

TIDES, TAXES, & NEW TACTICS

PLANNING FOR ADAPTATION AND IMPACTS OF SEA LEVEL RISE AND STORM SURGE THROUGH GIS-DRIVEN VULNERABILITY ASSESSMENTS AND COMMUNITY DIALOGUES

Municipal Virtual Workshop

Town of Kennebunk

Tuesday, March 2, 2021

6:30 – 7:30 pm



This presentation was prepared by SMPDC under award CZM NAI8NOS4097419 to the Maine Coastal Program from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of SMPDC and do not necessarily reflect the views of NOAA or the Department of Commerce.

Workshop summary

40 participants attended: project team, town staff (manager, community development, planning, clerk's office, public service, library, RSU 21); board members (selectboard, site plan review board); committee members (Lower Village, River, Energy Efficiency, Conservation Commission) and community members.

Purpose of the meeting, to provide an opportunity for participants to:

- Learn about the findings of the sea level rise vulnerability assessment and economic analysis of the Tides, Taxes, and New Tactics grant project. Ask questions about the findings from the vulnerability assessment and economic analysis of sea level rise in Kennebunk (and southern Maine).
- Review possible local strategies for protecting people, property, and natural resources from coastal flooding and provide feedback on incorporating strategies into town planning.
- Share strategies to engage community members in the conversation.

This event is part of the Tides, Taxes, & New Tactics Project: Planning for Sea Level Rise and Coastal Adaptation in Southern Maine, led by Southern Maine Planning and Development Commission and funded by the Maine Coastal Communities Grant Program.

Team Members:

Abbie Sherwin, Southern Maine Regional Planning and Development Commission (Lead)
Rachel Bouvier and Joie Grandbois, rbouvier consulting (Environmental Economists)
Alex Grey, GEI Consultants (Water Resources Scientist)
Annie Cox and Jessica Brunacini, Wells Reserve; and Kristen Grant, Maine Sea Grant (Community Engagement Specialists)

About This Workshop Summary Document

This document includes all the information presented during the community zoom webinar. It contains questions & answers alongside slides when it makes sense, otherwise they are found during the Q&A section. *Team Notes* are answers and thoughts put together after the workshop as not all questions were able to be answered during the live event. Participant Comments provided via the chat function or during the community engagement exercise are included. Light editing was done to participant comments, questions, and answers for clarity. Blue text denotes hyperlinks to resources.

WORKSHOP AGENDA

- I. Welcome & introduction
- II. Project overview
- III. Sea level rise assessment
 - GIS vulnerability assessment: overview & results
 - Socio-economic analysis: overview & results
- IV. Discussion, Q&A
- V. Flood resilience strategies
- VI. Community engagement



PROJECT PARTNERS



Summary Notes

Welcome & thank you

- A special thanks to Chris Osterreider and Karen Winton for their active participation and assistance with the project.

PROJECT OVERVIEW: TIDES, TAXES, & NEW TACTICS

- Funded by Maine Coastal Program's **Coastal Community Grant Program (CCG)**
 - **\$56,675**
 - \$46,187 (grant)
 - \$10,470 (supplemental state funding)
 - *Match: \$27,140 (cash and in-kind)*
 - Towns of Kennebunk, Wells, and York
 - Assess vulnerability to coastal flood hazards
 - Develop locally-tailored adaptation strategies

PROJECT GOAL

Engage and provide the towns with locally specific information about economic and social vulnerabilities associated with sea level rise and coastal flood events in order to develop strategic, effective, locally relevant adaptation and resiliency planning strategies and policies that address those vulnerabilities and are tailored to town conditions, needs, and interests.



Summary Notes

Project Overview

• This project, funded by the Maine Coastal Program's Coastal Community Grant Program and led by SMPDC, is working to assess local vulnerabilities to coastal flood hazards and develop strategies and recommendations to reduce flood risk and enhance resilience in the towns of Kennebunk, Wells, and York.

PROJECT OVERVIEW



Summary Notes

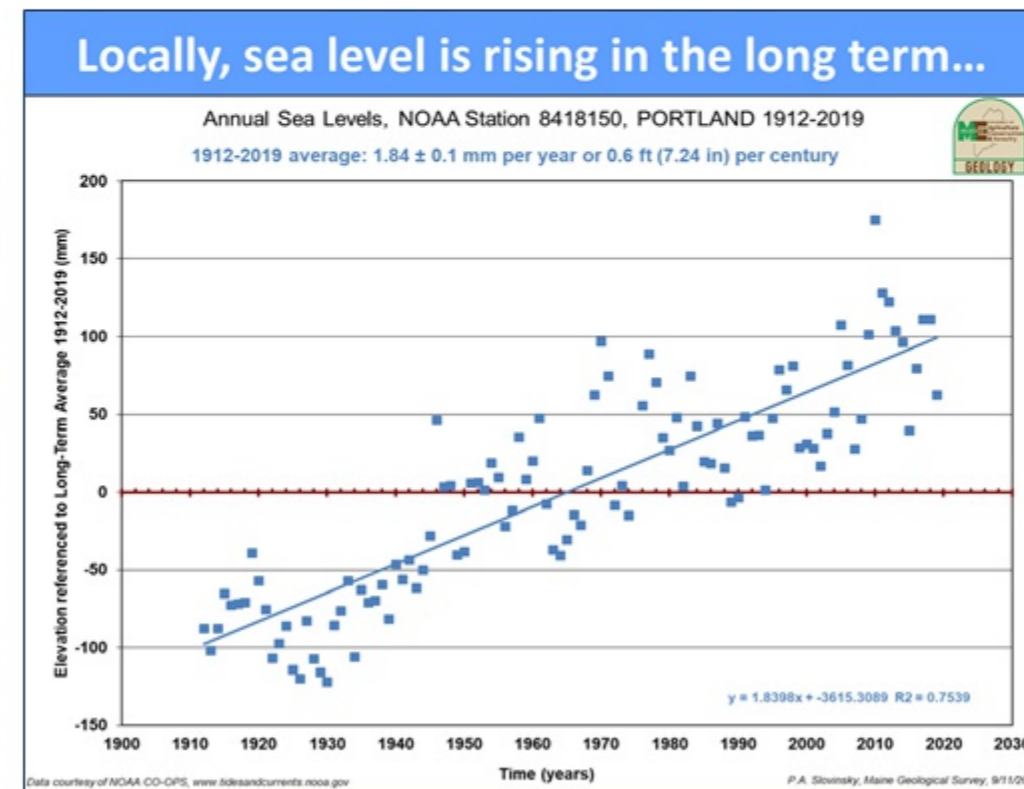
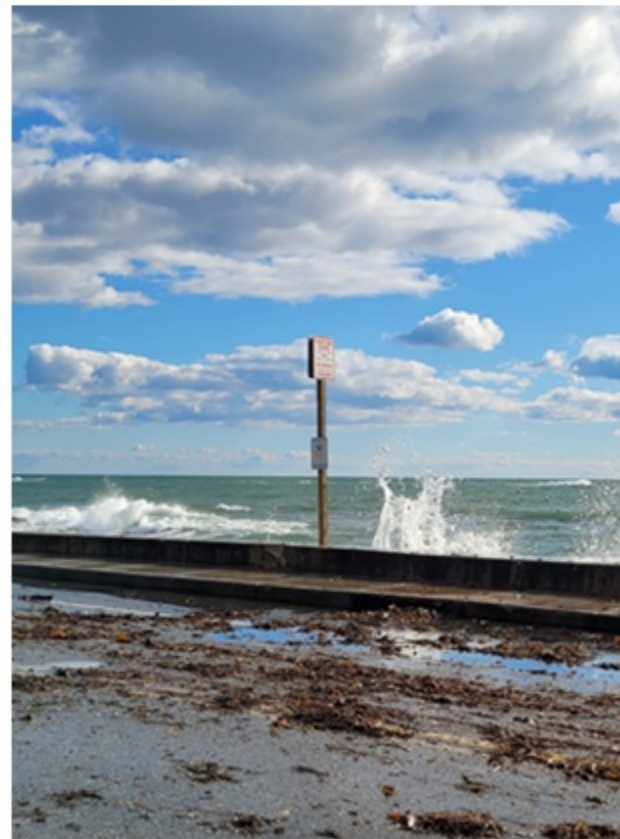
Overview of key components and timeline

• To accomplish that goal, the project, which began in November 2019 and is slated to conclude this coming June, has 6 primary components. The first was the establishment of a project advisory committee, made up of municipal staff from each of the three towns to guide the project and ensure the methodology, findings, and recommendations are tailored to and suit the needs of the towns. Next were the impact assessments, which are separated into the GIS-based vulnerability assessment completed by GEI Consultants, and the socio-economic analysis completed by rbouvier consulting. The results of those assessments are informing the development and identification of community resilience strategies to reduce flood risk, which is being led by SMPDC. Project information is being shared through community engagement efforts, such as this workshop, and will be compiled and published in the form of a regional plan that summarizes town-specific results and resilience strategies for consideration by the towns.

• It is worth mentioning that the community engagement workshops were originally meant to be held in-person so people could interact with the assessment maps and have group discussions, but we had to adjust our approach due to COVID, so we thank you for being flexible as we try to present this rich information through the confines of a computer screen.

COASTAL FLOODING: HISTORICAL TRENDS

- Sea levels have historically been rising and in recent decades, the rate of rise has accelerated to about **1 ft per century**, or **3 to 4 mm per year** in Maine.
- Roughly half of the rise we have seen over the past century has occurred since 1990.
- Nuisance flooding in southern Maine in the last decade occurred about **4 times more frequently** than the 100-year average.



Summary Notes

Coastal flooding historical trends

• One of the primary reasons for pursuing this project is that coastal flooding poses significant threats to southern Maine communities. Many of the characteristics that make towns like Kennebunk so desirable also make them exceptionally vulnerable to coastal storms and rising seas. Kennebunk's coastal development provides a substantial portion of the town's tax base, generating vital funds that sustain community operations, services, and programs. However, it is that same development that is most susceptible to coastal flooding. Additionally, coastal areas and resources that drive tourism and the local economy are also vulnerable to rising seas.

• Sea level in Maine, as shown in this graph, has been rising in the long-term. Over the past few decades, the rate of rise has accelerated to 3 to 4 millimeters per year. That rise is increasing the frequency of nuisance or high tide flooding, with southern Maine seeing 4 times as many nuisance flooding events over the last decade compared with the 100-year average.

