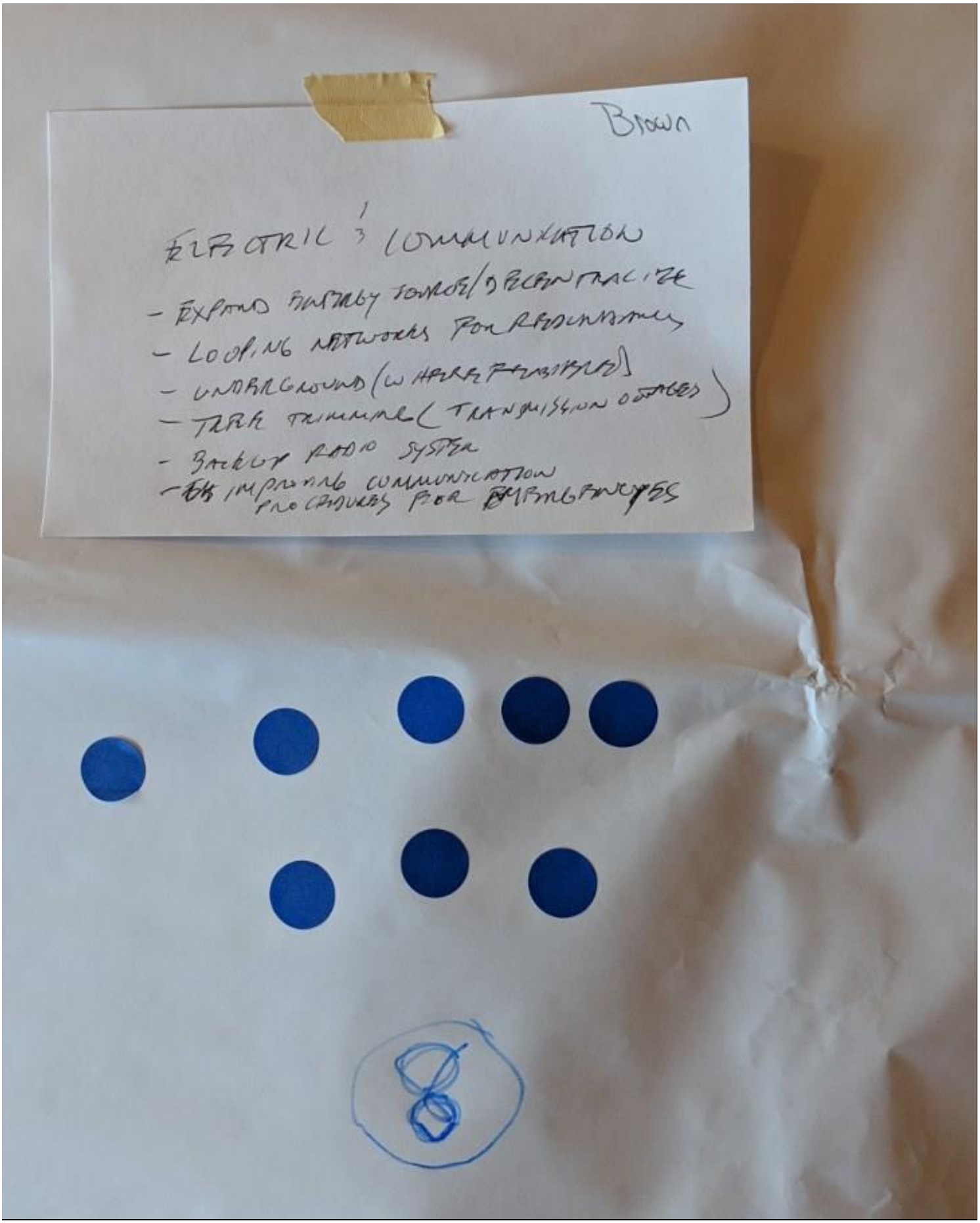
- upgrade Town Wharf pumping
- upgrade Siphon
- upgrade interceptor

