

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 York

Wednesday, March 24, 2021

6:00 – 7:00 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

34 participants, included project team, town staff (Planning Department, Parks and Recreation, Department of Public Works); board members (Board of Selectmen, Planning Board, Harbor Board); committee members (Budget Committee, Conservation Commission, Energy Steering Committee, Soheir Park and Nubble Lighthouse Committee, Bicycle and Pedestrian Committee); York Water District; York Sewer District; 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 Dylan Smith for his 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

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.
- The project aims to provide the towns with information about impacts to the built environment, as well as economic and social impacts of coastal flooding, in order to enhance understanding of local risk and inform action to protect people, property, the economy, and natural resources.
- The findings provide an overview of potential impacts and can serve as the foundation for further study and more detailed assessment and analysis. In other words, this project can be seen as a first step toward understanding York's vulnerability to sea level rise and guide additional assessment and planning.

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.

PROJECT OVERVIEW



Summary Notes

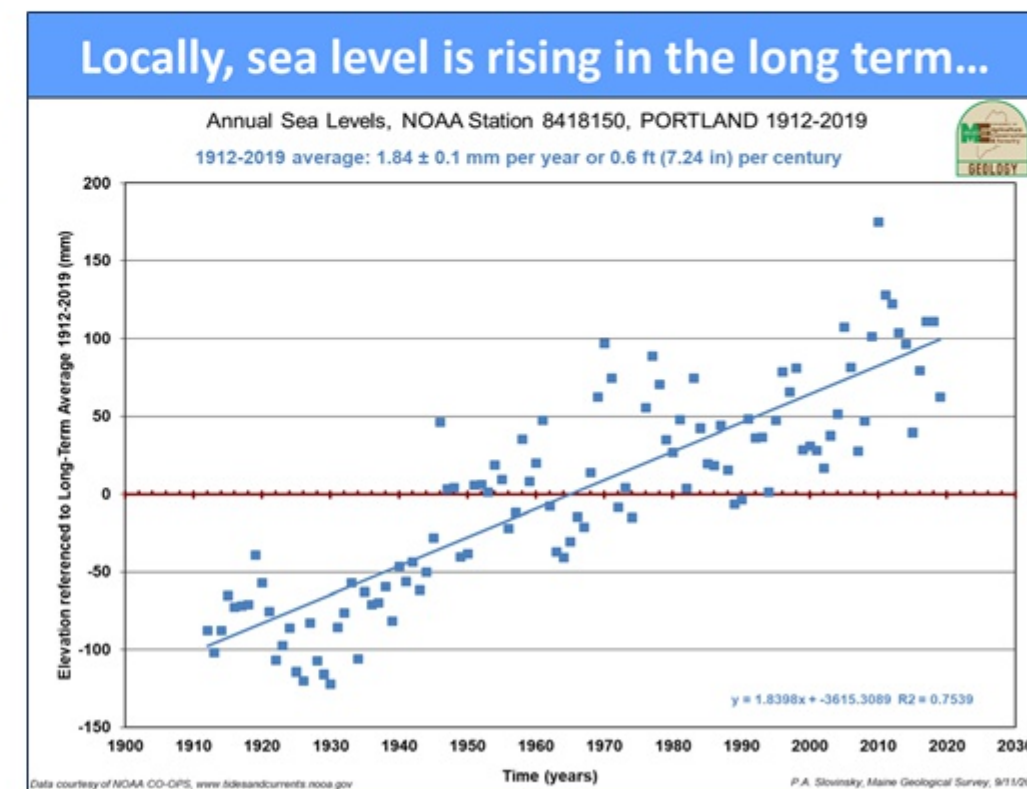
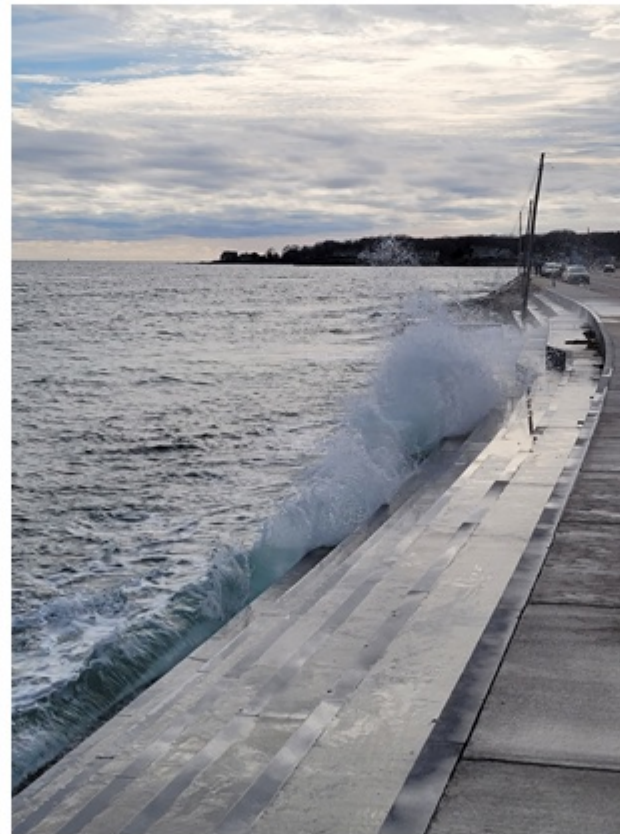
Overview of key components and timeline

- 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.