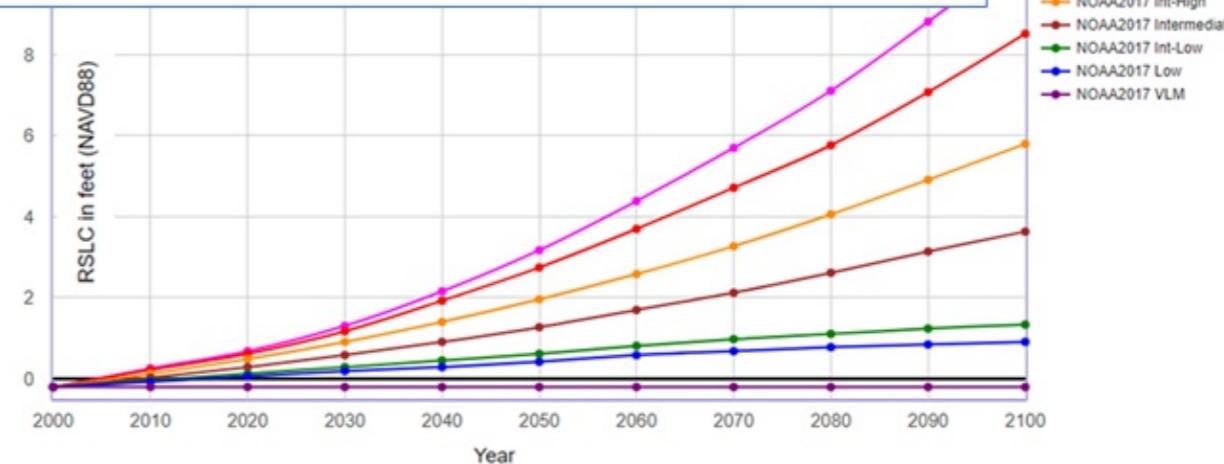
COASTAL FLOODING: FUTURE PROJECTIONS

SEA LEVEL RISE IN MAINE

- State Climate Action Plan:
 - 1.5 ft (3.0 ft) by 2050
 - 3.9 ft (8.8 ft) by 2100
- Sea level will likely continue to rise between 3 and 5 ft by the end of 2100, though higher scenarios are possible
- 1 ft of sea level rise will increase the frequency of nuisance flooding by 15-fold

Scenarios for PORTLAND
NOAA2017 VLM: 0.00000 feet/yr
All values are expressed in feet

Year	NOAA2017 VLM	NOAA2017 Low	NOAA2017 Int-Low	NOAA2017 Intermediate	NOAA2017 Int-High	NOAA2017 High	NOAA2017 Extreme
2000	0.10	0.10	0.10	0.10	0.10	0.10	0.10
2010	0.10	0.24	0.27	0.33	0.43	0.53	0.56
2020	0.10	0.37	0.43	0.60	0.79	0.93	0.99
2030	0.10	0.50	0.60	0.89	1.22	1.48	1.61
2040	0.10	0.60	0.76	1.22	1.71	2.24	2.47
2050	0.10	0.73	0.93	1.58	2.27	3.06	3.48
2060	0.10	0.89	1.12	2.01	2.89	4.01	4.70
2070	0.10	0.99	1.29	2.43	3.58	5.03	6.01
2080	0.10	1.09	1.42	2.93	4.37	6.08	7.42
2090	0.10	1.15	1.55	3.45	5.22	7.39	9.13
2100	0.10	1.22	1.65	3.94	6.11	8.83	10.90



- Project assessment scenarios: 1.6 ft, 3.9 ft, and 6.1 ft
- Source: Maine Geological Survey
 - Regionalized, specific to ME coast
 - Sea level rise and storm surge
 - Bathtub model - does NOT include wave action
 - Highest Astronomical Tide (HAT) as starting point

Summary Notes

Coastal flooding future projections

- That rise is projected to continue and accelerate into the future. We won't be going into detail about sea level rise projections in this presentation, but did want to provide some information for context.
- The recently released State Climate Action Plan recommends that the State commit to manage 1.5 ft by 2050 and 3.9 ft by 2100 and prepare to manage 3.0 ft by 2050 and 8.8 ft by 2100, targets that were identified by state experts and scientist based on the best available scientific information.
- The graph and associated table on the right side of the screen show the sea level rise projections for Maine, based on the long-term sea level rise data from Maine's tide gauges and sea level rise scenarios identified in the US National Climate Assessment.
- The black arrows indicate the scenarios assessed for this project, which were 1.6 feet, 3.9 feet, and 6.1 feet of flooding, which were selected by the project advisory committee. The data for these scenarios were developed by the Maine Geological Survey and use the highest astronomical tide as the starting point to model various water levels representing sea level rise and/or storm surge along the Maine coastline. It is important to note that the modeled data do not account for wave action. The scenarios can represent sea level rise and/or storm surge. For sea level rise, the modeled scenarios show what the average still-water high tide would be. For reference, the October 2019 nor'easter that caused widespread power outages had a recorded storm surge of 3.9 feet in Portland.
- While this project had started and the scenarios had already been selected well-before the state climate action plan was released, the plans' recommendations line up pretty well with the scenarios used for the project.

Questions & Answers

Q: What was the timeframe for each of the sea level rise scenarios?

Abbie: Project Advisory Council (muni staff from 3 participating towns) chose to pick 3 scenarios to represent: short term high probability outlook, mid term and long term moderate to high probability outlook. Give a solid range of information to consider. And relates to State Climate Action Plan and state agencies support of scenario based planning. Look at a range of potential scenarios that have a high likelihood of occurring rather than tying yourself to one date. Table shows the scenario and the year, 1.6 foot, can expect under intermediate scenario 2050; 3.9 can expect by 2100 (intermediate projection) and intermediate-high projection IDs 6.1 feet by 2100. Gets to what experts say we can reasonably expect to experience in a given time frame. Check out Maine Climate Action Plan for best guidance. Plan recommends to plan for at least 1.5 ' but up to 3' by 2050; Plan for at least 3.9 but up to 8.8 by 2100. These numbers tend to change as more and better information is generated by international scientific committee, but trend is always been for the numbers to increase (rather than decrease).

Alex: add, those boxes around each value, essentially the values the MGS used for their boundaries, using existing data sources, all ones you see on the bottom, by 2100, those are the boundaries that MGS developed and looked for where they could be used to show different points in time.

Participant follow up: the numbers in the climate models keep going up, when there are revisions it's not that scientists were pessimistic, they were conservative, what we predicted in 2005 for 2020 SLR has risen more than it was predicted. It seems likely we'll be in the intermediate-high end. If in 1.6-2.0 feet range, we're talking about our kids being impacted by the SLR impacts, not grandkids.

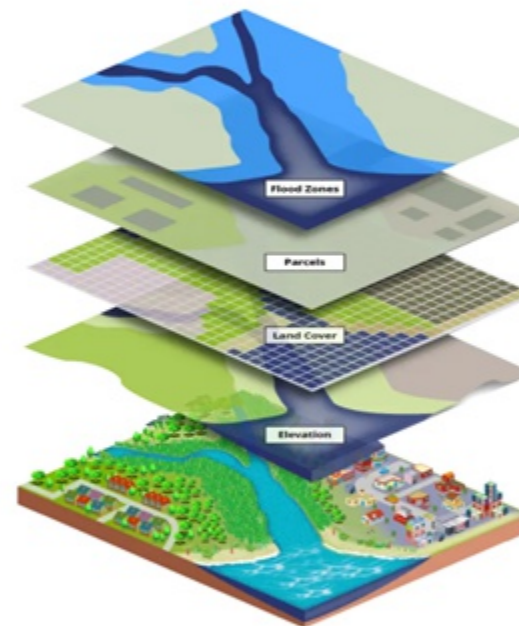
GIS VULNERABILITY ASSESSMENT

Inputs

- Sea level rise and storm surge projection
- Municipal geospatial and assessor's data
- Census data

Outputs

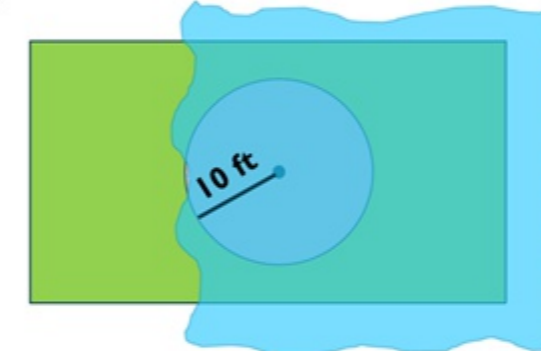
- Number of parcels impacted
 - Land & building vs. land only
 - Building footprints estimated
- Assessed value of impacted buildings and land
 - Residential, businesses, municipal
- Population and demographic information within impacted area
 - Census block group: people, households, median income, age
- Impacts by zoning district



“Impacted” means ‘touched’ by water

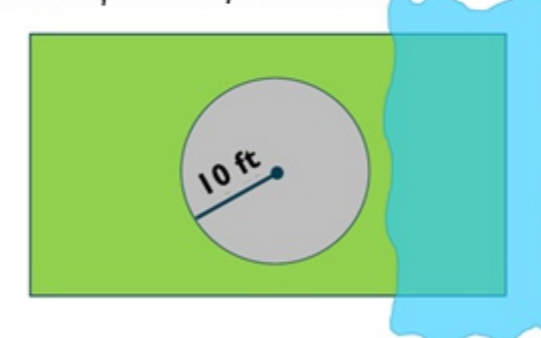
Building & land impacted

Total parcel value considered



Land only impacted

Proportional percent of value considered



Building footprints were represented using the parcel center buffered by 10 ft

Summary Notes

GIS vulnerability assessment

- For this project, a geographic information system, or GIS, was used to assess the impacts of the three flooding scenarios in each of the project towns. To accomplish this, the team used municipal geospatial data, parcel information (including the assessed value of properties, which Town staff helped us to assemble) US Census data, and sea level rise and storm surge projections developed by the Maine Geological Survey. For each of the three flooding scenarios, polygons depicting the inundation extent of each scenario were overlaid with the other geospatial data layers, as illustrated by the “pancake stack” graphic, to assess what was impacted by inundation and to what degree.
- For this project, ‘impacted’ means touched by water.
- In instances where certain data were not available, the assessment relied on assumptions to assess impacts. For example, building footprint data were not available for any of the towns, so in order to assess impacts to buildings, the GIS team created representative building footprints. They identified developed parcels, or those that have buildings on them based on town data, determined the center point of each parcel, then buffered the center point with a 10-foot radius circle to represent the approximate location of a structure, as shown in the graphic on the right-hand side of the screen.
- If the circle that represented the building footprint was ‘touched’ by flood inundation polygons, both the land value and building value were considered impacted.
- If the inundation only touched the land-portion of the parcel and not the building footprint, only that proportion of the land value was considered impacted.

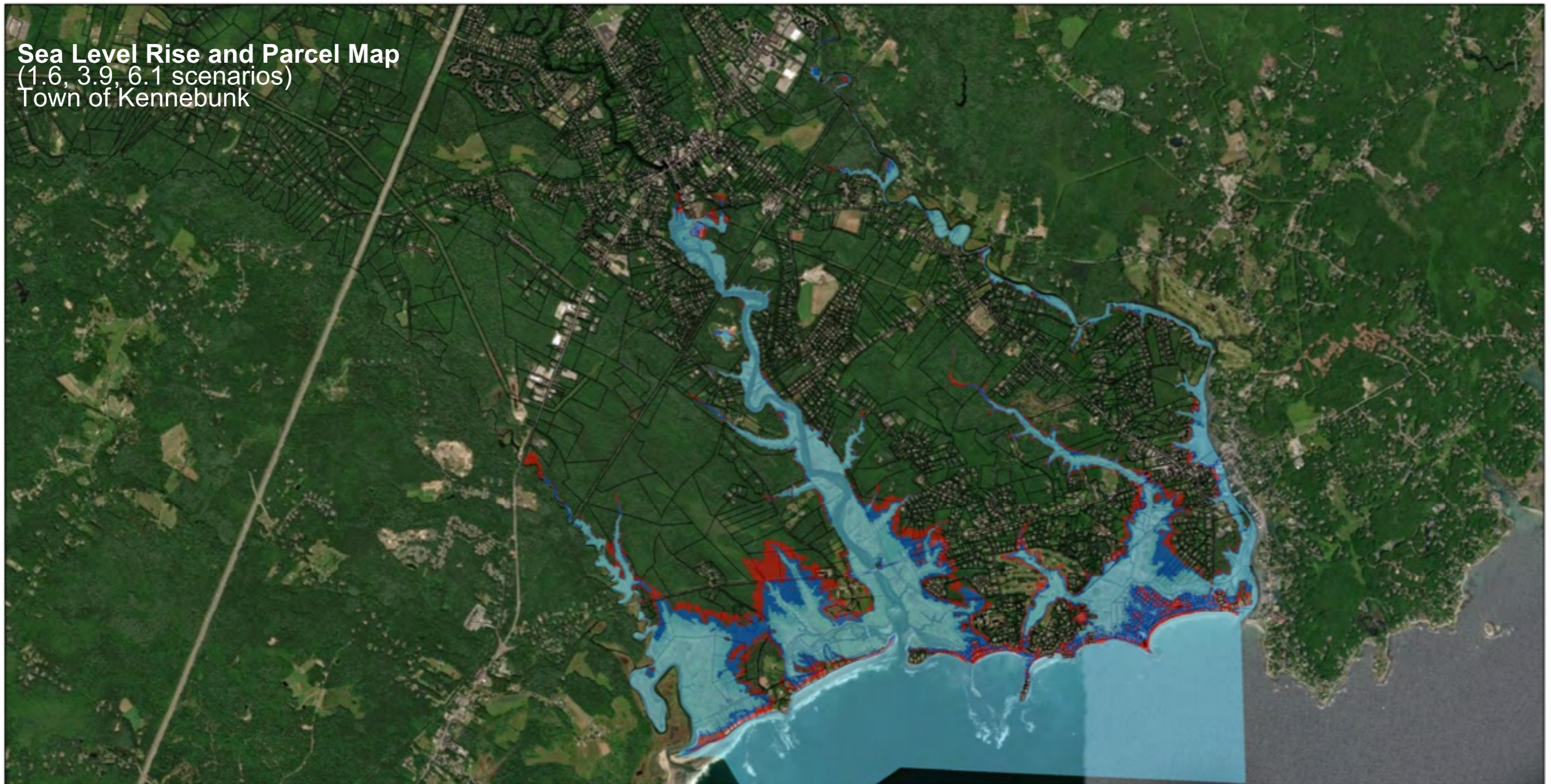
Questions & Answers

Q: Why did the VA not assess rivers?