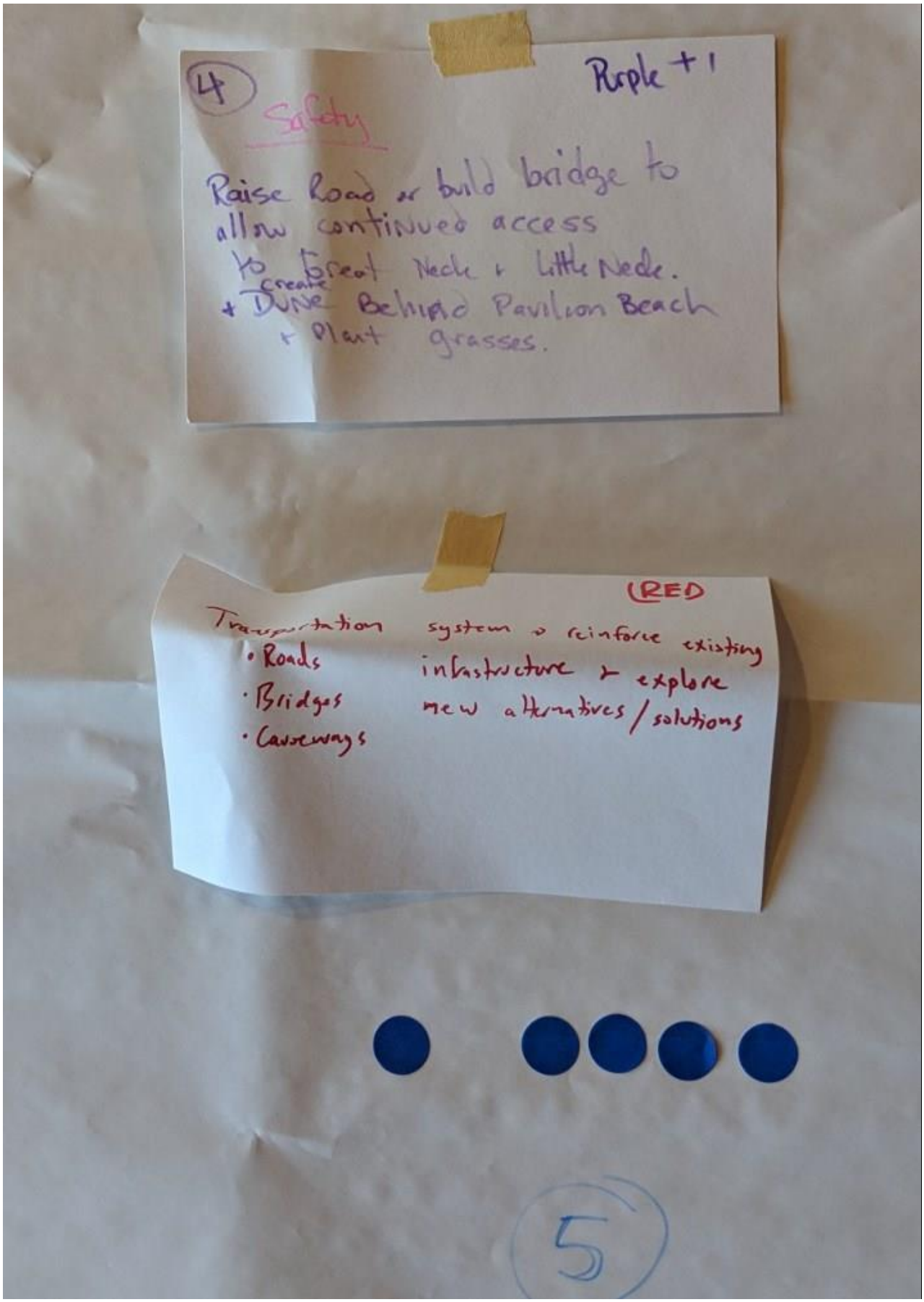
(2) Regulation Changes — Purple

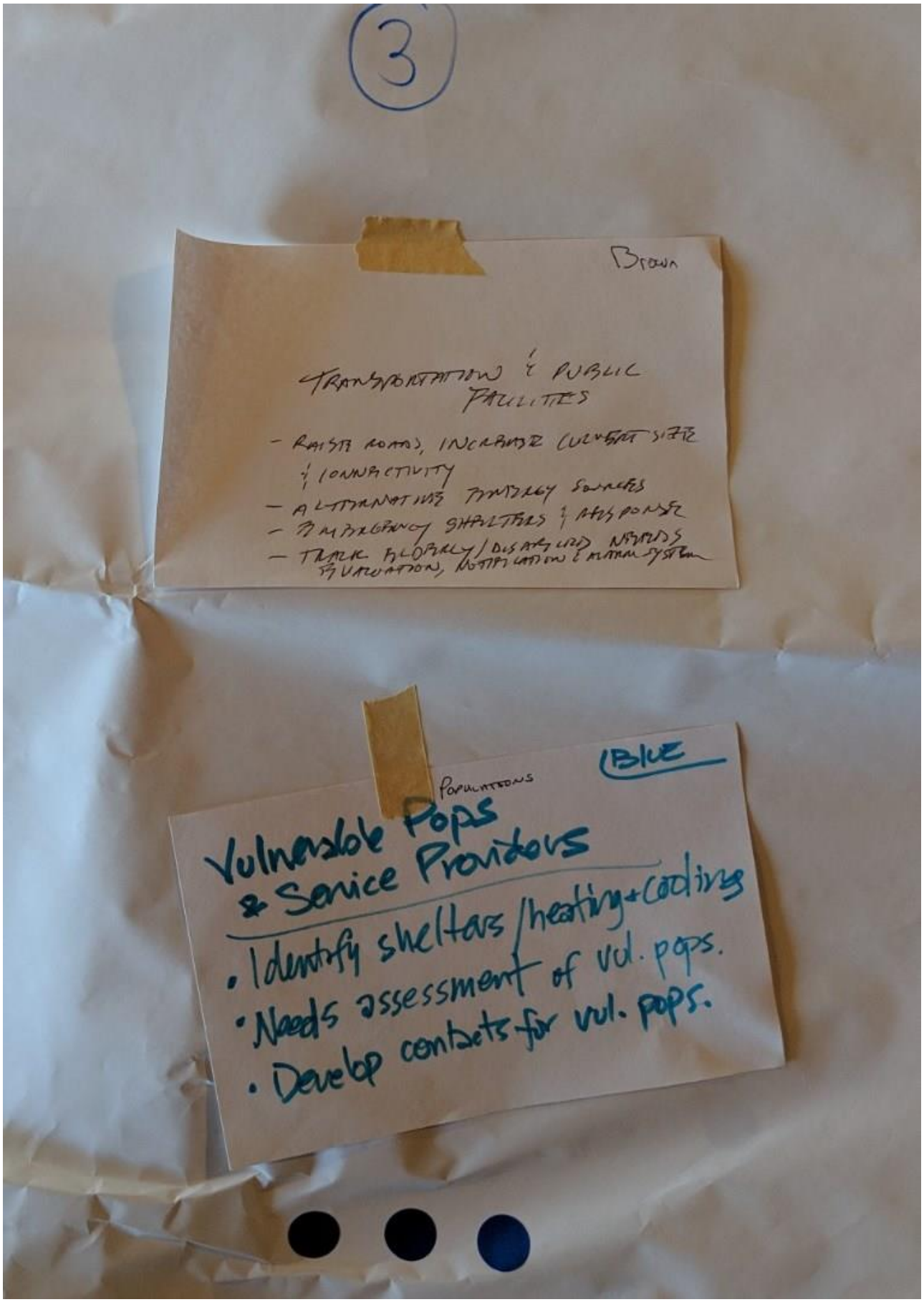
Include climate change and sea level rise considerations in all local regulations, Bylaws + Policies including: zoning, Building, Health, Wetlands stormwater management, Open Space, economic development, climate Action Plan, Community Development Plan, + MVP. Examples include: Add a flood plain overlay district, strengthen the stormwater management Bylaw to address stronger storms.



13


BROWN
ELECTRIC 3 COMMUNICATION
- EXPAND BATTERY POWER/SPECIFY CAPACITY
- LOOPING NETWORKS FOR REDUNDANCY
- UNDERGROUND (WHERE FEASIBLE)
- TREE TRIMMING (TRANSMISSION OUTAGES)
- BACKUP RADIO SYSTEM
- IMPROVING COMMUNICATION PROCEDURES FOR EMERGENCIES


4
Purple +1
Safety
Raise Road or build bridge to allow continued access to Great Neck + Little Neck.
+ Create Dune Behind Pavilion Beach + Plant grasses.
(RED)
Transportation
• Roads
• Bridges
• Causeways
system → reinforce existing infrastructure + explore new alternatives / solutions
5

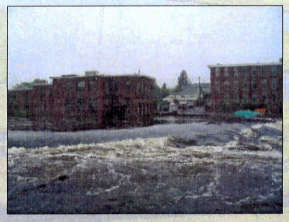

3
Brown
TRANSPORTATION & PUBLIC FACILITIES
- RAISE ROADS, INCREASE CULVERT SIZE & CONNECTIVITY
- ALTERNATIVE ENERGY SOURCES
- EMERGENCY SHELTERS & RESPONSE
- TRACK FLOODS / DISASTERS AND NEEDS EVALUATION, NOTIFICATION & ALARM SYSTEM
BLUE
POPULATIONS
Vulnerable Pops & Service Providers
• Identify shelters/heating+cooling
• Needs assessment of vul. pops.
• Develop contacts for vul. pops.

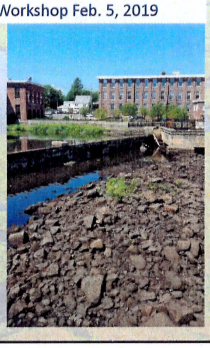
Appendix G:

Presentation Slides from Ipswich CRB Workshop Feb 5. 2019

Municipal Vulnerability Preparedness Program, Town of Ipswich, MA

Community Resiliency Building Workshop Feb. 5, 2019





May, 2006 August, 2016

Ipswich River, at the Ipswich Mills Dam

Ipswich MVP Workshop

February 5, 2019

Thank you to Ethan Parsons, Alicia Geilen, and Lt. Jonathan Hubbard for leading the Ipswich MVP Planning team.

Agenda

8am	Registration
8:30am	Welcome & Intros
9am	Presentation
9:40am	Small Group Work
12 noon	Lunch
12:45pm	Small Groups Reconvene
1pm	Large Group Discussion & Prioritization
3pm	Adjourn

Thank you for being here!

IPSWICH RIVER WATERSHED ASSOCIATION
The Voice of the River

Expectations of Workshop Participants

- *Permission to be active participants*
- *Your ideas & expertise are needed*
- *Respect contributions of others*
- *Be creative and remain optimistic*
- *Stay on task (as defined by your facilitators)*
- *Turn off your cell phone if you can*

Introductions

Your name

Your relationship to Ipswich

One place you want to go where you've never been

Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs

Municipal Vulnerability Preparedness Program

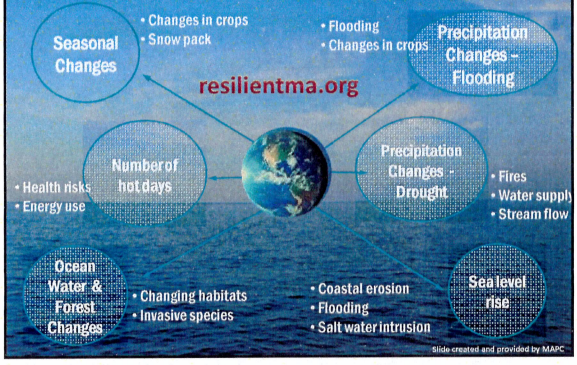
State and local partnership to build resiliency to climate change

1. Engage Community → 2. Identify CC impacts and hazards → 3. Complete assessment of vulnerabilities & strengths → 4. Develop and prioritize actions → 5. Take Action

The Municipal Vulnerability Preparedness (MVP) program helps communities in Massachusetts to:

- Define extreme weather and natural and climate related hazards
- Identify existing and future vulnerabilities and strengths
- Develop and prioritize opportunities to take action to reduce risk and build resilience

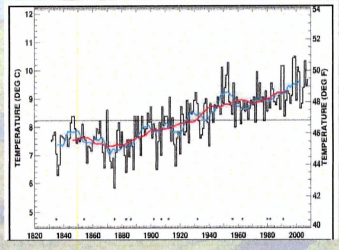
Our warming climate will have multiple impacts...