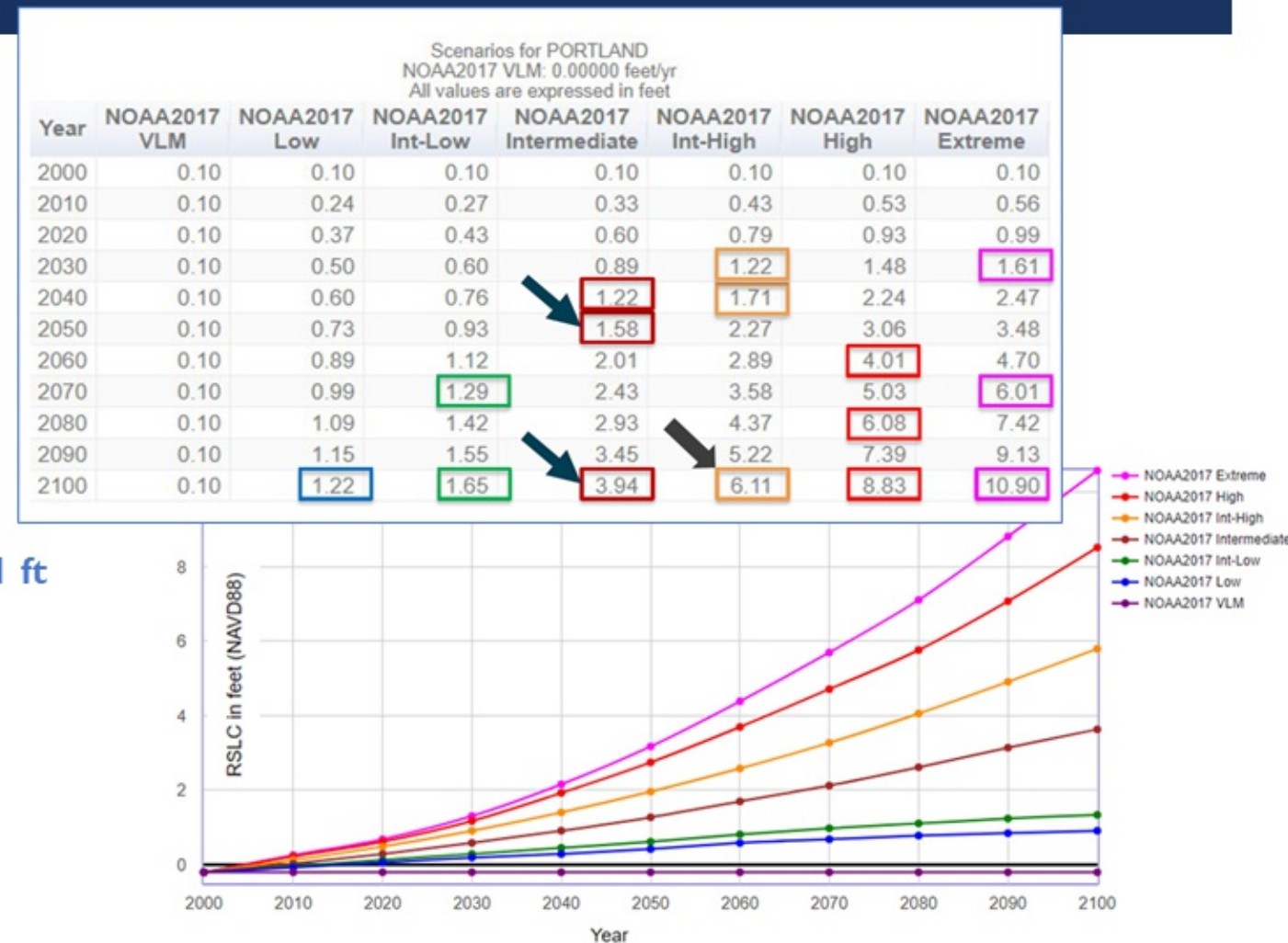
- Sea level in Maine, as shown in this graph, has been rising in the long-term. Over the past few decades, the rate of rise has accelerated to 3 to 4 millimeters per year. That rise is increasing the frequency of nuisance or high tide flooding, with southern Maine seeing 4 times as many nuisance flooding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

- 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: Given the estimated years each sea level rise will occur, are there scenarios where these estimates will be reached sooner?

Abbie: Straightforward answer: yes. We experience storms on a frequent basis that have considerable storm surge associated with them. Mentioned during the presentation Oct 2019 Nor'easter with a 4-foot storm surge associated with it. The surge did not happen at the high tide, the impacts were less than what they could have been, but the point is that even not accounting for SLR we can have storm events that bring high water levels to our coastlines and with SLR that is going to elevate the base height of water at high tide, so storm surge will have a greater impact and reach further inland. While we have the estimates, projections, and recommendations about SLR scenarios and projected time frames for each of those scenarios, we know that storms can bring higher tides and worse flooding before we experience the more severe SLR scenarios.

Participant follow up: Be worthwhile as this goes forward to the general population to have comparisons to previous storms (Mother's Day Storm) what was the rise at that point. Know York Beach that people were kayaking down the middle of the street. Helps bring reality to the maps. Find the maps fascinating.

Abbie: Great point, and a great way to help communicate what is difficult to visualize, such as what 3.9 feet of SLR looks like. Get a better sense of the impacts.

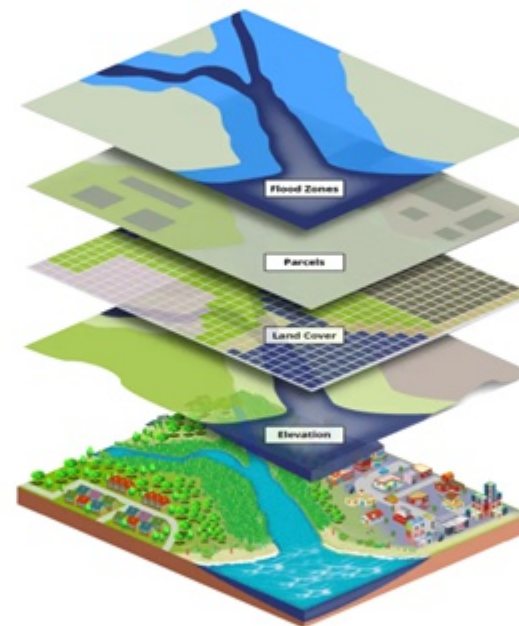
GIS VULNERABILITY ASSESSMENT

Inputs

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

Outputs

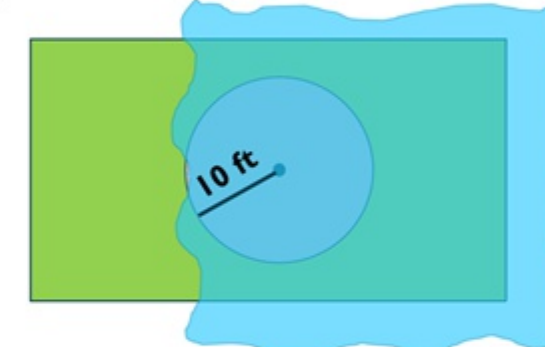
- Number of parcels impacted
 - Land & building vs. land only
 - Building footprints estimated
- Assessed value of impacted buildings and land
 - Residential, businesses, municipal
- Population and demographic information within impacted area
 - Census block group: people, households, median income,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