Abbie: Assessment does include tidally influenced portions of the rivers, it doesn't account for precipitation based flooding but it does include flooding associated with the tidal portions of the river. Maybe not covered in this presentation, but definitely in the full VA report.

Team Notes: the impacts in Kennebunk along the Kennebunk and Mousam Rivers were not as severe as in York because there is comparatively little development along those rivers and there are also relatively large-sized parcels, meaning the number of parcels impacted, even if undeveloped, was comparatively low. However, that is not to say that there were not impacts along those rivers..

Sea Level Rise and Parcel Map
 (1.6, 3.9, 6.1 scenarios)
 Town of Kennebunk

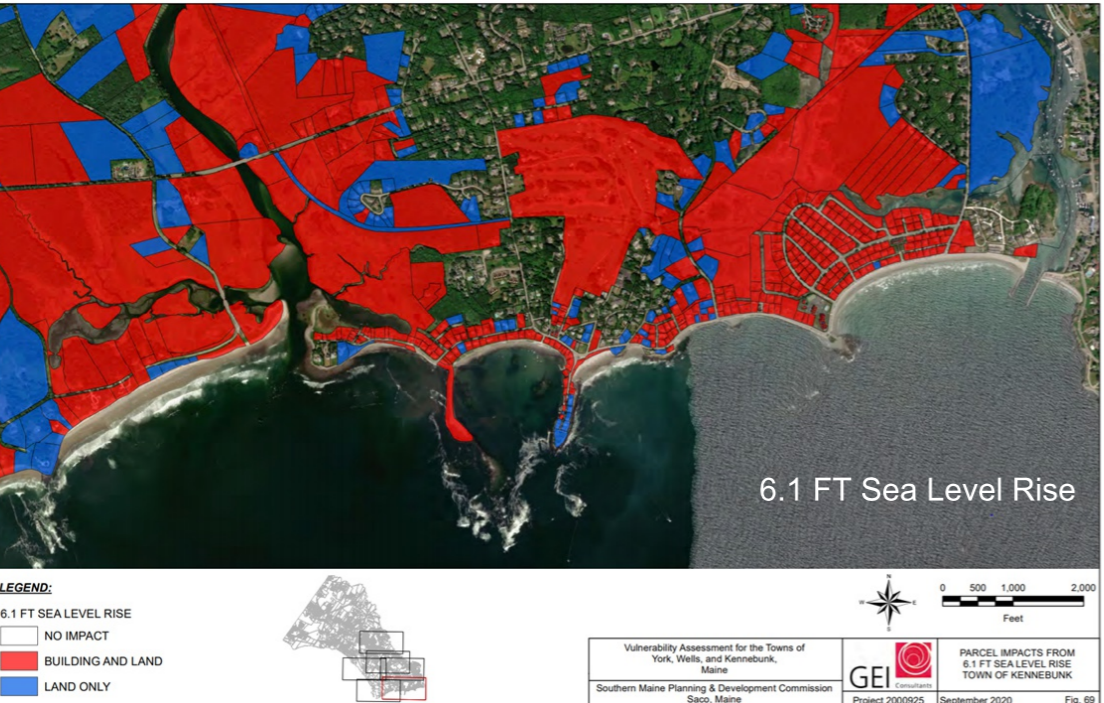
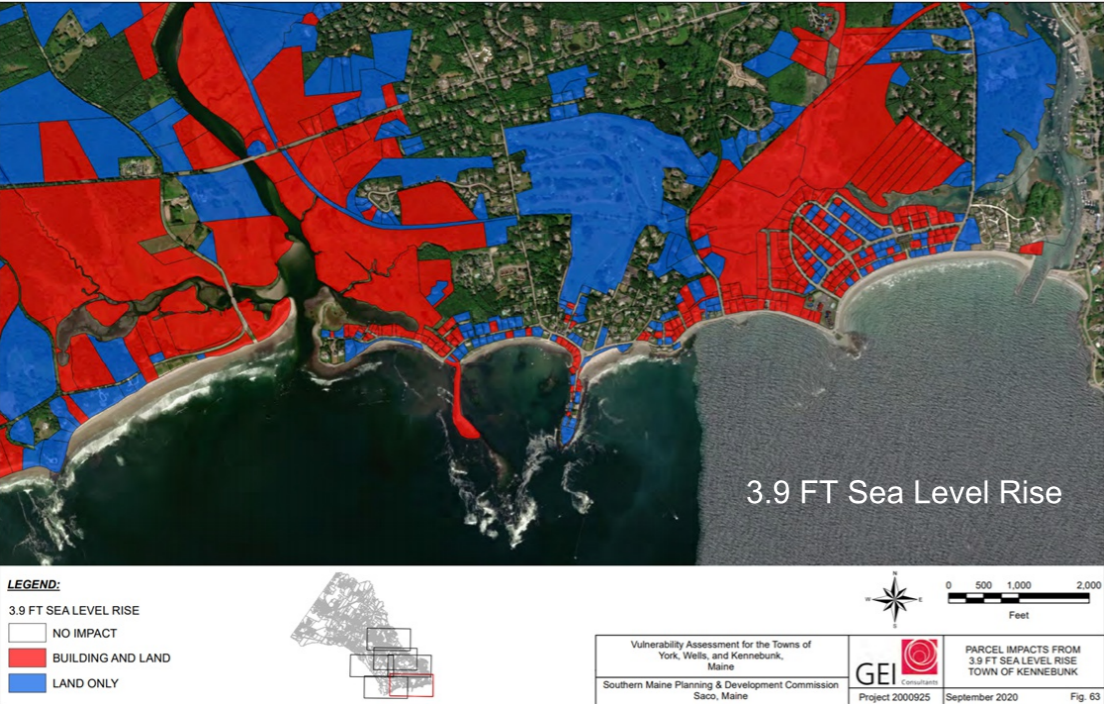
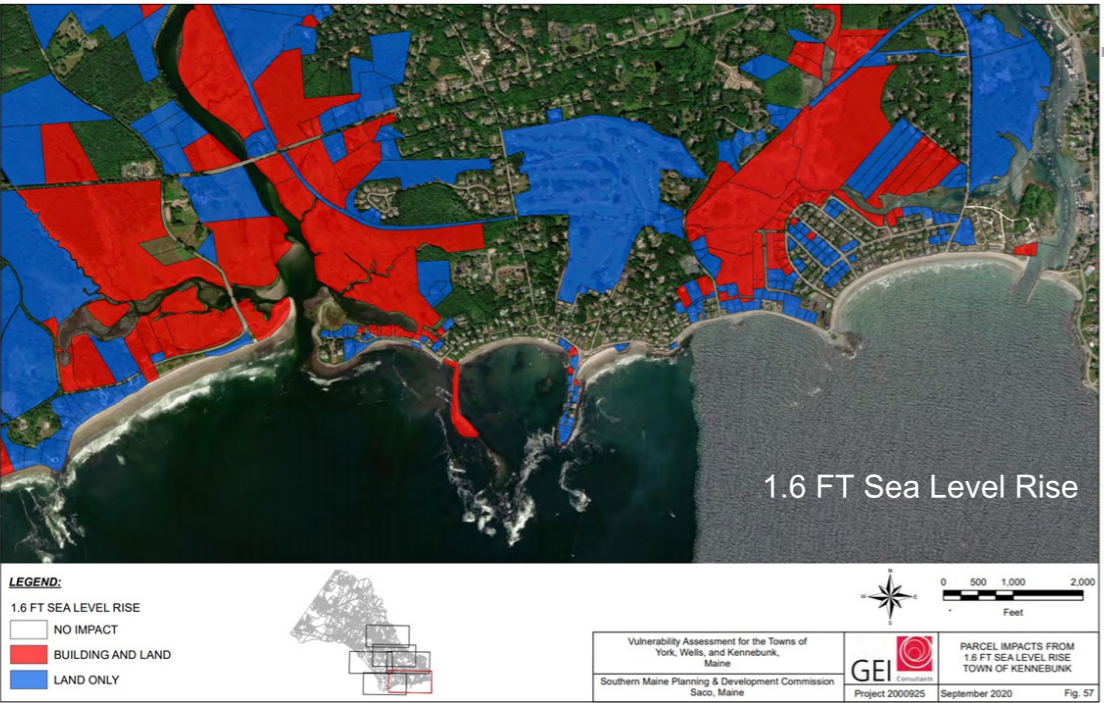


<p>LEGEND:</p> <ul style="list-style-type: none"> ■ 1.6 FT SEA LEVEL RISE ■ 3.9 FT SEA LEVEL RISE ■ 6.1 FT SEA LEVEL RISE PARCELS 			<p>Vulnerability Assessment for the Towns of York, Wells, and Kennebunk, Maine</p> <p>Southern Maine Planning & Development Commission Saco, Maine</p>		<p>SEA LEVEL RISE AND PARCEL MAP TOWN OF KENNEBUNK</p> <p>Project 2000925 September 2020 Fig. 8</p>
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Summary Notes

Town-wide inundation map
 •The next slides show inundation maps and results of the GIS-based vulnerability assessment. This map shows the mapped inundation boundaries for all three of the flood scenarios. All of these maps and figures are included in the vulnerability assessment report developed by GEI Consulting.

Parcel Impacts from Sea Level Rise



Summary Notes

Parcel Maps

- These maps are examples from the report and show impacted parcels for each of the three flooding scenarios, starting with 1.6 feet and moving to 6.1 feet so you can see the change with increased flooding scenarios. If any part of parcel was impacted, the entire parcel is shaded either blue or red. Blue parcels represent those that had only land impacted while red parcels represent those that had both land and buildings impacted, or ‘touched’ by water.

- Note that the legend at the bottom of the slide shows what area of town is being depicted. The report includes maps for each scenario and each area of town.

- You can see that as the flooding scenario increases, more of the parcels are red, meaning the inundation extends into the parcels to touch the estimated locations of building footprints.