Slide created and provided by MAPC

Temperature change: observed

For the Northeast United States: average temperature increased by almost 2 degrees, between 1895 and 2011 (US National Climate Assessment 2014)



Blue Hill Observatory (near Boston) Annual Temperature, 1831-2008

Source: Michael J. Iacono (from MA Climate Change Adaptation Report 2011)

Temperature change: predicted

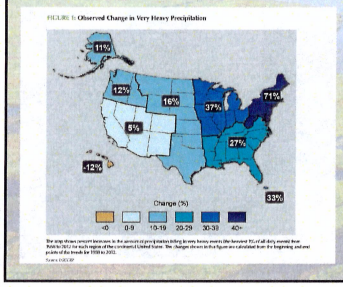
Projected Temperatures
Ipswich Watershed

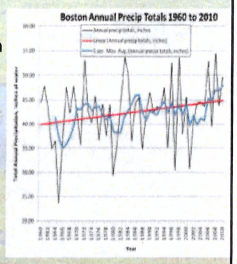
Temperature F°	Observed Baseline 1971-2000	Predicted 2050s	Predicted 2090s
Average annual temperature	49.48°F	52.22-55.69°F	53.07-60.24°F
Days over 90 ° (days/year)	6.88 days	8 to 30 more days, so a total of approx. 15-37 days	11 to 55 more days, so a total of approx.18-65 days

www.mass.gov/service-details/climate-change-in-massachusetts-and-its-impacts

Precipitation change: observed

For the Northeast United States:
71% increase in heavy precipitation from 1958 – 2012.
Source: US National Climate Assessment 2014





For Boston area:
10% increase in annual precipitation over the past 50 years

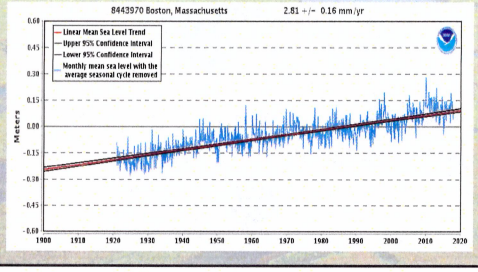
Precipitation change: predicted
Ipswich Watershed

Parameter	Current Conditions (1971-2000)	Predicted Change by 2050		Predicted Change by 2100	
		Low	High	Low	High
Annual Precipitation (inches)	45.59	+0.04	+5.35	+0.73	+7.0
Annual Consecutive Dry Days	16.69	+0.05	+2.50	+0.15	+3.09

www.mass.gov/service-details/climate-change-in-massachusetts-and-its-impacts

Sea level rise: observed

- Boston tide station
- Records from 1921-2016
- Equivalent to 11 inches in 100 years



Sea level rise: projected (Greater Boston Harbor)

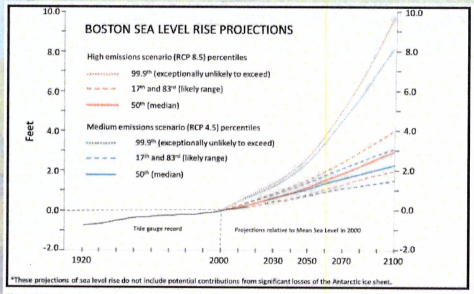
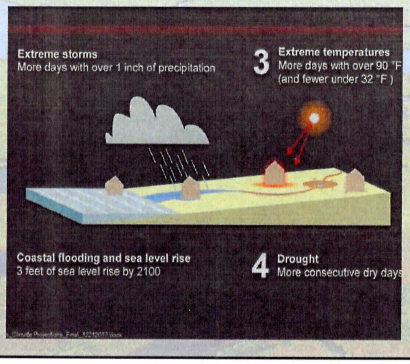
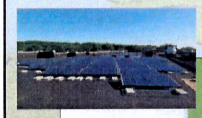


Figure 1: Sea level rise projections at the Boston tide gauge. Projection curves are given for the medium (RCP 4.5) and high (RCP 8.5) emissions scenarios, at multiple levels of likelihood, in feet relative to mean sea level in 2000. These projections of sea level rise do not include potential contributions from significant losses of the Antarctic ice sheet.

In summary, changes to our region include....



Prior Planning Efforts:
Climate Action Plan 2011, Updated 2017

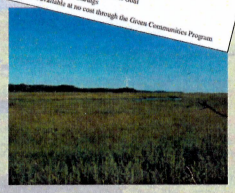


II. Key Recommendations to Undertake in FY 2018 and New Recommendations from the Climate Action Plan: 2017 Update

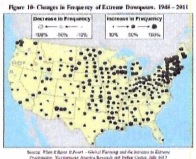
Key Recommendations for FY 2018

1. Include Energy Conservation Metrics in Department Staff Performance Plans
2. Hire an Energy Conservation Education Coordinator
3. Establish an Interdepartmental Energy Team
4. Establish a Climate Action Commission for the Town
5. Implement a Municipal Energy/GHG Emissions Reduction Goal
6. Perform Energy Audits for all Municipal Buildings
7. Adopt the energy tracking tool available at no cost through the Green Communities Program

Climate Action Plan
Ipswich, Massachusetts



Hazard Mitigation Planning
December, 2018



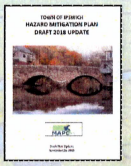
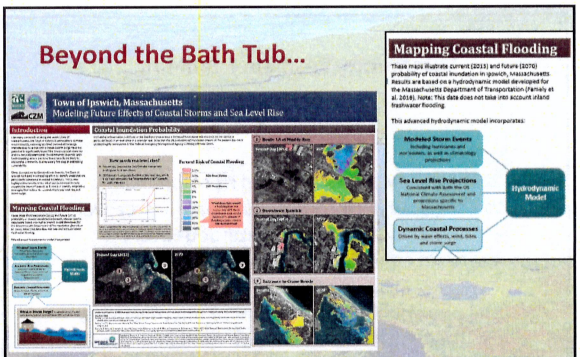


Table 5 - Hazard Risks Summary

Hazard	Frequency		Severity	
	Massachusetts	Ipswich	Massachusetts	Ipswich
Flooding	High	High	Serious	Serious
Dam failures	Very Low	Very Low	Extensive	Serious
Hurricane/Tropical Storms	Medium	Medium	Serious	Serious
Tornadoes	Medium	Very Low	Serious	Serious
Thunderstorms	High	High	Minor	Minor
Nor'easter	High	High	Minor	Minor
Winter-Blizzard/Snow	High	High	Minor	Minor
Winter-Ice Storms	Medium	Medium	Minor	Minor
Earthquakes	Very Low	Very Low	Serious	Serious
Landslides	Low	Very Low	Minor	Minor
Brush fires	Medium	High	Minor	Minor
Extreme Temperatures	Medium	Medium	Minor	Minor
Drought	Low	Low	Minor	Minor
Coastal Hazards	High	High	Serious	Serious
Tsunami	Very Low	Extensive	Extensive	Extensive

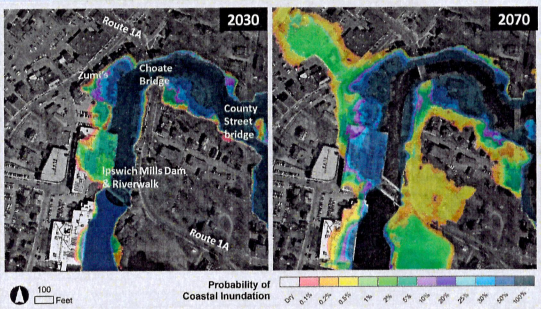
Great Marsh Coastal Resiliency Planning
December, 2017

Beyond the Bath Tub…



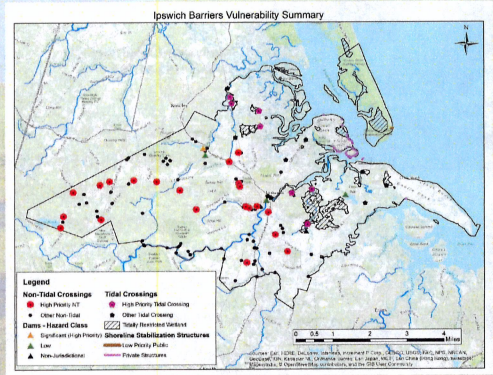
Woods Hole Group assessment of coastal storms and sea level rise for the Great Marsh

GIS-Based Vulnerability Assessments – including socioeconomic impacts - Downtown Ipswich & other important locations



Percent risk of flooding at least once in the calendar year 2030 and 2070

Previous Planning: Assessment of Barriers to Flow



Today's Planning

Community Resilience Building
WORKSHOP GUIDE

www.CommunityResilienceBuilding.org

Community Resilience Building...

What is "resilience"?

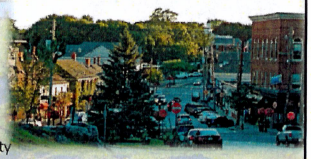
Community Resilience Building...