**“Impacted” means
‘touched’ by water**

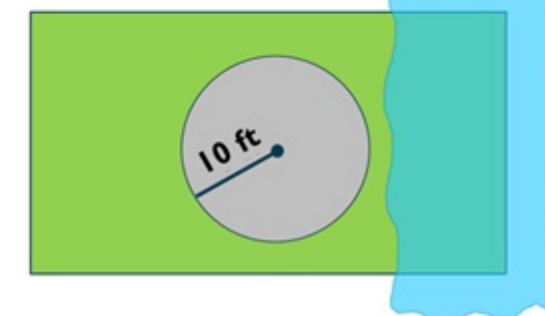
Building & land impacted

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

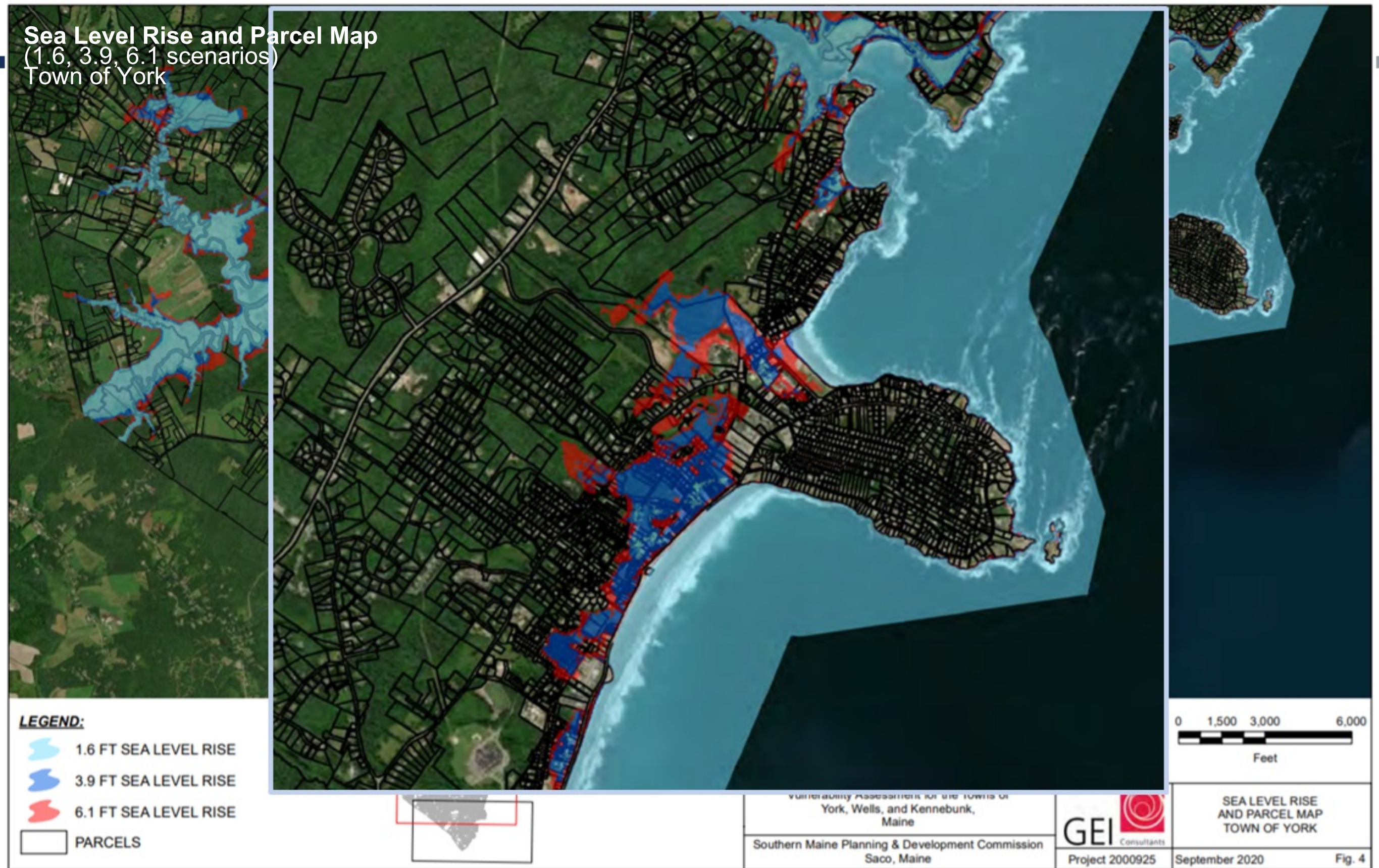
GIS vulnerability assessment

- 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.

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



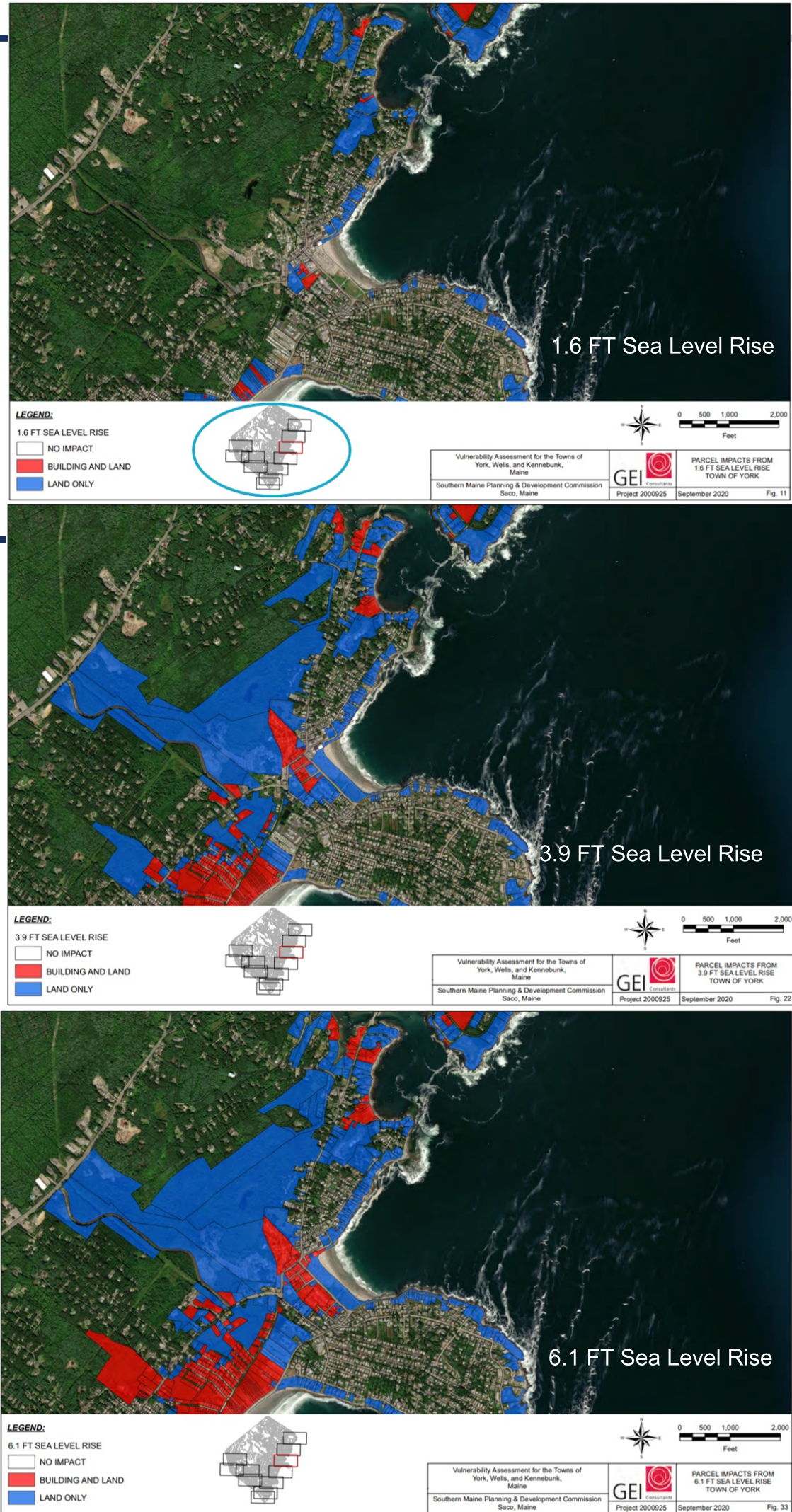
Summary Notes

Town-wide inundation map

- The next slides show inundation maps and results of the GIS-based vulnerability assessment. This image shows the mapped inundation boundaries for all three of the flood scenarios for the full town. York will experience flooding impacts all along the open coastline as well as along the tidal York River into the upper reaches. Areas especially impacted include the River, Cape Neddick, and Long

- All of these maps and figures are included in the vulnerability assessment report developed by GEI Consulting, which was sent to everyone who registered for this workshop and is available on SMPDC's website.
- The map images in the PDF report are high resolution, so you can zoom into areas of interest.

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, in this case, Cape Neddick around the Nubble. 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.