Questions & Answers

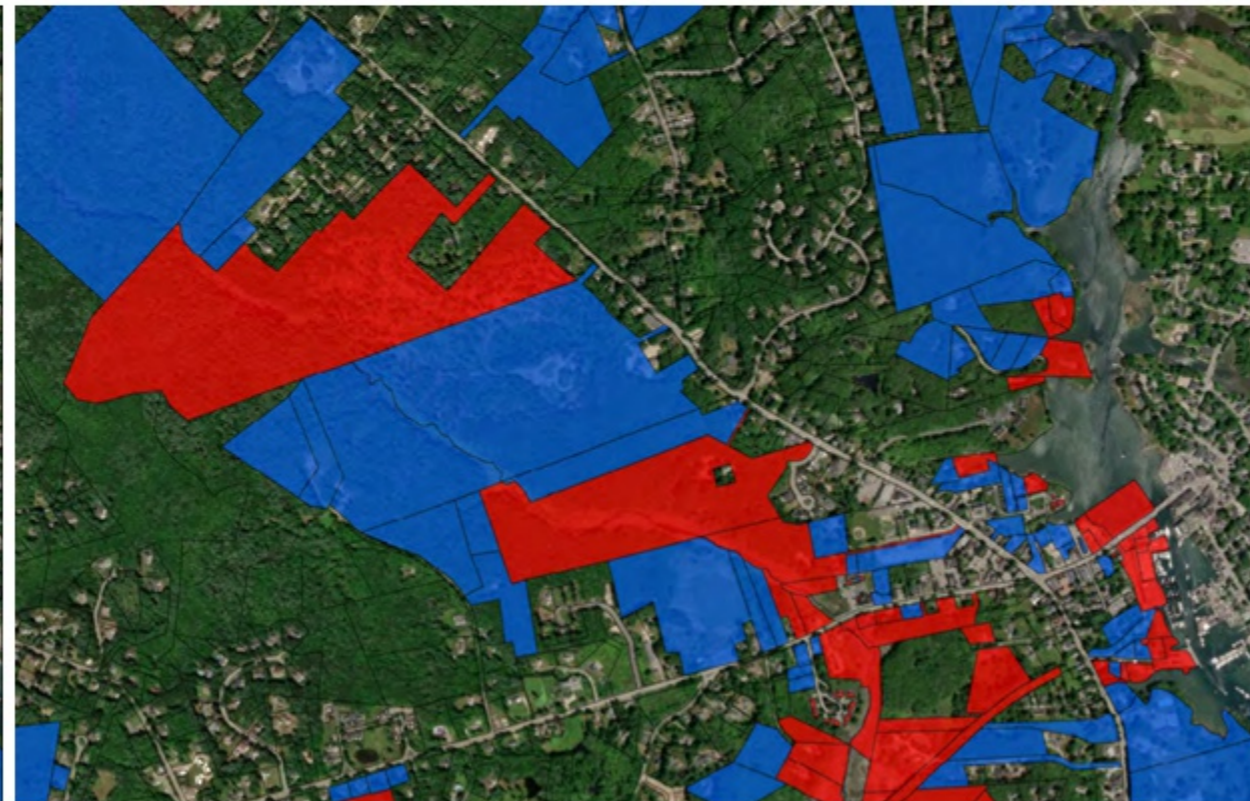
Q: Does any part of the assessments address loss of beaches?
Rachel: include a little bit about the economic loss of beaches in the Socio Economic Report. We will be taking a deeper dive into that in the next phase of the project (with EDA funding). Will look at from a more regional perspective rather than from individual towns.
Alex: Our portion was looking at real estate impacted, we didn’t do any modeling with beach erosion. Just looked at where the SLR boundaries come up to parcels and how they would impact those parcels.

LOWER VILLAGE

3.9 ft



6.1 ft

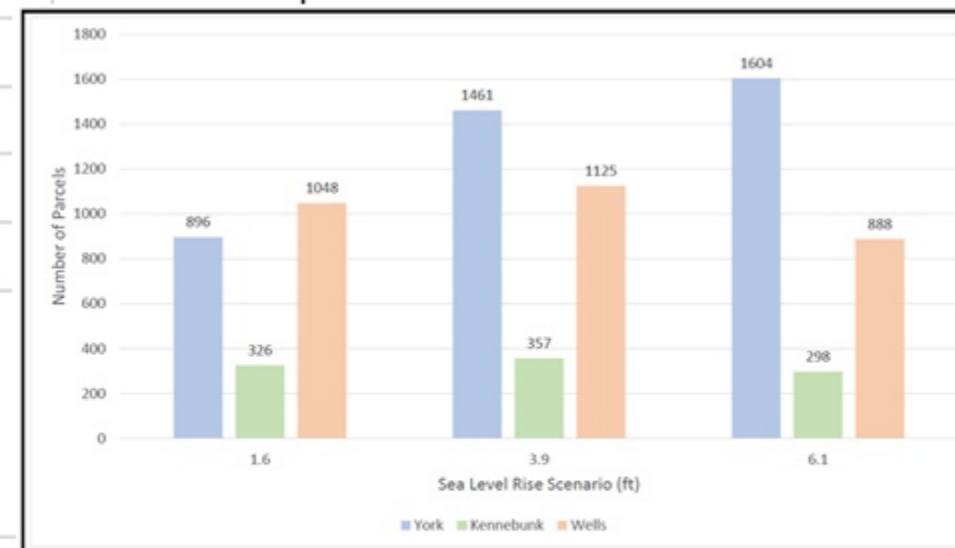
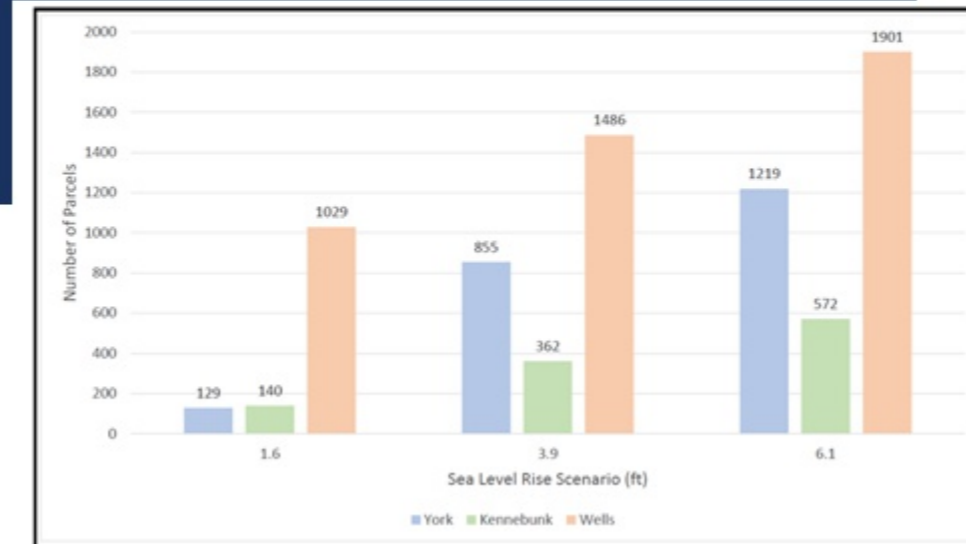
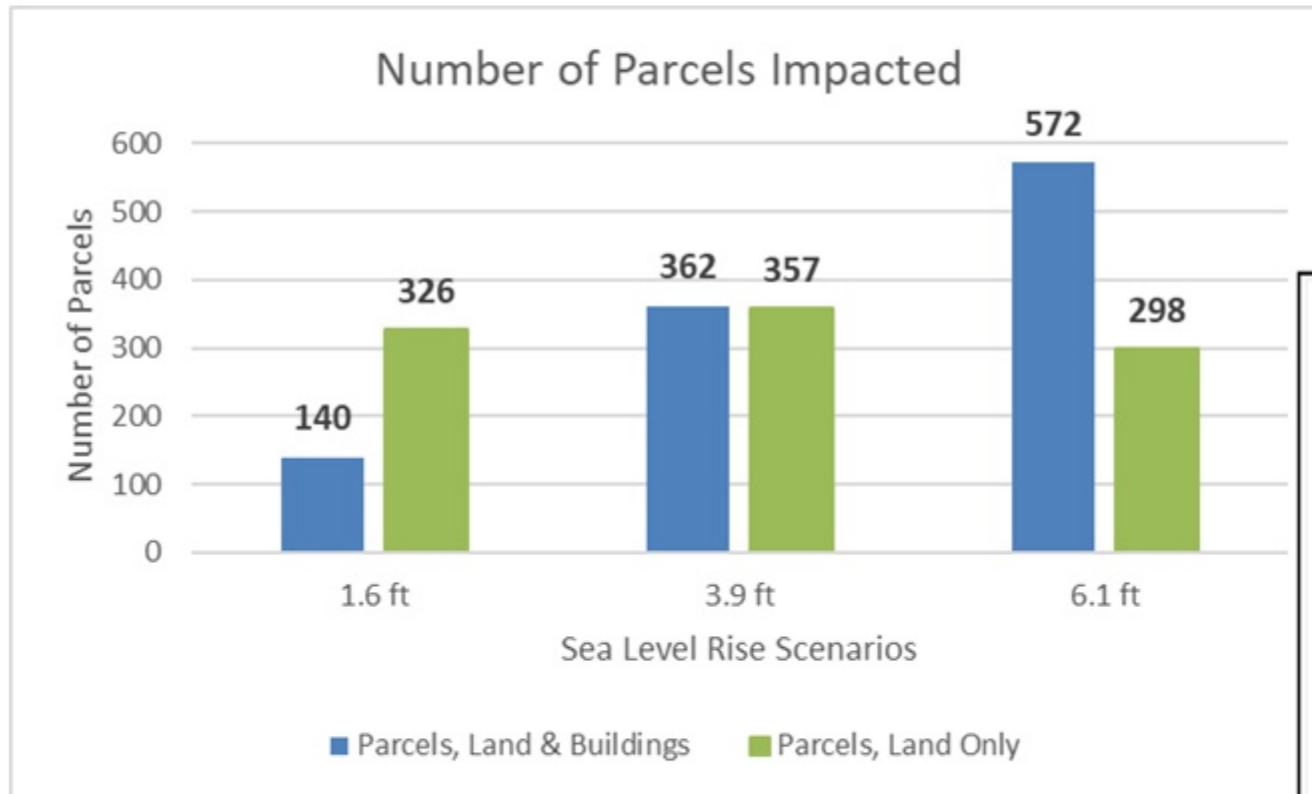


Summary Notes

Lower Village

- These side-by-side maps show a comparison of the lower village area under 3.9 and 6.1 feet of flooding, and is included to show that you can use the report maps to zoom into areas of interest.

RESULTS: NUMBER OF IMPACTED PARCELS



NUMBER OF PARCELS WITH BUILDINGS AND LAND IMPACTED BY SEA LEVEL RISE
September 2020 Fig. 88

Vulnerability Assessment for the Towns of York, Wells, and Kennebunk, Maine	GEI Consultants	NUMBER OF PARCELS WITH ONLY LAND IMPACTED BY SEA LEVEL RISE
Southern Maine Planning & Development Commission Saco, Maine	Project 2000925	September 2020 Fig. 89

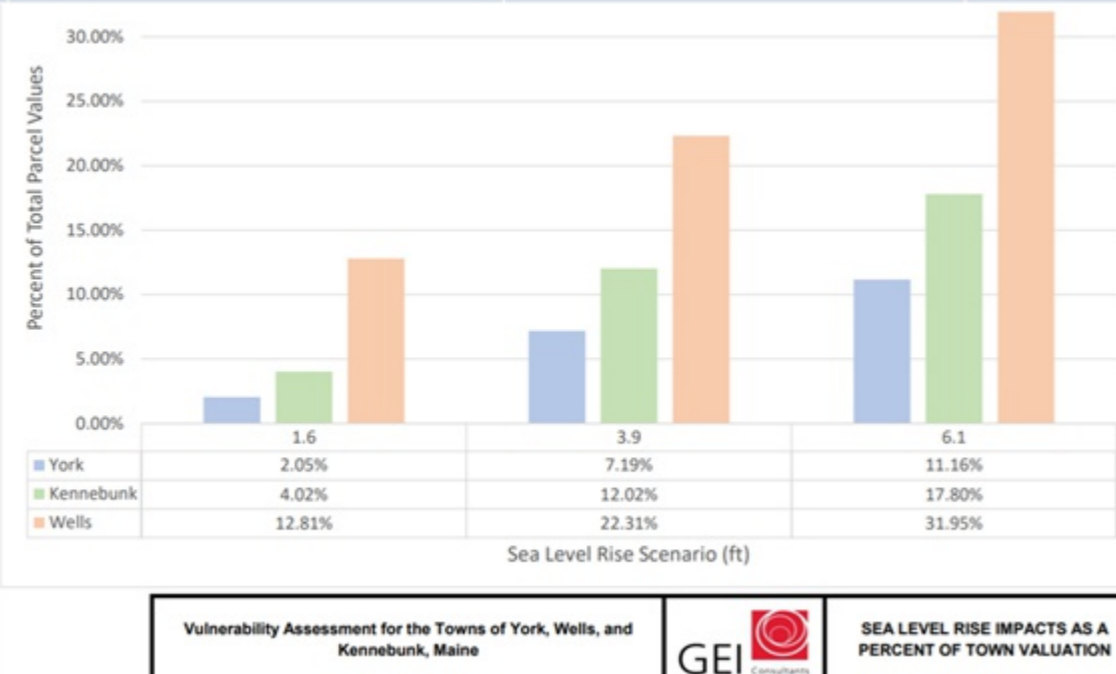
Summary Notes

Results: Number of Impacted Parcels

- This graph shows the number of parcels impacted by each of the three flood scenarios, differentiated by parcels with impacts to land and buildings compared with the number of parcels with only land impacted.
- These charts show the same results for Kennebunk compared with the other two towns. Kennebunk's results are represented by the green bars, York in blue, and Wells in orange
- Kennebunk had the lowest number of parcels with impacts to buildings and land and impacts to land only, across the three sea level rise scenarios. The comparatively low number of impacted parcels is partly due to the coastal areas of Kennebunk not being as large as York and Wells.