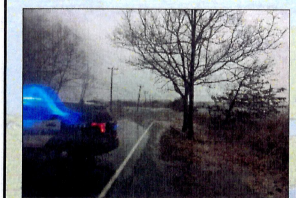
Resilience is...

The ability of a system and its components
to anticipate, absorb, accommodate, or recover
from the effects of a hazardous event
in a timely and efficient manner,
including through ensuring
the preservation, restoration, or improvement
of its essential basic structures and functions.

Ipswich

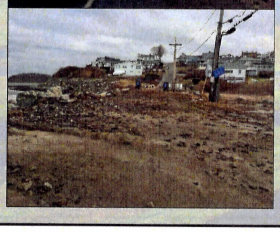
- 33 sq. miles, 21% of the town's land area is the Great Marsh
- 13,175 residents
- Dense downtown along the banks of the Ipswich River
- The Great Marsh, including Crane Beach, dunes, marshes, the Ipswich River, and the estuary, are important community resources for recreation, tourism, the overall economy
- These natural resources also serve to buffer and protect our infrastructure





Jeffrey's Neck Road, Ipswich
03/02/2018 | 11:15 am

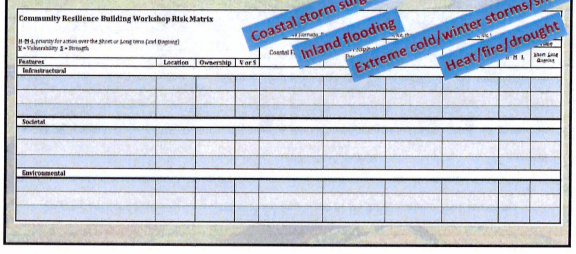
Ipswich is seeing the impacts of extreme weather and of climate change.

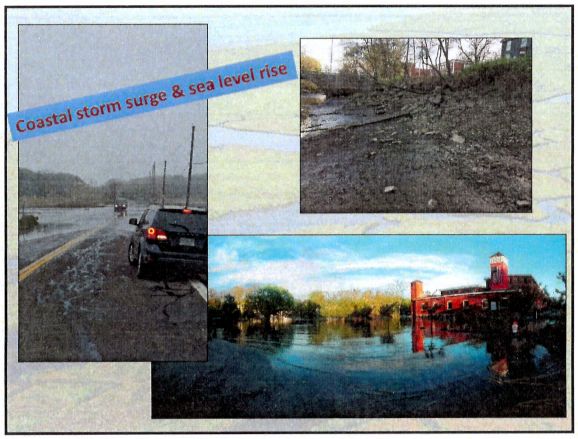


Pavilion Beach, Ipswich
03/03/2018 | 4:43 pm

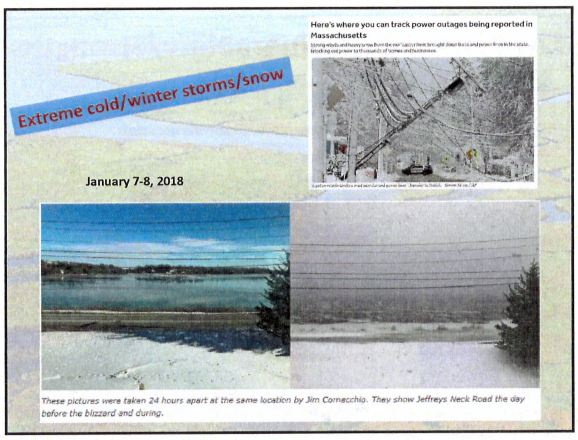
Community Resilience Building Workshop Matrix

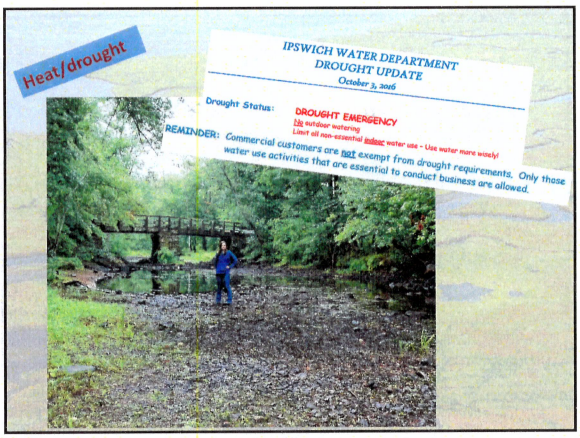
Step 1: What are our Top Hazards?

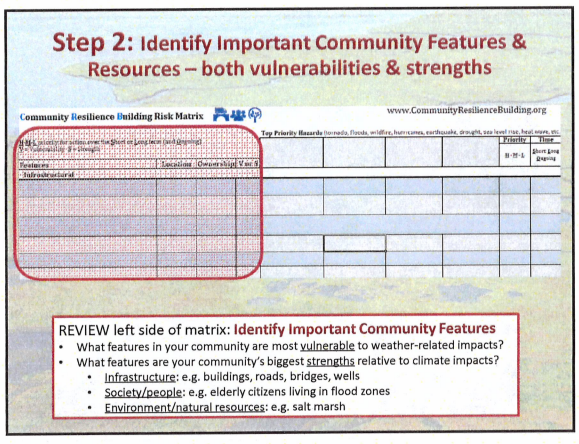


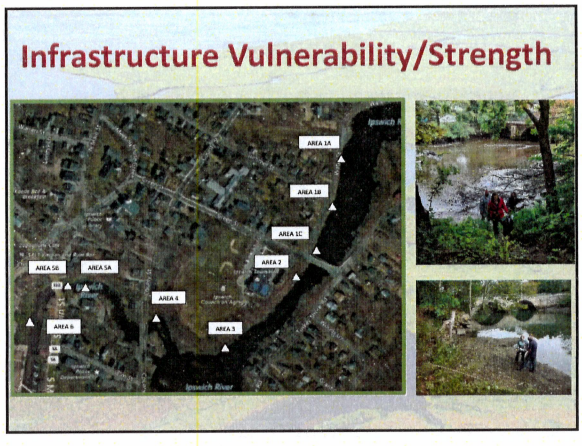

Coastal storm surge & sea level rise


Inland flooding


Extreme cold/winter storms/snow
Here's where you can track power outages being reported in Massachusetts
January 7-8, 2018
These pictures were taken 24 hours apart at the same location by Jim Comacchio. They show Jeffreys Neck Road the day before the blizzard and during.


Heat/drought
IPSWICH WATER DEPARTMENT
DROUGHT UPDATE
October 31, 2016
Drought Status:
DROUGHT EMERGENCY
No outdoor watering
Limit all non-essential indoor water use - Use water more wisely!
REMINDER: Commercial customers are not exempt from drought requirements. Only those water use activities that are essential to conduct business are allowed.


Step 2: Identify Important Community Features & Resources – both vulnerabilities & strengths
Community Resilience Building Risk Matrix
www.CommunityResilienceBuilding.org
Top Priority Hazards
Priority
Time
Features
Infrastructural
REVIEW left side of matrix: Identify Important Community Features
What features in your community are most vulnerable to weather-related impacts?
What features are your community's biggest strengths relative to climate impacts?
Infrastructure: e.g. buildings, roads, bridges, wells
Society/people: e.g. elderly citizens living in flood zones
Environment/natural resources: e.g. salt marsh


Infrastructure Vulnerability/Strength
AREA 1A
AREA 1B
AREA 1C
AREA 2
AREA 3
AREA 4
AREA 5A
AREA 5B
AREA 6
Ipswich River

Infrastructure

- **What infrastructure/facilities are exposed?**
  - *Wastewater treatment plant, elderly housing, schools, hazardous materials, etc…*
- **What makes this infrastructure vulnerable?**
  - *Location, age, building codes, type of housing, etc…*
- **Consequences of this infrastructure vulnerability?**
  - *E.g. lack of access to critical facilities – urgent care, pharmacies*

***POSSIBLE ACTIONS*: What can be done?**
- *Assess housing in vulnerable areas?*
- *Prioritize future development in lower-risk areas?*
- *Integrate risks into capital improvement plans?*

Societal Vulnerability/Strengths

POPULATION CHARACTERISTICS	BETTER / WORSE STATE RATE[1]	COMMUNITY ESTIMATE	STATE ESTIMATE
Total population all ages		13,682	6,742,143
Population 60 years or older as % of total population		28.3%	21.2%
Total population 60 years or older		3,877	1,428,144
Population 65 years or older as % of total population		20.9%	15.1%
Total population 65 years or older		2,866	1,016,679
% of 65+ population living alone		26.9%	30.2%
% 75-84 years		27.8%	29.4%
% 85 years or older		16.3%	15.2%

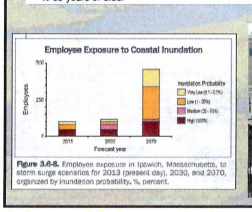
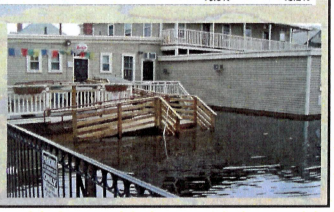


Figure 3.6-6. Employee exposure in Ipswich, Massachusetts, to storm surge scenarios for 2013 (present day), 2030, and 2070, organized by inundation probability, %, percent.