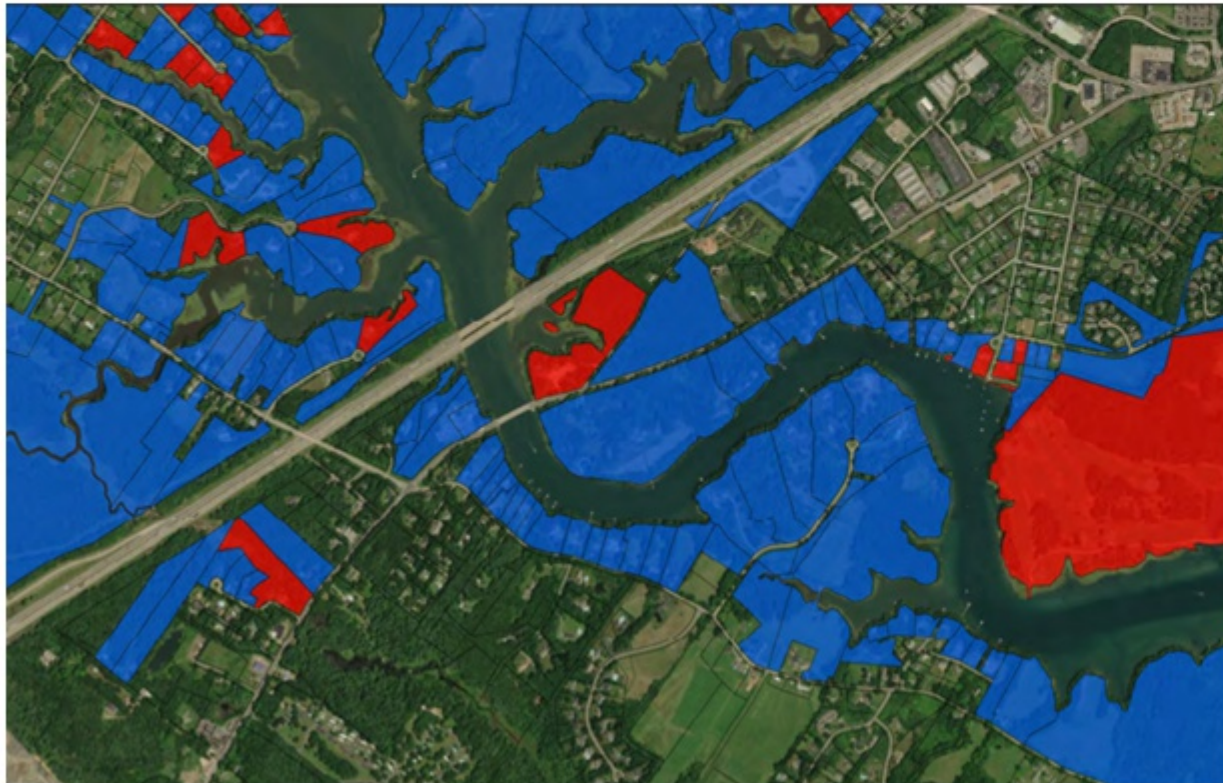
Questions & Answers

Q: Is there some sense of probabilistic analysis on where each of those scenarios are? Planning for adaptation, have 3 scenarios and likely outcomes, if sitting back, OK, 10-year time horizon, what specific infrastructure things might I need to deal with, what are the probabilities? Yes the State has set up targets for the impacts of mitigation but its still quite unclear to what extent those goals might be achieved, so if you are a planner and you are wondering what infrastructure needs to be supported and where and you pick a number (I know this is arbitrary) where's there a 70% probability for example that 3.6 feet is going to be the one at some time horizon, is that anything that is part of this analysis or might it be worthwhile to think about how to put it in those terms?

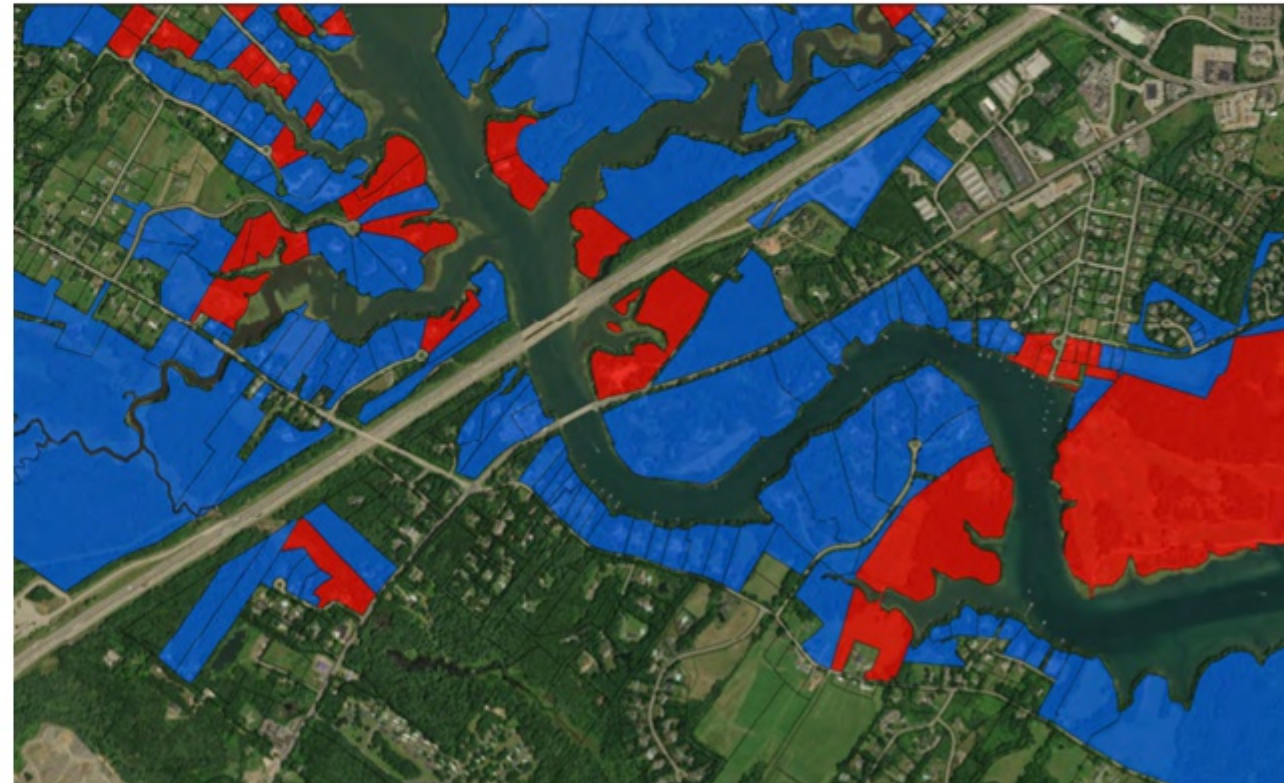
Abbie: There is a probability component to the sea level rise projections that have been developed that were used by the Maine Geological Survey to develop the inundation layers associated with each scenario. Doing probabilistic modelling at the local level is time intensive and expensive and one way some communities are getting around that while using the SLR data that is out there and widely available at the state level is to do planning that accounts for the risk tolerance of certain infrastructure, so looking at a specific piece of infrastructure or asset or neighborhood and looking at the risk tolerance in relation to flooding of that--something like a fire station might have a lower risk tolerance than something like a bridge. Looking at the intended life span of infrastructure is important as well. If a bridge serves a neighborhood and that bridge is the only way in or out of that neighborhood then its priority rises to the top, if its vulnerable to SLR compared with a segment of road that isn't travelled as heavily or isn't the only way in or out of one area. Looking at the impacts and tolerance to risk of certain assets in areas is an important component of that planning discussion.