RESULTS: ASSESSED VALUE OF IMPACTED PARCELS

Sea Level Rise Scenario	Assessed Value Impacted	Impact as % of Town-Wide Assessed Value	Impact as % of 2020 Town Budget
1.6 ft	\$110,467,678	4.02%	11.90%
3.9 ft	\$330,318,996	12.02%	35.58%
6.1 ft	\$489,051,066	17.80%	52.68%



Summary Notes

Results: Number of Impacted Parcels

- This table shows the assessed value of impacted parcels, the impacted value as a percentage of town-wide assessed value, and as a percentage of the 2020 town budget for each flooding scenario. You can see that even 1.6 feet of sea level rise puts roughly \$110.5 million at risk of flooding, which is almost 12% of the town's 2020 budget.
- The graph shows the same information for Kennebunk compared with the other project towns.
- It is important to note here that just because a parcel and its value is impacted, the total value isn't lost. These results simply reflect the parcels that will likely be partly touched by water at high tide for each of the given scenarios.

RESULTS: IMPACTS BY ZONING DISTRICTS

Asset (unit of measurement) EXPORT ZONES (sq ft)	Total Amount	Impacts from SLR			Percent of Total		
		1.6	3.9	6.1	1.6	3.9	6.1
119 Main Street Contract Zone	4,353	0	0	0	0%	0%	0%
12 Depot Street Contract Zone	35,665	0	0	0	0%	0%	0%
39 Portland Road Contract Zone	49,261	0	0	0	0%	0%	0%
Branch Brook A	43,035,115	0	0	1,032	0%	0%	0%
Branch Brook B	53,296,784	0	0	0	0%	0%	0%
Business Park	15,438,642	0	0	0	0%	0%	0%
Coastal Residential	40,387,824	13,141,612	19,506,324	23,763,076	33%	48%	59%
Cousens School Contract Zone	126,351	0	0	0	0%	0%	0%
Downtown Business	1,846,998	0	148	23,154	0%	0%	1%
Industrial	19,082,160	1,313,987	1,602,500	1,887,660	7%	8%	10%
Lower Village Business	8,760,441	1,452,754	1,887,658	2,340,744	17%	22%	27%
One Alfred Road Contract Zone	532,211	0	0	0	0%	0%	0%
Protland Road Mixed Use	333,077	0	0	0	0%	0%	0%
Rural Conservation	317,126,623	20,496,071	26,190,009	31,656,897	6%	8%	10%
Rural Residential	219,812,999	0	0	0	0%	0%	0%
Suburban Commercial	8,735,314	45,753	138,268	216,445	1%	2%	2%
Suburban Residential	74,445,974	5,661,872	7,464,317	9,428,198	8%	10%	13%
Terrace Green Contract Zone	4,593,567	0	0	0	0%	0%	0%
Upper Square	971,711	0	0	0	0%	0%	0%
Village Residential	161,522,827	2,864,698	3,329,375	3,764,626	2%	2%	2%
Webber Hill Road Contract Zone	1,265,024	0	0	0	0%	0%	0%
West Kennebunk Village Mixed Use	1,856,708	0	0	0	0%	0%	0%
Western Ave CZ	455,812	1,712	12,078	44,197	0%	3%	10%
York Street Mixed Use	8,065,787	0	0	0	0%	0%	0%

Summary Notes

Results: Impacts by Zoning District

- The vulnerability assessment also examined impacted areas based on town zoning districts, which is helpful to know if the Town is interested in pursuing and crafting land use measures that aim to reduce flood risk of new and redevelopment in vulnerable zoning districts.
- These red boxes show that the Coastal Residential, Lower Village Business, and Suburban Residential districts had the greatest amount of land impacted.

SOCIAL & ECONOMIC ANALYSIS

Inputs

- ME Dept. of Labor & DataAxle
- Census data
- Results of GIS vulnerability assessment

Outputs

- Economic profile of towns
- Population demographics
 - Age, income, poverty, housing occupancy
- Economic impacts – town and region
 - Businesses, industries, employment numbers, salaries, economic output
 - Direct, indirect, and induced effects
- Fiscal impacts
 - Property taxes, municipal budget, commercial taxes and fees



Summary Notes

Socio-Economic Analysis

- In addition to the GIS-based vulnerability assessment, the project also looked at the social and economic impacts of coastal flooding. This portion of the project was led by rbouvier consulting and used socio-economic data from state and federal sources as well as results of the GIS assessment to evaluate broader economic impacts of sea level rise and storm surge to towns and the region.
- The analysis generated economic profiles of each town, information about populations and demographics impacted by flooding, number and type of impacted businesses, employee numbers and annual wages at risk, impacts to economic activity, and municipal fiscal impacts. Some results are presented based on Census Block Groups. These results are summarized in the socio-economic report developed by Rachel and her team.

Questions & Answers

Q: Were the employee impacts seasonal or year round?

Rachel: They include both seasonal and year round so they should not be considered full-time equivalents.

Q: Were fishing and tourism industry included with socioeconomic study?

Rachel: No. They are covered in the analysis, but only looking at the businesses that are located or directly impacted within the inundation zones. There are larger impacts for tourism by some businesses being impacted. Much larger ripple effect, but the analysis wasn't able to get at that.

Q: Can provide numerator and denominator of the assessed value as a percentage of Town 2020 budget?

Team Notes: These numbers are included in the socio-economic analysis report (Table 4).

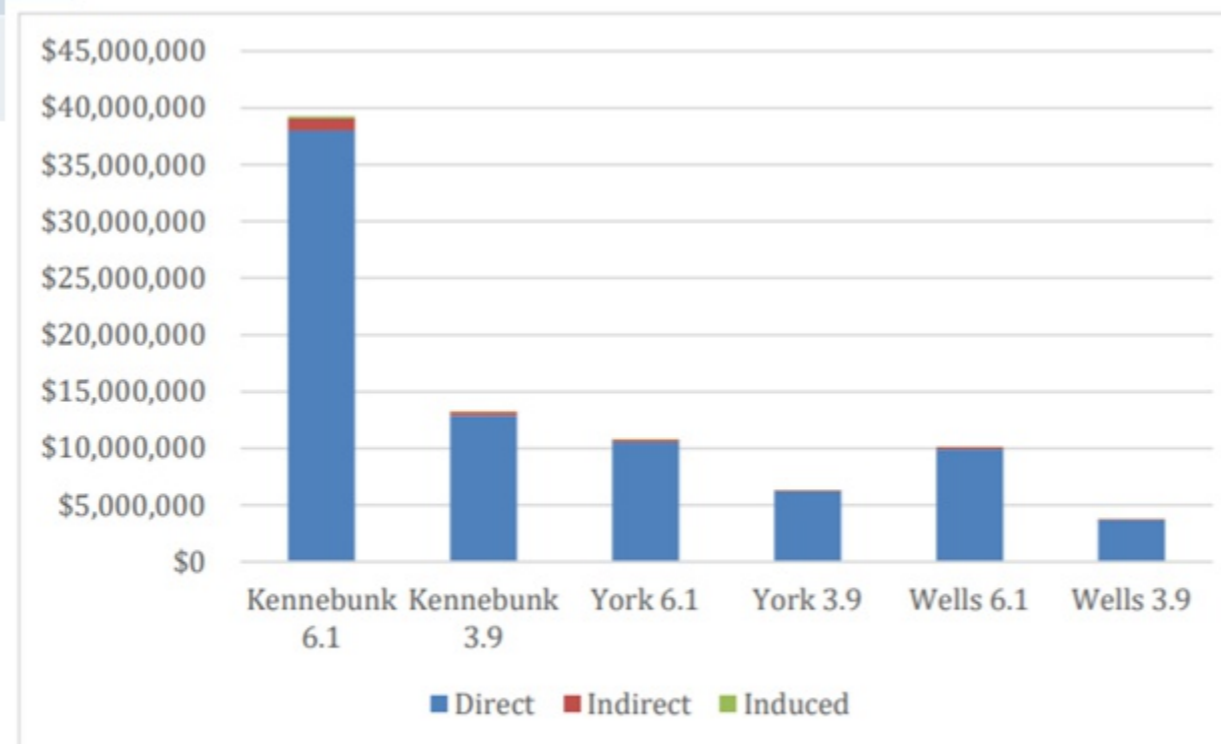
RESULTS: IMPACTS TO BUSINESSES AND ECONOMIC OUTPUT

Sea Level Rise Scenario	Number of Businesses Directly Impacted	Number of Employees	Percent of Total Employment in Town
3.9 ft	14	125	1.3%
6.1 ft	35	328	3.6%

Based on 2019 data from the Maine Dept. of Labor and Data Axle

6.1 ft of sea level rise would put nearly **\$110 million** of economic output at risk in York County, from just the three project towns

Town Economic Output at Risk



Summary Notes

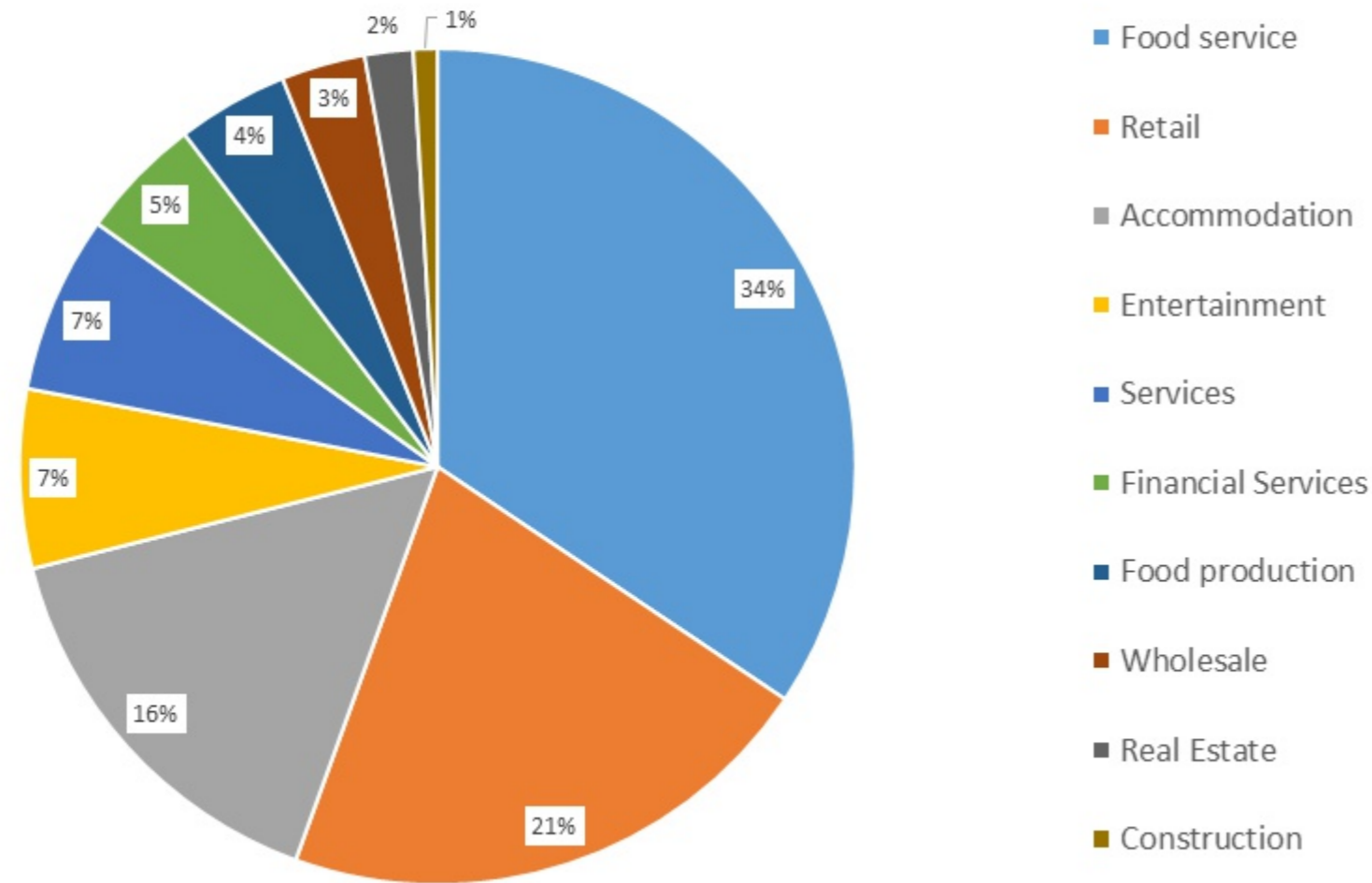
Results: Impacts to Business & Economic Output