Society

- **Population characteristics in high-risk areas?**
  - *Elderly, low income, special needs, etc…*
- **How will hazards intensify these characteristics?**
  - *Where are areas for improvement in the community?*
- **Strengths of your community?**
  - *Active civic groups, organizations, associations?*

POSSIBLE ACTIONS: What can be done?
- *Improve existing programs (which ones)?*
- *Increase awareness via education/outreach on hazards?*
- *Increase involvement by citizens (on what and with whom)?*

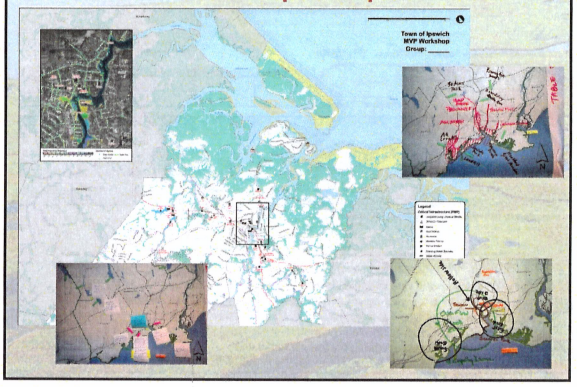
Environmental Vulnerability/Strengths

Environment

- **Natural resources important to your community and where?**
- **Benefits natural resources provide and where?**
  - *Storm buffering, flood protection, erosion control, water quality, recreation, etc.*
- **High risk areas and effects of hazards?**
  - *Impact without and with more natural resources*

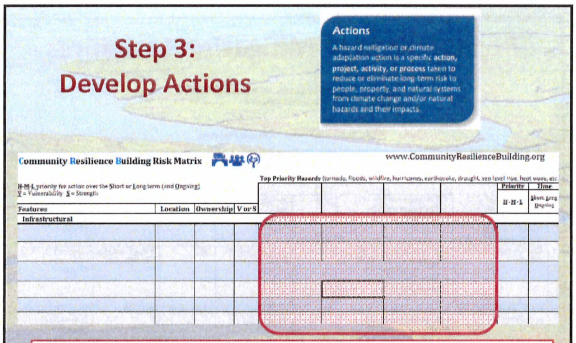
POSSIBLE ACTIONS: What can be done?
- *Conserve land located adjacent to flood zones?*
- *Green infrastructure in neighborhoods?*
- *Decrease impervious cover and encourage low impact development?*

Base Map Example



Step 3: Develop Actions

Actions
A hazard mitigation or climate adaptation action is a specific action, project, activity, or process taken to reduce or eliminate long-term risk to people, property, and natural systems from climate change and/or natural hazards and their impacts.



COMPLETE right side of matrix: **Develop Actions**
1. Develop Actions – How should we reduce vulnerability and/or reinforce strengths?
2. Prioritize – Are actions high, medium, or low priority?
3. Determine Urgency – Are actions ongoing? Or a short-term or long-term step?

Nature-based strategies can complement engineering solutions to benefit our communities.

- Planning and Zoning
- Protect coastal & inland natural habitats
- Restore degraded natural habitats
- Replicate natural systems & cycles in developed areas

Great Marsh Regional Adaptation Strategies

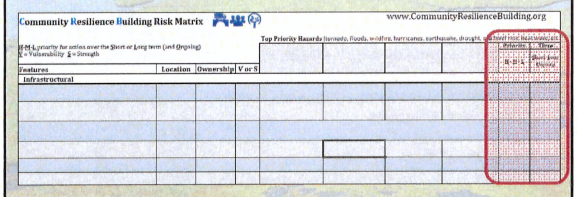
Natural and Nature-Based Strategies *(see also page 130-137)*
- Ensure and restore connectivity of river and coastal systems
- Use living shorelines to stabilize shoreline edges, where appropriate
- Explore construction of offshore shellfish reefs and beds to attenuate wave energy, reduce erosion, and improve water quality
- Protect and restore barrier beaches and dunes through renourishment and revegetation
- Explore opportunities to beneficially reuse dredged material
- Restore sub-aquatic vegetation
- Restore degraded salt marshes
- Facilitate marsh migration
- Enhance land conservation efforts

Outreach and Engagement *(see also page 144-146)*
- Develop municipal strategies for enhanced outreach and education
- Strengthen existing regional outreach and education programs
- Support and develop opportunities for citizen science

Land-use Planning and Policy *(see also page 140-144)*
- Update municipal policies
- Prioritize low-impact development (LID) practices
- Revise local wetlands protection bylaws and regulations
- Move development away from the coast and from wetlands
- Create "freeboard incentive" for residential and commercial buildings
- Use transferable development credits (TDCs) to reduce risky coastal development
- Institute comprehensive water resources management, including strategies for stormwater, waste water, and public drinking water

Gray Infrastructure and Retrofits *(see also page 138-139)*
- Remove unnecessary dams
- Upgrade road-stream crossings
- Retrofit buildings to be more flood resilient
- Elevate roadways to prevent nuisance flooding and to withstand projected sea level rise
- Pursue retrofits and planning for Massachusetts Bay Transportation Authority (MBTA) railroad

Step 4: Developing Priorities



In the last two columns identify the ***Priority*** *of each Action (High, Medium, Low) and the* ***Urgency*** *(ongoing, short-term, long-term).*

4.2-5. TOWN OF IPSWICH: Adaptation Strategies and Recommendations for Selected Areas of Concern

Downtown Ipswich, including Choate Bridge and South Main Street

Location: Downtown along the Ipswich River, Route 133/1A.
Description of hazard: Riverine & coastal flooding; river bank erosion
Consequences of hazard: Includes EBSCO, businesses, housing (Rivercourt)
Existing efforts underway: Town is also studying river bank erosion between Ipswich Mills dam and Town Wharf and prioritizing green solutions.

Short-term Strategies (now-2030)
- ☐ Convene Downtown Ipswich resiliency working group (business owners, town officials, and other partners) to consider long-term flooding risk and impacts. Focus on business owner engagement & education on building retrofits and general principles of resiliency.
- ☐ Encourage landscaping techniques for stormwater mitigation, e.g. rain gardens, pervious walkways & patios, infiltration trenches, and other green infrastructure techniques to reduce flooding.
- ☐ Create, enhance, and protect riparian buffer along the Ipswich River up and downstream of Town center to address current erosion and future climate impacts.

Long-term Strategies (2030-2070)
- ☐ Evaluate feasibility of river flood bypass through Veteran's Green/Elm Street area to accommodate flow from a 500-year flood.
- ☐ Incorporate climate projections, particularly increased freshwater flooding, into long-term infrastructure planning.