YORK RIVER

3.9 ft



6.1 ft

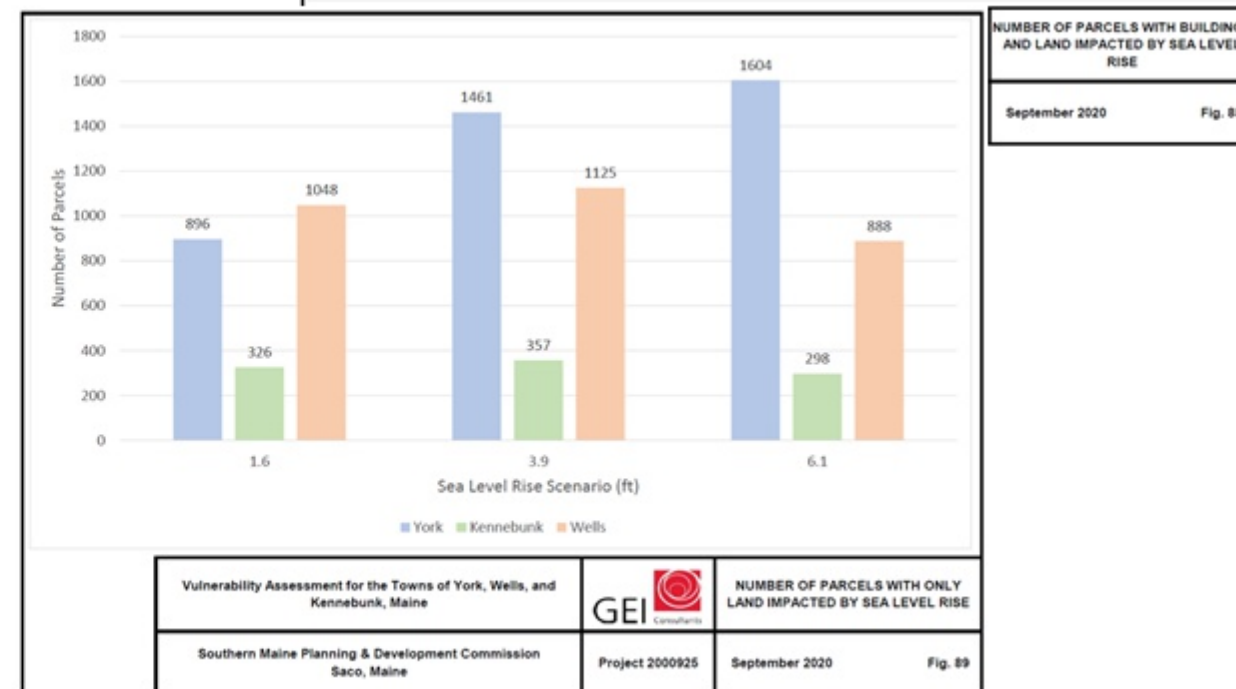
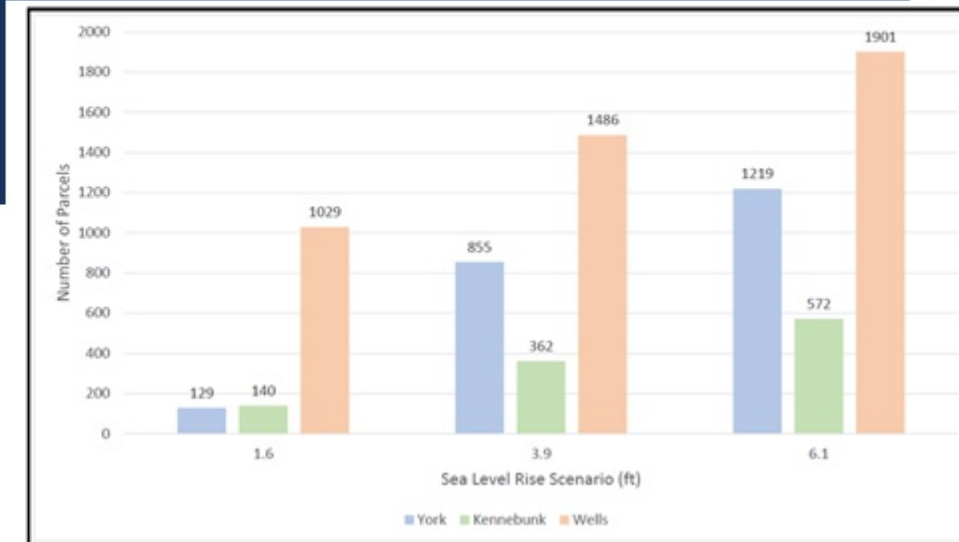
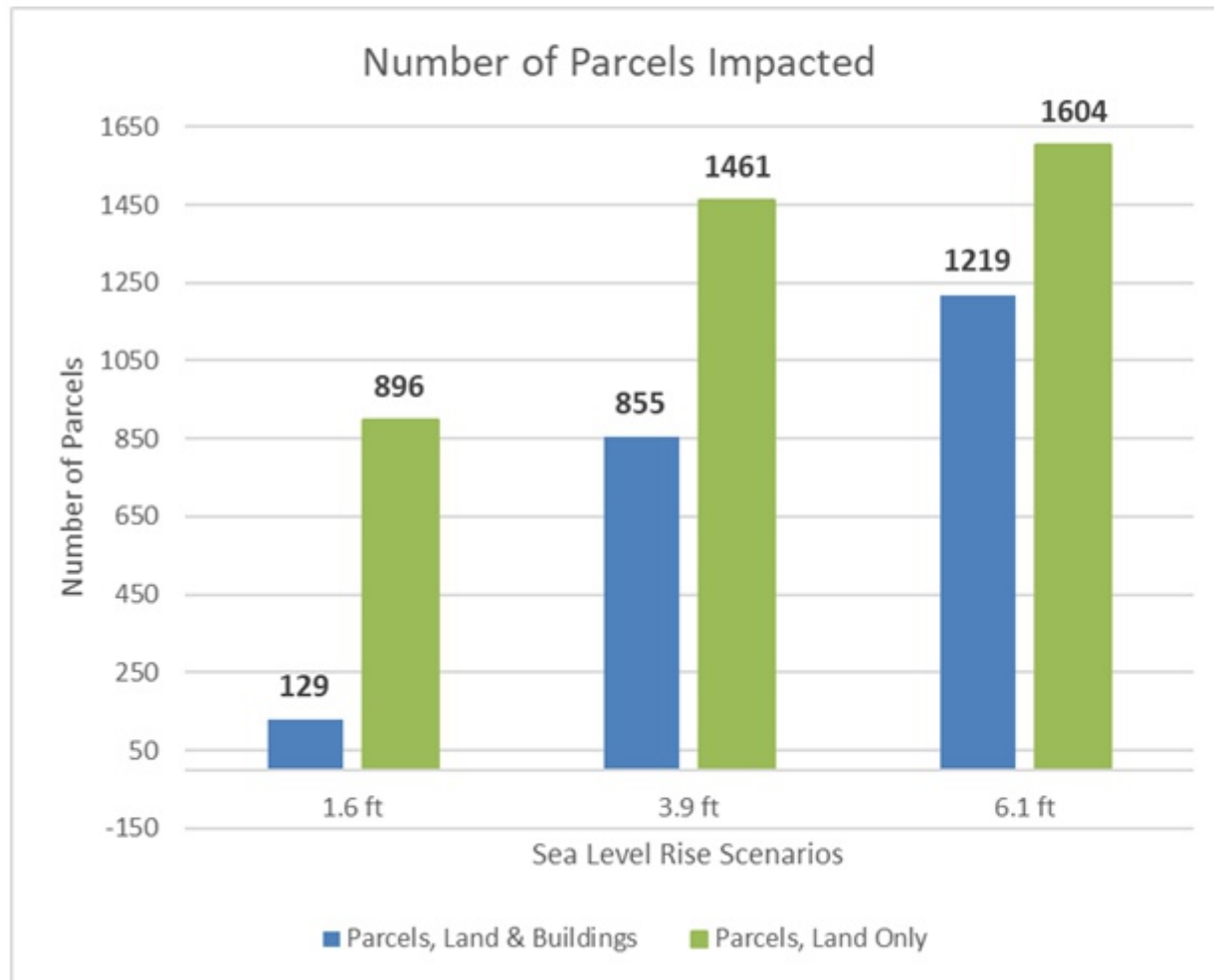