- The economic analysis showed that 14 business with 125 total employees would be directly impacted by 3.9 feet of sea level rise. Under 6.1 feet of sea level rise, those numbers jump to 35 businesses and 328 employees, representing 3.6% of the total employment in Kennebunk.
- The graph on the right shows the total output, value added, and employee compensation at direct risk from 3.9 and 6.1 feet of sea level rise.
- It is important to note that those numbers represent the number of businesses and employees directly impacted by the inundation scenarios, meaning the parcels of those businesses are 'touched' by water'. The results do not account businesses that could be effected by secondary impacts, such as decreased tourism activity or fishermen who rely on piers and docks being high and dry to offload and sell their catch.

- To evaluate other impacts, Rachel's team used an economic assessment software to determine the indirect and induced effects of sea level rise. Induced effects include the supply chain effects, for example, when a restaurant buys bread from a local bakery, and the induced effects are when a local employee spends their money locally, such as a restaurant employee buying their groceries at the local grocery store.
- The analysis found that under 6.1 feet of sea level rise, \$110 million of economic output at risk in York County, just from those three towns alone.

RESULTS: INDUSTRY IMPACTS

Industry Breakdown of Output at Risk from 6.1 feet of SLR: Kennebunk



Summary Notes

Results: Industry Impacts

- The analysis also evaluated the industries at greatest direct risk from flooding. In Kennebunk, food service, retail, and accommodation industries would be most impacted by 6.1 feet of flooding.

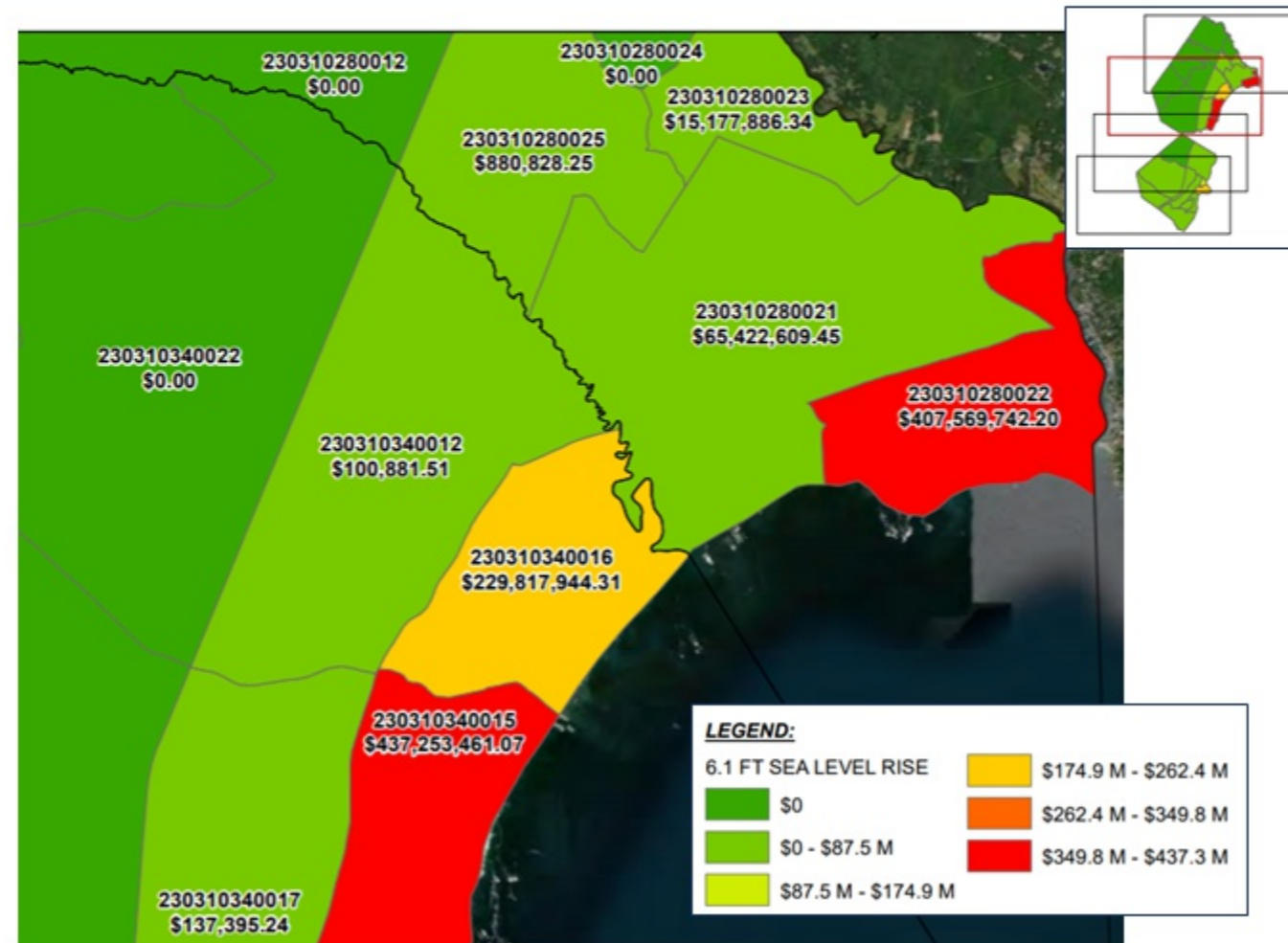
RESULTS: HOUSING OCCUPANCY

Housing occupancy rates within block groups with greatest impact from 6.1 ft sea level rise

Block Group	Total Residences	%Unoccupied
0360012 (York)	1564	82%
0340015 (Wells)	1551	81%
0340014 (Wells)	964	59%
0280022 (Kennebunk)	949	58%
0280021 (Kennebunk)	896	14%
0360015 (York)	278	59%

Table 7 of report. Occupancy rates 2018-2019. Data source: US Census 2020

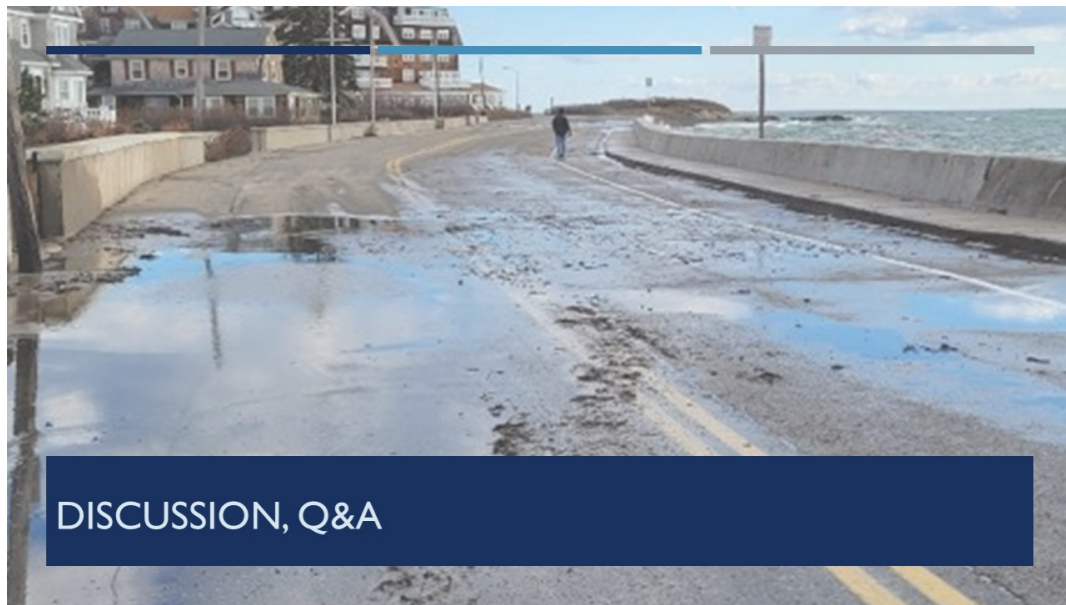
- Large amount of seasonal and rental housing
- Contributes to tourism activity
- Economic impact not accounted for by analysis



Summary Notes

Results: Housing Occupancy

- Kennebunk, like other area towns, has a relatively large amount of seasonal and rental housing which contributes to the local economy as well as the municipal tax base. While economic activity associated with seasonal and rental housing was not assessed through this project, housing occupancy rates within inundation areas was evaluated to provide towns with a better sense of impacts.
- This table shows the percent of unoccupied homes within the Census block groups that are most impacted by 6.1 feet of sea level rise, with 58% of residences unoccupied in the group closes to Kennebunkport. The map shows the block groups and the total assessed value impacted within each block group.



Q: Thoughts on using this information for future program planning for the Community Development Office?

Staff: Community going through a lot of reinvestment of shoreline because of damage in 2018 tide inundation. Monthly basis get splash-over on Beach Avenue. Everyday getting warnings about sea level rise. Challenge is our town's planning efforts look 10-20 years in the future, after that, those that make the decisions aren't as in touch with them, and this project goes beyond that. Our planning and zoning efforts have been focused on elevating structures (freeboard). The reality is with SLR it won't be feasible to get to the structures. Have a bathtub effect with the wall along the sidewalk at Beach Ave and the walls along the properties. That's where the water levels are going to be in the future. Have a challenge for planning. Can't change access points, supports occupancies of structures, utilities, access, all impacted by this. Don't have protocols that encourage more development there, it's how we're going to manage it going into the future. Our investment gives us time to plan. Looking forward, these are decisions for people's grandchildren. Putting it in context it's difficult compared to what we typically do. Kennebunk is flat, impacts felt at the beach go inward quickly. Everyone can understand. 3 feet sea level rise is a lot, 1.5 feet is a lot. Make some difficult decisions for the future. Biggest challenge, a lot of seasonal residences down there, hard to get participation about challenges, only there when it's sunny. This project and analysis are a valuable tool for us. Pay attention to it for every decision we make.

Team Notes: The impacts of Sea Level Rise and coastal flooding represented are based on the 'middle of the road' sea level rise projections for the future based on global conditions, however, the change may be gradual or abrupt. Planning for municipal-scale impacts can start today. Note the scenarios used represent sea level rise projections presented in the SLR curve table (NOAA 2017) for intermediate and intermediate high global emission scenarios for 2050 and 2100.

Q: Has there been a systematic evaluation of Kennebunk's culverts and storm water outfalls?