Hazard Mitigation Plan Strategies

Updated Mitigation Strategies

FLOOD RELATED HAZARDS
- County Road/Rt. 1A/Heartbreak Road drainage study and upgrades
- Pine Swamp Road–culverts & elevate
- Old Right Road culverts
- Linebrook Road culverts
- Town Farm Road–elevation & culvert
- Sewer Trunk line along Ipswich River & siphon under the river—replace / rehabilitate and armor piping
- Topsfield Road–culvert
- Town-wide—protection & acquisition of open space

DAMS
- Dow Reservoir Dam repairs
- Ipswich Mills Dam complete feasibility study and analyze options for removal

COASTAL HAZARDS
- Elevate 2 sections of Jeffrey's Road
- Elevate section of Argilla Road
- Replace culvert on Labor in Vain Road
- Flood-proof pump station, elevate critical facilities, explore alternative locations
- Crane Beach: Elevate boardwalk, dune protection & nourishment
- Water Street—coastal bank stabilization
- Water Street—elevate homes above BFE

REGULATORY/ADMINISTRATI
- Designate a Flood Plain Manager
- Increase admin. for Wetlands bylaw
- Apply for Community Rating System
- Set up process for elevation certificat

Recommended Mitigation Measures

TOWN OF IPSICH HAZARD MITIGATION PLAN
DRAFT 2018 UPDATE

Table 34: Recommended Mitigation Measures

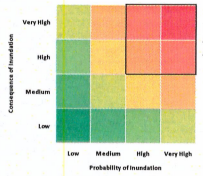
Hazard Category	Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Flooding						
Flooding at 110 -112 County Road/Route 1A, 12-14 Heartbreak Road and southern end of Heartbreak Rd	1) Conduct a drainage study and implement drainage improvements	High	Ipswich Dept. of Public Works and MassDOT	2018-2023	$150,000	Town of Ipswich General Fund; MassDOT; FEMA
Pine Swamp Road and culverts	2) Replace existing 18-inch corrugated culverts with 30-48-inch precast concrete culverts and elevate low section in road.	High	Ipswich Dept. of Public Works	2023	$50,000 culverts $40,000 road	Town of Ipswich General Fund; FEMA
Linebrook Road culverts at Bull Brook	3) Upgrade Linebrook Road culverts – replace at Bull Brook	High	Ipswich Dept. of Public Works	2019-2022	$500,000	Town of Ipswich General Fund; FEMA
Sewer trunk line along the Ipswich River, and siphon under the River	4) Replace/rehabilitate piping, protect by armoring line	High	Ipswich Wastewater Department	2019	$1,000,000	Ipswich Wastewater Enterprise Fund
Topsfield Road culvert at Gravelly Brook	5) Replace culvert with structure based on design that is more resilient to erosion and meets the Mass. Stream	High	Ipswich Dept. of Public Works	2019-2021	$29,000 for 75% design; $400,000 for construction	Town of Ipswich General Fund; Grant from DMF for 75% Design

Vulnerability Assessment & Adaptation Planning

Risk Based Approach and Adaptation Investment Prioritization

- Phase I
  - SLR / Storm Surge Projections
  - Scenario Development
  - Gather asset data
  - Determine Asset Critical Elevations
- Phase II
  - Map Inundation Probability
  - Score Asset Inundation Consequence
  - Vulnerability/Risk Assessment
    - *Risk = Probability * Consequence*
- Phase III
  - Prioritize High Risk Assets
  - Develop Adaptation Strategies for Priority Assets

Rating	Area of Service Loss	Duration of Service Loss	Cost of Damage	Impact on Public Safety & Emergency Services	Impact on Important Economic Activity	Impact on Public Health & Environment
5	Whole Town/City	>30 days	>$50m	Very High	Very High	Very High
4	Multiple Neighborhoods	14-30 days	$5m-$10m	High	High	High
3	Neighborhood	7-14 days	$100k-$5m	Moderate	Moderate	Moderate
2	Locality	1-7 days	$50k-$100k	Low	Low	Low
1	Property	<1 day	<$50k	None	None	None



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The Trustees

Coastal Vulnerability Assessment

FID	Dataset	Property	Name	JN	SC	JN	SC	LV	SC	IC	IM	UP	TOTAL_CON	2070AVG	2030AVG	CV2070AVG	CV2030AVG
37	Infrastruct	Crane Beach	Argilla Road Culvert	0	0	0	0	1	2	5	5	5	44.4	100.0	100.0	4444	4444
82	Infrastruct	Wenham	Wenham Pt. Beach Stairs	0	0	0	0	5	5	4	5	0	42.2	100.0	100.0	4222	4222
90	Infrastruct	World's End	Dunde Meadows Bridge	0	0	0	0	4	5	4	5	5	42.2	100.0	100.0	4222	4222
30	Infrastruct	Crane Beach	Crane-side Ferry Dock	0	0	0	0	2	1	5	5	5	40.0	100.0	99.6	4000	3985
89	Infrastruct	World's End	Dunde Meadows Education Shed	0	0	0	0	4	4	5	5	0	35.6	100.0	100.0	3556	3556
41	Infrastruct	Crane Wildlife Refuge	Choate-side Ferry Dock	0	0	0	0	1	1	4	2	4	35.6	100.0	89.0	3556	3305
0	Infrastruct	Cape Pogo Wildlife Refuge	Dike Bridge	0	0	0	0	5	5	5	5	0	44.4	100.0	70.7	4444	3141
2	Infrastruct	Cape Pogo Wildlife Refuge	Dike Bridge Causeway	0	0	0	0	5	5	5	5	0	44.4	100.0	61.4	4444	2730
38	Infrastruct	Crane Beach	Fox Creek Bridge	0	0	0	0	3	2	0	5	5	33.3	90.0	90.0	2999	2667
40	Infrastruct	Crane Wildlife Refuge	Choate House Culvert	0	0	0	0	0	0	4	2	3	17.8	100.0	100.0	1778	1778
73	Infrastruct	Old Town Hill	Adam's Field Causeway Culvert	0	0	0	0	2	2	0	0	5	15.6	100.0	100.0	1556	1556
74	Infrastruct	Old Town Hill	Newman Road Culvert	0	0	0	0	2	2	0	0	5	15.6	100.0	100.0	1556	1556
75	Infrastruct	Old Town Hill	Newman Road Bridge	0	0	0	0	2	2	0	0	5	15.6	100.0	100.0	1556	1556
76	Infrastruct	Old Town Hill	Hay Street Bridge	0	0	0	0	2	2	0	0	5	15.6	93.4	82.3	1453	1281
70	Infrastruct	North Reservation	Gordon Pond Dam	0	0	1	1	5	1	0	0	0	28.9	81.1	31.1	2342	900
77	Infrastruct	Old Town Hill	Boardwalk	0	0	0	0	2	2	0	0	0	8.9	100.0	100.0	889	889
27	Infrastruct	Conkata Coatue Wildlife Refuge	Conkata Life Saving Cottage	0	0	5	5	1	2	2	0	0	35.6	100.0	26.0	3556	670
54	Infrastruct	Long Point Wildlife Refuge	Off-season Road Culvert	0	0	0	0	5	5	3	2	0	24.4	100.0	20.0	2444	489
34	Infrastruct	Crane Beach	Stone Septic Tank	0	0	0	0	0	0	0	5	4	17.8	100.0	25.0	1778	444
63	Infrastruct	Symon Reserve	Red Brook Aluminum Bridge	0	0	0	0	0	2	0	0	4	4.4	100.0	91.2	444	405
25	Infrastruct	Coolidge Reservation	Coolidge Point Jetty	0	0	0	0	1	1	0	0	0	4.4	100.0	73.4	444	326
91	Infrastruct	World's End	Culvert	0	0	0	0	2	1	1	0	0	13.3	10.0	20.0	133	267
1	Infrastruct	Cape Pogo Wildlife Refuge	Cape Pogo Sand Planks	0	0	0	0	1	2	2	1	0	22.2	46.0	11.8	1021	261
72	Infrastruct	Norton Point Beach	Norton Pt. Air Station	0	0	0	0	5	5	2	5	2	42.2	100.0	5.0	4222	211
97	Infrastruct	World's End	Culvert	0	0	0	0	2	1	1	0	0	13.3	22.5	15.0	300	200

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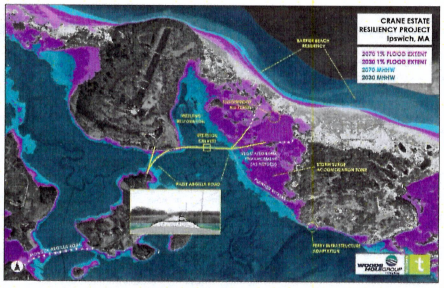
The Trustees

Coastal Vulnerability Assessment



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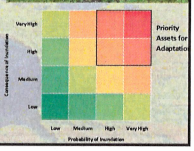
Next Steps … Apply for a MVP Action Grant.

Types of Actions can include:

- ❑ *Detailed Vulnerability & Risk Assessment*
- ❑ *Public Education and Communication*
- ❑ *Local Bylaws, Ordinances, Plans, and other Management Measures*
- ❑ *Redesigns and retrofits*
- ❑ *Nature-Based Storm-Damage Protection, Drought Prevention, Water Quality, and Water Infiltration Techniques*
- ❑ *Nature-Based, Infrastructure and Technology Solutions to Reduce Vulnerability to Extreme Heat and Poor Air Quality, Pests and vector-borne illnesses*
- ❑ *Ecological Restoration and Habitat Management to Increase Resiliency*



February 5th is the start of the Chinese New Year.
Happy Lunar New Year!
2019 is the Year of the Pig.