Summary Notes

York River

These side-by-side maps show a comparison of the York River area where it is crossed by I-95 under 3.9 and 6.1 feet of sea level rise or storm surge. It illustrates that you can use the report maps to zoom into areas of interest and compare impacts of different flooding scenarios.

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
Southern Maine Planning & Development Commission
Saco, Maine
Project 2000925
September 2020
Fig. 89

Summary Notes

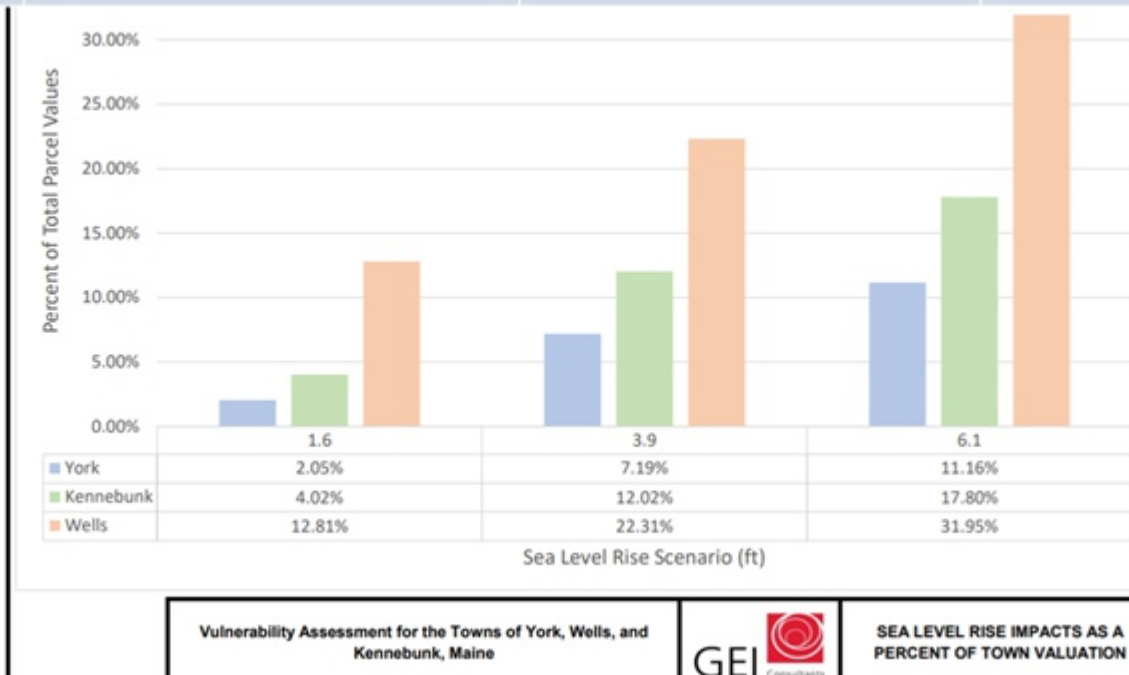
Results: Number of Impacted Parcels

- 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.
- For each of the three scenarios, there are more 'land only' impacted parcels than parcels that have land and buildings.

- These charts show the same results for York compared with the other two towns. York's results are represented by the blue bars, Kennebunk in green, and Wells in orange.
- Under the 6.1-foot sea level rise scenario, York has the greatest number of parcels impacts by flooding out of all three of the project towns.

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	\$101,867,774	2.05%	4.77%
3.9 ft	\$357,583,872	7.19%	16.74%
6.1 ft	\$554,852,922	11.16%	25.97%



Summary Notes

Results: Assessed Value 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 \$102 million at risk of flooding, which is almost 5% of the town's 2020 budget. That number jumps to almost 26% for 6.1 feet of sea level rise.
- The graph shows the same information for York 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 is not 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 TO MUNICIPAL ASSETS

Asset (unit of measurement)	Total Amount	Impacts from SLR			Percent of Total		
		1.6	3.9	6.1	1.6	3.9	6.1
Sidewalk (sq ft)	378,384	0	5,742	30,814	0%	2%	8%
Centerlines (ft)	1,045,478	5,956	27,562	53,338	1%	3%	5%
York septic systems (n)	336	0	0	7	0%	0%	2%
York parks (sq ft)	12,433,554	238,854	369,688	590,768	2%	3%	5%
York MHCP archeological sites (n)	142	84	84	85	59%	59%	60%
York local historic districts (sq ft)	9,003,042	973,006	1,063,934	1,198,213	11%	12%	13%
York health/medical parcels (sq ft)	680,510	35,041	54,010	70,773	5%	8%	10%
York government parcels (sq ft)	5,616,573	22,919	22,919	30,547	0%	0%	1%
York farm district parcels (sq ft)	32,257,029	140,163	241,012	368,897	0%	1%	1%
York emergency services (sq ft)	388,214	33	8,744	27,658	0%	2%	7%
York Water District water mains (ft)	433,493	3,679	12,636	25,790	1%	3%	6%
York Water District summer line mains (ft)	84,782	1,657	9,393	12,893	2%	11%	15%
York Sewer District sewer pipes (ft)	246,961	2,141	23,402	37,613	1%	9%	15%
York drainage pipes culverts (ft)	77,308	1,887	8,039	16,604	2%	10%	21%
York drainage ditches (ft)	16,402	474	1,142	3,356	3%	7%	20%
York Water District hydrants (n)	438	1	10	23	0%	2%	5%
York drainage structures (n)	1,087	13	71	136	1%	7%	13%
York drainage pipe openings (n)	3,675	86	175	296	2%	5%	8%
York drainage outfalls (n)	153	16	37	56	10%	24%	37%

Summary Notes

Results: Impacts to Municipal Assets

- The vulnerability assessment also examined impacts to certain municipal assets and infrastructure, as well as impacts to 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 highlight some impacts of interest, including linear feet of sidewalks and roadways impacted, archaeological sites impacted, and linear feet of sewer and water infrastructure impacted by the three inundation scenarios. This information is also included in the vulnerability assessment report completed by GEI.