Team Notes: There has been systematic documentation of the culverts, and to a certain extent evaluation as well, for example:

- The [Maine Stream Habitat Viewer](#) includes a database of road crossings that covers most sites in Kennebunk.
- The [CoastWise Tidal Restriction Atlas](#) is the latest database that has been developed for road crossings (tidal or future tidal crossings).
- Stormwater outfalls were mapped in the Kennebunk River as part of the [Kennebunk River Watershed-based Management Plan](#). This does not include any outfalls in the other two watersheds that are in Kennebunk (Branch Brook, Mousam River).
- The [York County Bridge and Culvert Analysis](#) project developed a tool for ranking and prioritizing stream crossings. This tool was intended for use on a site-by-site basis.

Q: Has there been any NOAA data on storm surge and numbers of storms?

Team Notes: NOAA tide gauges along the Maine coastline monitor water levels continuously and the NOAA Tides and Currents website provides tide data for those gauges, including the predicted/expected tide and observed tide (raw data and graphs/tables). Storm surge values can be gleaned from that website. The Maine Climate Council's Scientific and Technical Subcommittee's report 'Scientific Assessment of Climate Change and its Effects in Maine' identifies trends in storm event frequency. Recommended websites:

- [Maine Sea Level Rise/Storm Surge Viewer](#)
- [Maine Sea Level Rise Dashboard](#)
- [Scientific Assessment of Climate Change and its Effects in Maine Report](#)
- [NOAA Storm Events Database](#)

Q: Would dykes at strategic spots in the rivers to redirect water be helpful?

Team Notes: This is a major structural engineering question that would require in depth site-specific analysis involving the Army Corps of Engineers and US Fish and Wildlife Service. While the team can not begin to answer this, there has been much research on agricultural dykes in the Maine's salt marshes (including dike removal in the Mousam River by Rachel Carson National Wildlife Refuge). The town of Machias, Maine offers an example as a community exploring the upkeep of its dike (Route 1 causeway) with similarly-funded Maine Coastal Communities Grant projects.

Q: How have other towns that have taken the lead handled beach properties?

Team Notes: Assuming the question is asking how other towns have handled impacted beach properties through things like land use, policy, and mitigation to address vulnerabilities, we recommend looking to the town of Hampton, NH. From the Seabrook-Hamptons Estuary Alliance (SHEA) website: Hampton, NH, SHEA, in partnership with the NH Department of Environmental Services Coastal Program, has embarked on a long-term planning process to research and guide coastal adaptation strategies to cope with coastal flooding from high tides, storm surges, and sea-level rise. [. . .] They conducted a "Situation Assessment" to better understand flooding impacts, costs, concerns, and experiences in Hampton. The Situation Assessment was based on the results of an extensive survey completed by 69 Hampton residents and property owners, plus select one-on-one interviews. The results of this Assessment will help inform an effort (Phase 2) to evaluate a range of strategies to "keep water out," "live with water," and/or "get out of the water's way" at the property and Town-wide levels. The investigation and evaluation is being conducted by the Coastal Hazards Adaptation Team (CHAT). CHAT is comprised of members of the Hampton Board of Selectmen, Planning Board, Zoning Board of Adjustment, Department of Public Works, Hampton Beach Village District, Hampton Beach Area Commission, and the Hampton Town Planner and the Hampton Conservation Coordinator. The ultimate goal of this long-term planning process is to empower Hampton to plan for community-wide coastal flooding adaptation. (www.shea4nh.org)

Additionally, the final report for this project will include example adaptation strategies and solutions used by other communities in New England.

Participant Comments

- Include tidal rivers in language about sea level rise (not just seas). Include Mousam River in the 2-pager project summary.
- Engage with MSK and KHS students--its their future



COASTAL RESILIENCE STRATEGIES

Summary Notes

A major part of this project is focused on providing information about what the towns can do to act on the project results to reduce risk and enhance resilience. In other words, trying to provide answers to the question of “ok, now what?” that usually comes up after an assessment like this is complete.

WHAT CAN THE TOWN DO TO PREPARE?

- Municipal action is vital
 - Home Rule = Opportunities!
- No “one size fits all” approach
- Addressing the range of impacts and vulnerabilities requires employing a range of solutions
 - People, private property, municipal assets and infrastructure, natural resources, economy



- Integrate resilience measures into existing plans, policies, and land use tools
 - Floodplain management ordinance
 - Increase freeboard requirement
 - Require structures in coastal flood areas to be elevated on posts or piers to accommodate water
 - Tidal culvert repair
 - Upsize culvert to handle additional flows and design based on future sea level rise
 - Capital Improvement Plan
 - Include coastal resilience criteria in project consideration

Summary Notes

What Can the Town do to Prepare?

- To that end, the team is developing tailored resilience planning strategies to help Kennebunk and the region prepare for sea level rise and protect people, property, and municipal resources now and into the future.
- Fortunately, our towns have a number of options to address coastal flooding. Municipal action is critical for addressing climate impacts and Maine’s home rule status offers plenty of opportunities for towns to develop tailored solutions to address local vulnerabilities, conditions, and needs.

- While the challenges posed by future sea level rise may seem overwhelming, the good news is that we tackle impacts incrementally through a variety of different options. Flood resilience measures can be integrated into existing planning, policy, and regulatory tools. For example, existing floodplain management ordinances can incorporate better flood risk reduction measures such as increased freeboard, or the elevation to which structures must be built, to account for future flooding. Municipal culverts can be upsized to accommodate increased water flows and higher tidal elevations. Municipal expenditures can be informed by coastal impact assessments.

RESILIENCE AND ADAPTATION STRATEGIES



Protect



Accommodate



Retreat

Summary Notes

Strategies – Protect/Accommodate/Retreat

- Adaptation and mitigation strategies such as these are usually organized into three overarching categories: protect, accommodate, and retreat. Protect means to fortify against flood waters, such as by building a seawall. Accommodate means to design things in a way that allows water to move freely while reducing risk, such as elevating a house on piers. Retreat means to pull back out of inundation areas.

EXAMPLE STRATEGIES



Photo: Woods Hole Group

Relocation of beach parking lot landward and dune restoration and enhancement

Nauset Beach, Orleans, MA



Coastal resilience overlay zoning district with provisions for reducing flood risk while stimulating mixed-use development

Hull, MA



Public park designed to serve as a flood storage area near coastal wetlands

Beverly, MA

Summary Notes

Example strategies

- Examples that have been used in nearby areas include relocating beach parking lots, developing coastal resilience overlay zoning districts with development standards designed to decrease flood risk, and designing public areas that can be flooded when needed and serve recreational purposes when dry.

STRATEGIES FOR ENHANCING MUNICIPAL FLOOD RESILIENCE

Coastal Resilience Strategies		DRAFT		THIS SPREADSHEET COMPILED BY SMPDC		SMPDC		
Strategy Name	Hazard Category	Subhazard	Type	Municipal	State	Strategy	Substrategy	Description
Local Wetland Ordinance w/ Flood Resilience Zones	Natural Resource	Wetland Conservation	Retreat	Boston	MA	Regulatory	Zoning	Establishes a "Waterfront Area" that will serve as a buffer zone and allow for implementation of the Resilient Boston Harbor Plan and creation of Flood Resilience Zones. Also protects isolated vegetated wetlands, vernal pools, and vernal pool habitat. Allows Cons Comm to develop standards for projects in floodplain to ensure resiliency measures are incorporated and expressly directs the Comm to consider climate change, SLR, and climate resiliency. Creates Flood Resilience Zones
Tax increment reinvestment zones (think same as TIF)	Coastal Resilience	All	Funding	Houston	TX	Local financing	TIF	An economic development tool that captures projected increase tax revenue that is created by a development within a defined area and reinvests those funds into public improvements and development projects that benefit the zone.
Environmental impact bond	Coastal Resilience	All	Funding		Louisiana	Local financing	Bond	Form of 'pay-for-success' debt financing in which investors purchase a bond and repayment to investors is linked to the achievement of a desired environmental outcome
Coastal Trust Fund	Coastal Resilience	All	Funding		Louisiana	State financing		
Coastal Resilience Overlay Zone	Coastal Flooding	Sea Level Rise	Accommodate	Portland	ME	Regulatory	Zoning	Zoning district designated by coastal hazard risk / vulnerability for the purpose of applying development standards and performance measures to reduce risk and enhance resilience
		Sea Level Rise		Sandwich	MA			
		Sea Level Rise		Falmouth	MA			
		Sea Level Rise		Harwich	MA			
Managed relocation	Coastal Flooding	Sea Level Rise	Retreat	Brewster (Br)	MA	Policy	Land use	Managed retreat, or the voluntary movement and transition of people and ecosystems away from vulnerable coastal areas, is increasingly becoming part of the conversation as coastal states and communities face difficult questions on how best to protect people, development, infrastructure, and coastal ecosystems from sea-level rise, flooding, and land loss.
Conservancy overlay district - prohibition of new residential dwelling unit in district & regulatory floodplain and prohibition of new structures VE Zone	Coastal Flooding	Sea Level Rise, Precipitation and Stormwater, Storm Surge	Retreat	Chatham	MA	Regulatory	Zoning	Conservancy District: Purpose: d) protect persons and property from the hazards of flood and tidal waters which may result from unsuitable development in or near swamps, ponds, bogs and marshes, along water courses or in areas subject to flooding, extreme high tides and the rising sea level. Prohibited Uses: d. No person shall construct a new residential dwelling unit, or use a houseboat or barge designed or used as a dwelling unit in the Conservancy District. (5/9/16 ATM); e. No person shall construct any new building (except as allowed with a marina or boatyard under Section IV.A.3.b of this Bylaw) in a VE Zone, as defined on the Flood Insurance Rate Maps, prepared by the National Flood Insurance Program for the Town of Chatham, dated July 16, 2014. (5/9/16 ATM). Area: a. The Coastal Conservancy Districts shall consist of all the submerged lands along the coast of Town, and areas subject to flooding including: 1. Areas delineated as the 100-year flood plain (Zones A, AE, AO, VE) on the Flood Insurance Rate Maps, prepared by the National Flood Insurance Program for the Town of Chatham dated July 16, 2014. (5/9/16 ATM) 2. When a coastal bank exceeds the elevation of the relevant one hundred (100) year floodplain, the Coastal Conservancy District boundary shall be the top of the bank.
Prohibition of expansion of existing structures or increase in impervious surface in VE zone	Coastal Flooding	Sea Level Rise, Precipitation and Stormwater, Storm Surge	Retreat	Chatham	MA	Regulatory	Zoning	Floodplain District: 5. Prohibited Uses- The following uses and activities are prohibited in the VE Zone. a. Addition, alteration or reconstruction of an existing structure that results in an increase in building footprint. b. Repair of a substantially damaged existing structure which results in an increase in building footprint. c. Any increase in impervious surface on a residential lot. This may include, but is not limited to, swimming pools, tennis/basketball courts and retaining walls. For functionally dependent projects allowed in the VE Zone, impervious surfaces accessory to the use are allowed provided a Massachusetts registered civil engineer certifies in writing that...

Summary Notes

Strategy Matrix

• To assist the project towns with sea level rise planning, the team has compiled a spreadsheet of strategies and solutions for enhancing flood resilience. This spreadsheet and tiny text is not meant to be read right now, it is just a screenshot of a large excel document that presents examples of what other communities, regions, and states have done to address coastal flood hazards. This will be included in the project's final report as a resource for towns.

RESILIENCE STRATEGIES

Policy

- ✓ Consider sea level rise impacts in municipal expenditures
- ✓ Incorporate resilience criteria in CIP
- ✓ Address coastal flood hazards in the Comprehensive Plan update

Land Use

- ✓ Freeboard for structures through floodplain management ordinance
- ✓ Coastal resilience overlay zoning district
- ✓ Open space subdivision provisions

Mitigation Projects

- ✓ Strategically conserve floodable open space
- ✓ Enhance resilience of existing seawall
- ✓ Improve stormwater management infrastructure
- ✓ Retrofit impacted structures using floodproofing

Funding

- ✓ Pursue external grant opportunities
- ✓ Establish a municipal resilience fund
- ✓ Impact fee for supporting Town resilience projects

Summary Notes

Resilience Strategies columns

• The strategies in the spreadsheet are organized based on categories, including policy, land use, mitigation projects, and funding. Listed here under each category are example strategies that Kennebunk might want to consider. These strategies were identified based on conversations with town staff as well as the results of the project's assessment.