Pig is the last animal sign of 12 Earthly Branches.
Pig is in the Water group according to Chinese Five Element theory.
Water is related to wisdom.
Pig is connected to river or running water.
Pig has wisdom, initiative and energy.

IPSWICH RIVER WATERSHED ASSOCIATION

www.CommunityResilienceBuilding.org

Community Resilience Building Risk Matrix:

Town of Ipswich, MA

H-M-L priority for action over the **S**hort or **L**ong term (and **O**ngoing)
V = Vulnerability **S** = Strength

Top Priority Hazards

Features	Location	Ownership	V and/or S	Coastal Storm Surge & Sea Level Rise	Inland Flooding	Extreme cold/ winter storms/ snow	Heat/ fire/ drought	Priority H - M - L	Time Short Long Ongoing
Infrastructural				**ACTIONS - list below**					
Water & Wastewater Infrastructure - aging infrastructure, generally at increased risk due to increased intensity/amount of rainfall and flood risk, and sea level rise/erosion of coastal bank	throughout town, especially sewer interceptor & siphon, Town Wharf pump station, Ipswich Mills Dam	Public	V	• where possible/ feasible remove infrastructure that will be adversely impacted by climate change & extreme weather to limit town's future liability • elevate or otherwise protect infrastructure that can not be moved (e.g. wharf pump station) • replace sewer interceptor & siphon • evaluate Ipswich Mills dam removal and opportunities to restore or create natural floodplains so as to mitigate upstream flooding/property risk and to increase buffer against floods • protect and restore Ipswich river bank so as to protect sewer trunkline, through living shorelines and other green infrastructure strategies, including outreach & education				**H**	**Short Long & Ongoing (all)**
Water Supply - overallocated Ipswich River supply, increasing community demand, lack of drought resiliency, deteriorating water quality, wells vulnerable to sea level rise	Parker & Ipswich watersheds	Public	V	• complete supply & demand study • consider options for supply development • water conservation outreach & education • explore water use mitigation programs ("water bank") and other strategies to reduce water use in new and redevelopment projects • explore adoption of a zero net water use policy • work regionally & seek support from State to solve water supply issues/needs • advocate upstream communities and seek equitable water restrictions across watershed and among all water suppliers • protect & enhance water storage • study desalination • pursue strategies for infiltration & low impact development • study strategies for greater water retention through nature-based solutions (slow the flow, pervious concrete on new sidewalks and parking lots, strategically placed swales and vegetated buffers/depressions/rain gardens - e.g. bottom of Spring St, Downtown Ipswich, and like locations) • pilot and demonstrate these solutions to other towns in the Watershed and in the Commonwealth				**H**	**O**
Transportation - roads, culverts & bridges	throughout town	Public & private	V	• use results of the 2018 Great Marsh Barriers Report and the 2019 IRWA/MassBays/CZM projects to upgrade or replace vulnerable culverts throughout the Town (both coastal and inland) • use updated sea level rise modeling to monitor erosion and scouring and to ensure stability of roads • regularly remove debris caught in culverts • restore natural water movement under Jeffrey's Neck Road • explore dune creation at Pavillion Beach				**H**	**Short & On-going**
Electricity & Communication	throughout town	Public	V	• expand energy source & decentralize • loop networks for redundancy • put power lines underground where feasible • tree trimming to address transmission outages • backup radio system • improving communication procedures for emergencies				**H**	**O**
Societal									
Vulnerable populations including elderly citizens and residents of all neighborhoods vulnerable to inland & coastal flooding and sea level rise	throughout town		S/V	• alternating energy sources • maintain and constantly improve emergency shelters (heating & cooling) & response, evacuation plans, notifications, and alarm system • needs assessment of vulnerable elderly & disabled citizens • develop contact lists & improve communications with (tracking of) vulnerable populations • address health impacts such as insects, waterborne illnesses				**H**	**O**
Environmental									
The Great Marsh, including Crane Beach and Pavillion Beach	throughout coastal areas	public & private	S/V	• address erosion of degraded marsh and other coastal bank through protection and restoration • work with partners to study the movement of sand and sediment throughout the region, including at the mouth of the Essex River and throughout Essex Bay, including analyses of channel and creek hydrology, marsh platform elevation changes and response to sea level rise, marsh bank stability, and the erosion of the protective tip of Crane Beach • land protection/acquisition to allow for marsh migration • invasive species control, including continuing to support Green crab trapping and removal program • use green infrastructure to reduce stormwater pollution so as to keep shellfish beds open and healthy • dune restoration and protection • shore up & stabilize beach & dunes - encourage natural processes, plant grasses to stabilize sediment				**H**	**O**
Land Use & Regulatory Issues				• Include climate change and sea level rise considerations in all local regulation, bylaws, policies & planning, including: zoning, building, health, wetlands, stormwater management, open space, economic development, climate action plan, community development plan, and MVP • add a floodplain overlay district • strengthen the stormwater management bylaw to address stronger storms • use low impact development regulations and innovative natural resource protection zoning tools • track & advocate for changes to state regulations that allow for innovative environmental protection strategies				**H**	**O**

Municipal Vulnerability Preparedness Workshop
Town of Ipswich, MA

Tuesday, February 5, 2019
8:00am–3:00pm
Ipswich Town Hall
AGENDA

The Massachusetts **Municipal Vulnerability Preparedness Program** provides support for cities and towns in Massachusetts to plan for climate resiliency and prepare immediate action steps.

TIME	ACTIVITIES	WHO
8:00 AM	Registration and Refreshments	
8:30 AM	Welcome	Anthony Marino Ethan Parsons
8:35 AM *(15 mins)*	Overview of the Workshop Participant Introductions	Kristen Grubbs
8:50 AM *(50 mins)*	Presentation on Climate Science (15 min) Presentation on Hazards (15 min) Past Planning Efforts & Outcomes (10 min) Q & A and Confirm Major Hazards (10 min)	presenters
9:40 AM *(10 mins)*	Instructions & Break into Small Groups	K. Grubbs
9:50 AM *(60 min)*	Small Group Exercise #1a Review & Discuss Vulnerabilities & Strengths of Features Infrastructure (20 min), Societal (20 min), & Environmental (20 min)	Small groups & facilitators
10:50 AM	Small Group Exercise #1b Discuss & Prioritize Top 3 Vulnerabilities within Each Feature (sticky dot exercise) Small Groups Report Out on Top 3 Vulnerabilities	Small groups & facilitators
11:25 AM	10 MINUTE STRETCH	
11:35 AM	Presentation on Strategies & Actions to Protect Features, including nature-based solutions Review Haz Mit Plan actions, Great Marsh Plan strategies, & other actions currently underway Q & A	presenters
12:05 PM *(30 min)*	LUNCH	
12:35 PM	Directions Small Group Exercise #2a: Identify Actions to Address Vulnerabilities or Protect Strengths (20 minutes/hazard)	K. Grubbs Small groups & facilitators
1:35 PM	Small Group Exercise #2b: Discuss & Prioritize Top 3 Actions within Each Feature (sticky dot exercise) Small Groups Report Out on Top Priority Actions	Small groups & facilitators
2:10 PM	BREAK (facilitators summarize top actions on sheets)	

2:15 PM	Large Group Activity & Discussion Determine Overall Priority Actions (sticky dot activity) Discuss Top 3 Community Actions for Municipal Climate Resilience (discuss timeframe, responsibility, funding)	Facilitators
2:45 PM	Closing Remarks & Next Steps How will Ipswich use the recommendations/outcomes from the MVP workshop?	E. Parsons
2:50 PM	Adjourn	

For more information about the Ipswich MVP Workshop, please contact Kristen Grubbs, Environmental Planner, Ipswich River Watershed Association (kgrubbs@ipswichriver.org, 978-412-8200)

IPSWICH RIVER WATERSHED ASSOCIATION

Municipal Vulnerability Preparedness Program, Town of Ipswich, MA

In September 2016, Massachusetts Governor Charlie Baker signed Executive Order 569, instructing state government to provide assistance to cities and towns to complete climate change vulnerability assessments and resiliency action plans. The Municipal Vulnerability Preparedness (MVP) program provides funding for communities in Massachusetts to begin this process. The program helps communities to:

- ✓ Define extreme weather and natural and climate related hazards
- ✓ Identify existing and future vulnerabilities and strengths
- ✓ Develop and prioritize actions for the community
- ✓ Identify opportunities to take action to reduce risk and build resilience

The **Municipal Vulnerability Preparedness Program** provides support for cities and towns in Massachusetts to plan for climate resiliency and prepare immediate action steps.