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: How can communities use the results of the economic analysis and information about impacted businesses and economic activity to better understand secondary impacts to the local economy. For example, businesses that aren't going to be touched by water but rely on tourism or the beach?

Rachel: Important to look at York's economy and look at the intersections between businesses, again businesses don't exist in a vacuum they are all interconnected, look at it as an ecosystem, look at which businesses connect or depend upon each other and look at, what do we do if disaster strikes, so think about resiliency plans or think about diversifying the economy away from tourism, which might be a bit of an issue, but that is something that a lot of coastal communities are thinking about now. There aren't any easy answers, hopefully use this information as a stepping stone.

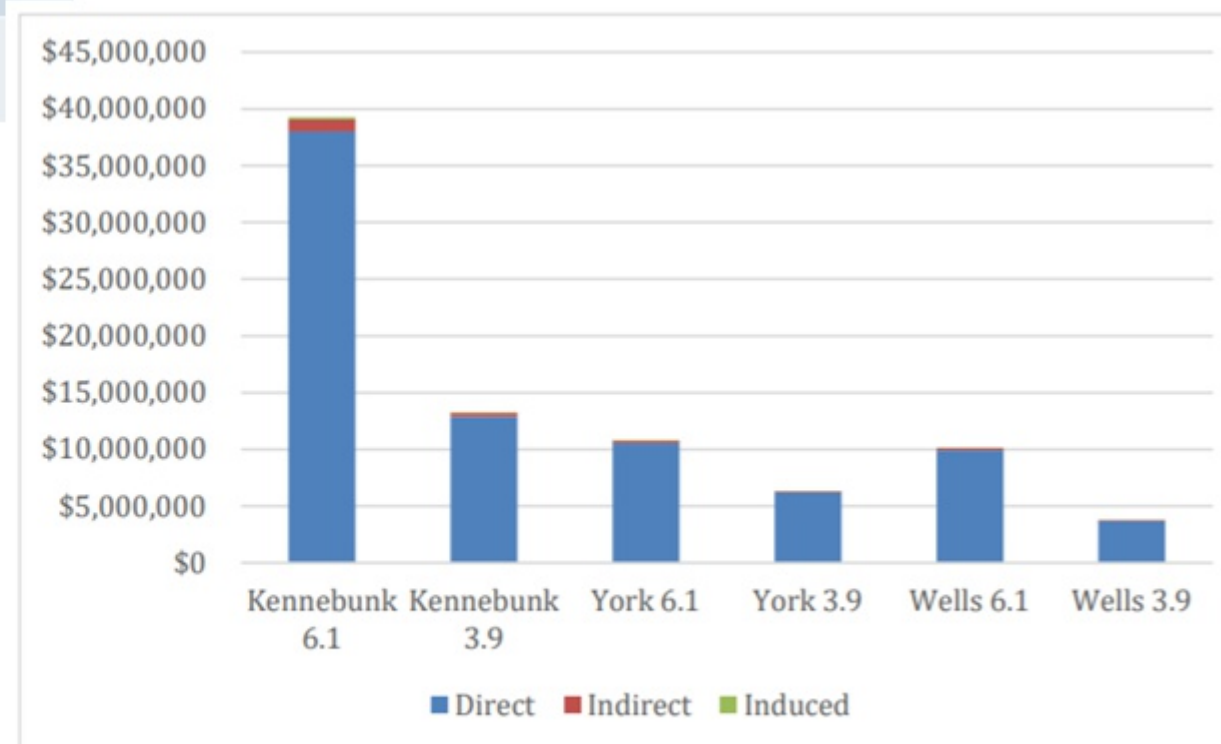
RESULTS: IMPACTS TO BUSINESSES AND ECONOMIC OUTPUT

Sea Level Rise Scenario	Number of Businesses Directly Impacted	Number of Employees	Percent of Total Employment in Town
3.9 ft	21	188	2.3%
6.1 ft	30	259	3.2%

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

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

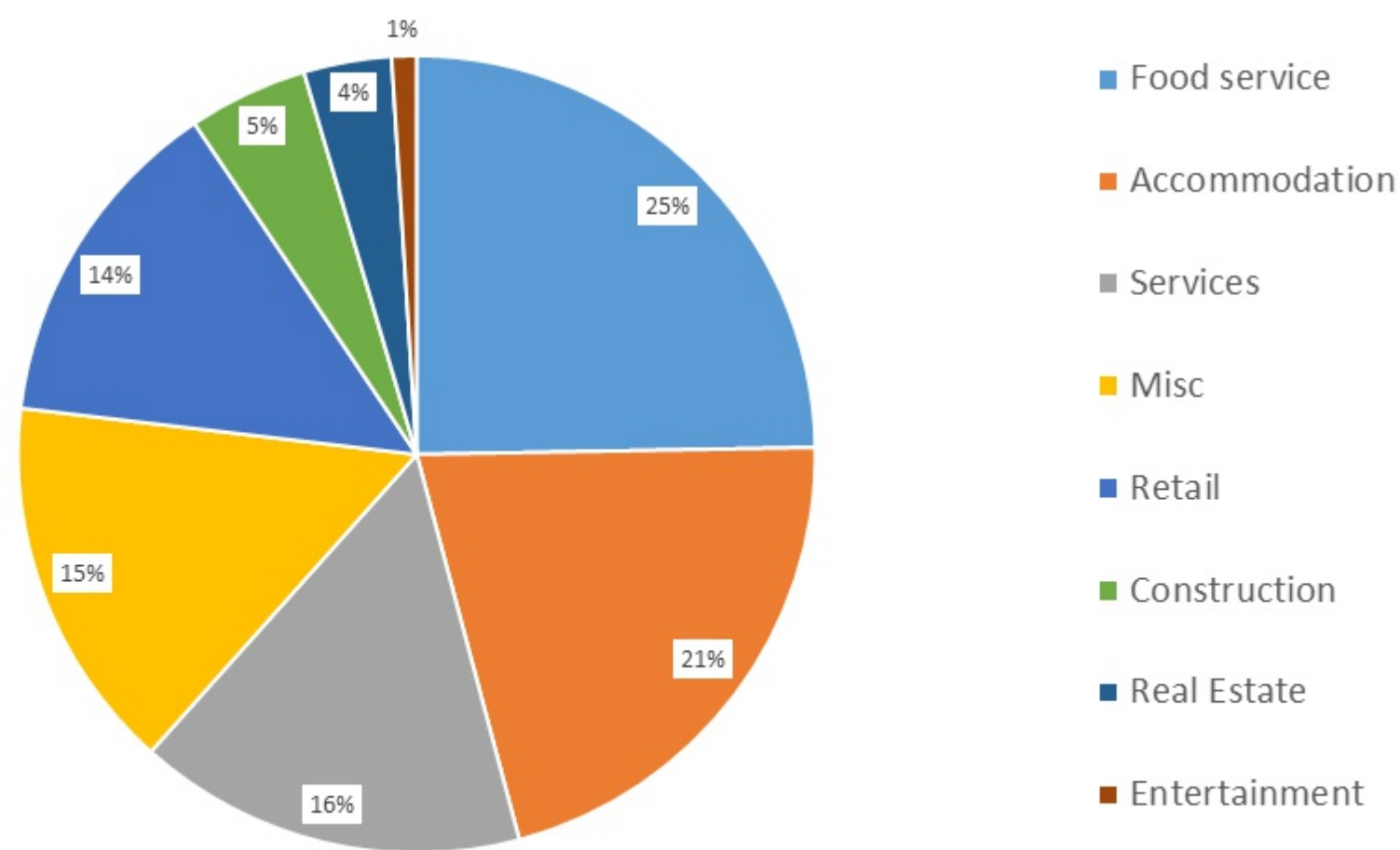
Results: Impacts to Business & Economic Output