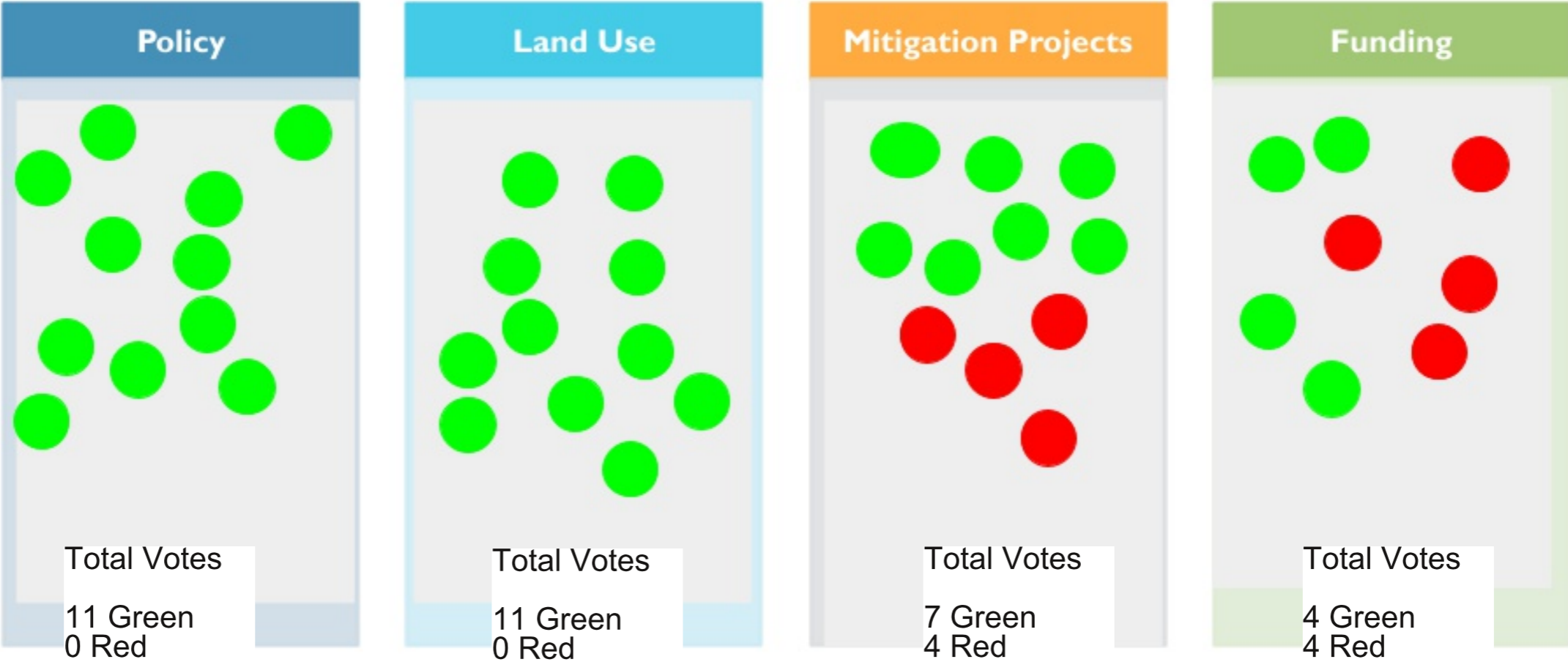


ENGAGEMENT ACTIVITY: RESILIENCE STRATEGIES

Engagement Summary

As an exercise to get the municipal perspective on where to begin focusing resilience work, participants were given 2 green and 1 red dot and asked to place them in strategy categories that they felt Kennebunk should focus its work. A red dot could be placed if they felt a strategy should not be a focus for Kennebunk. Using all dots was optional.

Directions: Each participants gets 2 green dots and 1 red dot. Place green dots in strategy categories where Kennebunk should focus its work. Place a red dot if a strategy should not be a focus for Kennebunk. You do not need to use all your dots.



Share your thoughts on specific strategies: what will work in Kennebunk? Won't work? What would need to happen for them to work? What would you like to see?

Policy	Land Use	Mitigation Projects	Funding	Other--what's else?

Engagement Summary

Participants were asked to share their thoughts on specific strategies presented. The following comments were typed by participants into the slide.

- Policy**
- Ordinances about building in the affected areas
 - Publicity now about potential loss of land and homes
 - Look for ways to increase and move tax base - i.e. recreate a clean industrial park area inland to attract businesses now - to offset future losses in beach area
 - Improve/change view of West K and out rt 99 to encourage development
 - Develop a plan for transitioning away from infrastructure that will no longer be tenable (sea wall, beach roads)
 - Transitional Retreat (Buyout & no longer Invest)
 - Requirements that development address SLR impacts
 - Setting funding caps on failing existing sea wall infrastructure
 - Zoning Updates that reflect the Climate Action Plan goals
 - Providing education for contractors working in these areas.
 - Should there be disclosures made about SLR when an at risk property is for sale?

- Land Use**
- Yes to making, “strategically conserving floodable open space” an incentive and plans to reclaim open space as it becomes available.
 - Establish Coastal barrier system (buffer between inland)

- Mitigation Projects**
- Living Shorelines

- Funding**
- Use fees from other wetland impacts in town?

- Other**
- Beach renourishment

Community Engagement Strategies

Share ideas about who to engage and how--be specific.

Example: share project information with property owners thru tax bill. Ask them to visit a website to vote on adaptation strategies.		

Summary Notes

Participants were asked to share ideas by typing directly into the above slide about the best way to engage their community members.

Community Engagement Ideas

- Create video/animation to show exactly what homes and streets would look like under the various circumstances (the different water rises)
- Education through electronic media possible newsletters to stakeholders
- There was a scary comment earlier that many of the impacted residential properties are seasonal owners and are not attuned to the problem. Direct outreach to owners of properties in the blue/red zones to build awareness. Repeat this program in July or August? Work through “summer” programs to educate their members (KBIA, River Club, Edgcomb, etc.)
- Place temporary signs around town that show areas that would be underwater under various scenarios
- Create a model that tells a visual story - the bathtub fills (Atlantis?) Show how each step of the transition affects properties (access from the road, access into dwelling, loss of services - Fire, Ambulance)
- Develop an educational plan to raise community awareness throughout the town. This will lead to support throughout the tax base for future strategies that require funding.
- Need to have films, speakers, forums on sea level rise and its impacts -- need to awaken folks now - hopefully can have in person meetings in 2022 -
- 2 pager (project summary) in the tax bill

Questions & Answers

Q: Are you looking for ways to engage people in developing strategies or ways to engage people to review strategies once they exist?

Annie: both

Participant Comment

Participant: I'm very concerned about the idea of developing a strategy based on the responses of people who have had a fifteen minute introduction to the issue.

Abbie: this is an exercise to get feedback, not to make any decisions or prioritize strategies.

How vulnerable are Kennebunk, Wells and York to sea level rise?

Shawn P. Sullivan | Portsmouth Herald

Published 5:54 a.m. ET Feb. 11, 2021 | Updated 1:59 p.m. ET Feb. 11, 2021

[View Comments](#)    



Damage to the seawall on Gooch's Beach in Kennebunk, Maine, is seen after a nor'easter battered the coast in early March 2018. Jonathan Bryant

KENNEBUNK, Maine – Selectperson Edward Karytko on Tuesday mentioned some recorded footage he had seen that showed large waves crashing on the town's shores during the snow storm earlier this month.

"If we get a direct hit from a hurricane, it's probably going to be 10 times as worse," he said.

Karytko made his remark during the Kennebunk Select Board's discussion on rising sea levels as a result of climate change, the impacts that could have on the community, and what the town is doing to take action.

To that end, Community Development Director Chris Osterrieder updated the board on the Tides, Taxes and New Tactics Project, an ongoing effort led by the Southern Maine Planning and Development Commission in collaboration with the towns of Kennebunk, Wells and York.

More: Kennebunk Select Board awards bid for improving Beach Avenue shoreline

The project is focusing on the impacts rising sea levels will have on these coastal communities, as well as on local vulnerabilities and strategies for protecting people, property and natural resources from the impacts of coastal flooding.

Osterrieder said the project's analysis of Kennebunk is finished, so now is the time for the town to begin to understand what the analysis means and discuss strategies for the future.

March 2018 Nor'easter: FEMA surveys storm damage in Kennebunk

The town will hold a virtual workshop on Tuesday, March 2, to share the local assessment results with municipal staff. The workshop is expected to start at 6:30 p.m. and last about one hour, Osterrieder said.

"This step here is really important," he added.

Osterrieder said that the project team has determined a sea level rise of about 3.9 feet over time would affect at least 700 properties on the Kennebunk coast.

Team Notes: Next Steps and Resources

Climate change is one of the most pressing issues of our time and planning for it is a tremendous challenge for municipalities on the front lines. Read more about how Kennebunk is planning for climate action.

Local Next Steps

Tides, Taxes, and New Tactics Project

Kennebunk, York and Wells are all participating in the project and have had a vulnerability assessment and socio-economic analysis completed. The project team will provide assistance to the Towns to incorporate the project findings into municipal planning efforts. The community engagement team will meet with the town committee working on climate adaptation and mitigation planning (Energy Efficiency Committee) to discuss feedback from participants in this workshop and possible next steps to engage community members. Project findings will be summarized and compiled in a regional report to outline results of the vulnerability assessment and economic analysis, town specific findings, and recommendations for advancing coastal resilience planning.

Resources:

[Project Summary: Kennebunk](#)

[Vulnerability Assessment Towns of York, Wells, and Kennebunk, Maine](#) (GEI Consulting)

[Economic Analysis of Sea Level Rise: Kennebunk, York, and Wells](#) (rbouvier consulting)

Timeline: April 2020-June 2021

Funder: Maine Coastal Communities Grant Program

Partners: Towns of Kennebunk, York, Wells; GEI Consulting; rbouvier consulting; SMPDC;

Wells Reserve; Maine Sea Grant

Regional Next Steps

Regional Resilience and Sustainability Program
Kennebunk is one of six southern Maine communities in the Regional Resilience and Sustainability Program to help the towns address climate change impacts and advance sustainability and resilience efforts. Projects include municipal solar contracts to reduce municipal energy costs and emissions; Peer to peer learning on municipal fleet electrification.

Resources:

[Getting There From Here: A Baseline for Advancing Climate Action in Southern Maine Regional Sustainability and Coastal Resilience Assessment](#)

Timeline: 2019-Ongoing

Funders: Towns of Kennebunk, York, Wells

Southern Maine Regional Coastal Resilience Plan

Kennebunk is one of ten municipalities in York and Cumberland counties to collaborate with land trusts, regional conservation organizations and state natural resource agencies to better prepare for impacts of storms and sea level rise. Projected outcomes: assessing resilience needs and socio-economic conditions; assessing coastal impacts and vulnerabilities; creating a working group; identifying and prioritizing resilience strategies and projects; and developing the plan.

Timeline: April 2021-2023

Funders: National Fish and Wildlife Federation, National Oceanic and Atmospheric Administration

Partners: Towns of Biddeford, Saco, Kennebunk, Kennebunkport, Old Orchard Beach, Scarborough, Kittery, York, Ogunquit, and Wells; SMPDC; Wells Reserve

Maine's Next Steps

On June 26, 2019, the Governor and Legislature created the Maine Climate Council, an assembly of scientists, industry leaders, bipartisan local and state officials, and engaged citizens to develop a four-year plan to put Maine on a trajectory to reduce emissions by 45% by 2030 and at least 80% by 2050. By Executive Order of Gov. Mills, the state must also achieve carbon neutrality by 2045.

Resources

[Maine Won't Wait: A Four Year Plan for Climate Action Scientific Assessment of Climate Change and Its Effects in Maine](#)