MVP certified providers, trained in workshops across the state, will provide technical assistance to communities in completing the assessment and resiliency plan using the Community Resilience Building Framework, a process developed by the Nature Conservancy that the State of MA has chosen to use for the MVP program: https://www.communityresiliencebuilding.com/. Communities who complete the MVP program become certified as an MVP community and are eligible for follow-up grant funding and other opportunities. For more information: https://www.mass.gov/municipal-vulnerability-preparedness-program

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The Town of Ipswich received a grant to run this program during fiscal year 2019, and has now contracted with the Ipswich River Watershed Association (IRWA) to provide the technical management of the MVP grant. Working with Ipswich Senior Planner Ethan Parsons and a planning team, IRWA planner Kristen Grubbs has begun gathering information regarding potential climate hazards and risks, both public health concerns and coastal impacts. The next step is convening a group of stakeholders in Ipswich to review, comment on, and prioritize how the Town will deal with these factors in the future.

You are invited to join us! *Our goal is to work together to determine and prioritize mutually beneficial actions that address the vulnerabilities of our community.*

Please save the date of Tuesday, February 5, 2019.

Who: Diverse group of stakeholders in the Town of Ipswich, including you
What: Municipal Vulnerability Preparedness Workshop
When: Tuesday, February 5, 2019, 8-2:30 (including coffee and lunch)
Where: Ipswich Town Hall
RSVP to: Ethan Parsons, ethanp@ipswich-ma.gov or (978) 356-6607 x2

For more information about the MVP process, please contact **Kristen Grubbs** (kgrubbs@ipswichriver.org, 978-412-8200)

Municipal Vulnerability Preparedness (MVP) Program

Town of Ipswich

Listening session

Wednesday, March 27, 2019

Ipswich Town Hall

What is the Municipal Vulnerability Preparedness (MVP) Program?

- State level support for local response to climate change impacts
- Planning process using community input

What is the Municipal Vulnerability Preparedness (MVP) Program?

Outcomes for Town of Ipswich:

- Receive MVP Community designation
- Be eligible for MVP Action Grants up to $2M

Municipal Vulnerability Preparedness: Purpose

- Use the Community Resiliency Building (CRB) process (www.communityresiliencebuilding.com)
- Engage a new and diverse set of stakeholders
- Assess and evaluate vulnerabilities and hazards
- Identify and prioritize opportunities to increase resilience

4.2-5. TOWN OF IPSWICH: Adaptation Strategies and Recommendations for Selected Areas of Concern

Downtown Ipswich, including Choate Bridge and South Main Street

Location: Downtown along the Ipswich River, Route 133/1A.
Description of hazard: Riverine & coastal flooding; river bank erosion
Consequences of hazard: Includes EBSCO, businesses, housing (Rivercourt)
Existing efforts underway: Town is also studying river bank erosion between Ipswich Mills dam and Town Wharf and prioritizing green solutions.

Short-term Strategies (now-2030)

- Convene Downtown Ipswich resiliency working-group (business owners, town officials, and other partners) to consider long-term flooding risk and impacts. Focus on business owner engagement & education on building retrofits and general principles of resiliency.
- Encourage landscaping techniques for stormwater mitigation, e.g. rain gardens, pervious walkways & patios, infiltration trenches, and other green infrastructure techniques to reduce flooding.
- Create, enhance, and protect riparian buffer along the Ipswich River up and downstream of Town center to address current erosion and future climate impacts.

Long-term Strategies (2030-2070)

- Evaluate feasibility of river flood bypass through Veteran's Green/Elm Street area to accommodate flow from a 500-year flood.
- Incorporate climate projections, particularly increased freshwater flooding, into long-term infrastructure planning.

Recommended Mitigation Measures

TOWN OF IPSICH HAZARD MITIGATION PLAN
DRAFT 2018 UPDATE

Table 34: Recommended Mitigation Measures

Hazard Category	Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Flooding						
Flooding at 110 -112 County Road/Route 1A, 12-14 Heartbreak Road and southern end of Heartbreak Rd	1) Conduct a drainage study and implement drainage improvements	High	Ipswich Dept. of Public Works and MassDOT	2018-2023	$150,000	Town of Ipswich General Fund; MassDOT; FEMA
Pine Swamp Road and culverts	2) Replace existing 18-inch corrugated culverts with 30-40-inch precast concrete culverts and elevate low section in road.	High	Ipswich Dept. of Public Works	2023	$50,000 culverts $40,000 road	Town of Ipswich General Fund; FEMA
Linebrook Road culverts at Bull Brook	3) Upgrade Linebrook Road culverts – replace at Bull Brook	High	Ipswich Dept. of Public Works	2019-2022	$500,000	Town of Ipswich General Fund; FEMA
Sewer trunk line along the Ipswich River, and siphon under the River	4) Replace/rehabilitate piping; protect by armoring line	High	Ipswich Wastewater Department	2019	$1,000,000	Ipswich Wastewater Enterprise Fund
Topsfield Road culvert at Gravelly Brook	5) Replace culvert with structure based on design that is more resilient to erosion and meets the Mass. Stream	High	Ipswich Dept. of Public Works	2019-2021	$29,000 for 75% design; $400,000 for construction	Town of Ipswich General Fund; Grant from DMF for 75% Design

Why are we here today?

- In February, the Town of Ipswich held a stakeholder workshop:
  - Led by staff from Ipswich River Watershed Association
  - 41 attendees
  - 5 small discussion groups
  - Facilitated by staff from Town of Ipswich, The Nature Conservancy, Woods Hole Group, Metropolitan Area Planning Council, MassAudubon, 8 Towns and the Great Marsh

Why are we here today?

- In February, the Town of Ipswich held a stakeholder workshop:
  - Identified existing and future vulnerabilities and strengths
  - Developed and prioritized actions for the community
  - Identified opportunities to take action to reduce risk and build resilience

Why are we here today?

Our purpose today:

- Summarize workshop findings
- address additional concerns/questions/ideas about the impacts of future climate change

Town of Ipswich

Office of the Town Manager

25 Green Street ♦ Ipswich, Massachusetts 01938

p: (978) 356-6609 ♦ f: (978) 356-6616 ♦ e: tm@ipswich-ma.gov ♦ w: ipswichma.gov

M E M O R A N D U M

TO: Ipswich residents, Elected & Appointed Officials, Business owners, or Regional Partners

FROM: Anthony Marino, Town Manager

DATE: **November 30, 2018**

RE: **Municipal Vulnerability Preparedness (MVP) Workshop – Tuesday, February 5, 2019**

Given previous and ongoing events, such as recent snow storms/flooding and fluctuations in temperature, we now find ourselves in a new era of more unpredictable and severe weather that can potentially cause damage to the community. To be as proactive as we can in preparing and protecting the Town, I would like to invite you to join me at a Municipal Vulnerability Preparedness (MVP) Workshop on Tuesday, February 5th. The MVP Workshop will take place from 8 am to 2:30 pm in Room A of Ipswich Town Hall. Breakfast, refreshments, and lunch will be provided. Snow date will be Thursday, February 7th, same time, same place.

The Town of Ipswich is working with the Ipswich River Watershed Association and other key partners to offer this workshop, which will bring together community leaders like you to comprehensively identify and prioritize steps to reduce risk and improve resilience across Ipswich. This workshop will help clarify and advance comprehensive community resilience planning and hazard mitigation efforts. Once we complete the MVP process, we may also receive preference concerning future grant applications and programs.

The workshop objectives are as follows:

- Understand connections between natural hazards and local planning/mitigation efforts.
- Evaluate strengths and vulnerabilities of residents, infrastructure, and natural resources.
- Develop and prioritize actions for the municipality, local organizations, businesses, private citizens, neighborhoods, and community groups.
- Identify immediate opportunities to advance actions that reduce the impact of hazards and increase resilience in Ipswich.

I have attached a flyer that provides some additional details.

Please RSVP (both if attending and for regrets) for the February 5th Workshop to Ethan Parsons by December 15th, at 978-356-6607 x2 or ethanp@ipswich-ma.gov. Your prompt reply will help us to plan for the size of the group and invite others, if necessary.

I hope you or a designee (please ask your designee to reply and tell us who they are coming for) can join me at this important workshop. Thank you for your consideration!

Municipal Vulnerability Preparedness Program, Town of Ipswich, MA

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