- The economic analysis showed that 21 business with 188 total employees would be directly impacted by 3.9 feet of sea level rise. Under 6.1 feet of sea level rise, those numbers increase to 30 businesses and 259 employees, representing 3.2% of the total employment in York.
- 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 Associated with 6.1 feet of SLR: York



Summary Notes

Results: Industry Impacts

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

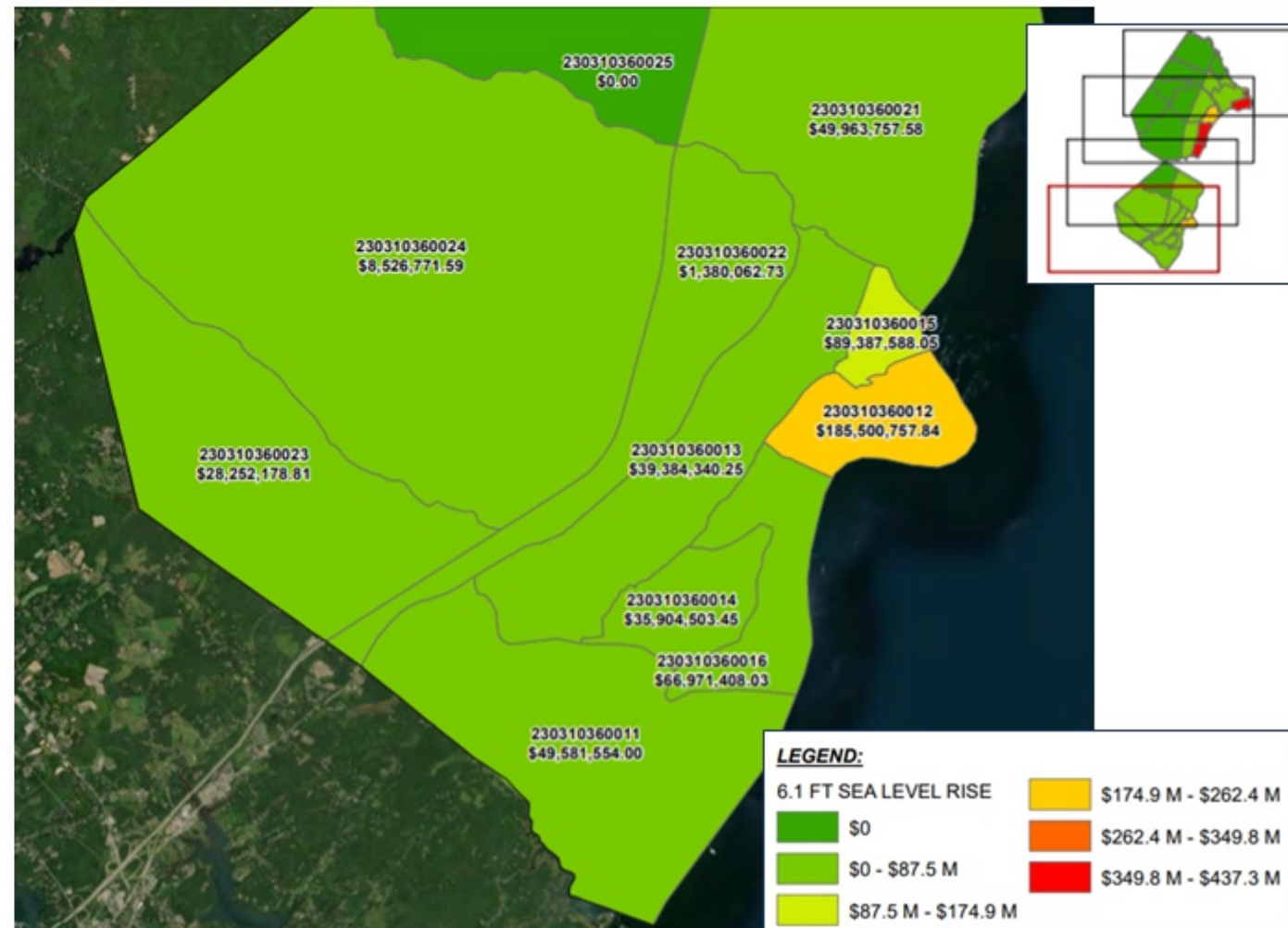
RESULTS: HOUSING OCCUPANCY

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

- York, 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 and the map shows the Census block groups and the total assessed value impacted within each block group.

- Looking at the table and map, we can see that 82% of residences are unoccupied in the Census block group ('0360012') that has the largest amount of assessed property value impacted by 6.1 feet of sea level rise in the town, as shown in yellow in the map.



Q: Is there information available on impacts to inland drinking water sources from increased underground penetration of salt water?

Abbie: NH has done quite a bit on this issue. Not something I'm aware of that southern Maine has looked at, it's on the radar as information that is needed for planning purposes, but hasn't been pursued yet. Need to ID the impacts from saltwater intrusion on groundwater and also on impacts on infrastructure. Sea level rise essentially forces groundwater up which damages infrastructure from below.

Participant follow up: related issue would be septic system flooding with rising groundwater, obviously has a financial cost and public health impact and just wondering if GIS analysis component could talk about which parcels could be impacted or not on public water or waste water services, I know you highlighted the number of parcels or areas where wastewater and drinking water might be impacted but maybe you could articulate the number of parcels on septic and ground water wells to give a sense of potential number of areas that could be impacted, thinking mostly upper part of York River is all well water and septic systems. Being able to highlight the number of parcels that could be impacted, tells part of the story.

Abbie: GIS analysis did ID parcels on septic that were going to be impacted by the inundation scenarios, that table that was shown at the end with the list of assets had a line item for septic but doesn't include a detailed analysis of the exact location of the septic systems and under what flooding scenarios they would be impacted.

Team notes: Read the 2018 NH Coastal Adaptation Workgroup's workshop summary: [As Sea Level Rises Groundwater Does Too](#)

Q: Thoughts on using this information for future program planning for the Planning Department?

Town Staff: Definitely a lot of information to take in, even as someone part of the group, look at this information as a stepping stone for further evaluation, provides a lot of important start off information for looking at various ways and adaptation strategies for coping with these sea level rise projections. Comes at an opportune time for the town of York, creating a climate action plan, as well as updating our comprehensive plan. Right now, and see in our contract, look at this information and incorporate it into these large planning documents. Provides great opportunity to open the conversation about land use and future of growth areas of our town. Do we want to start pushing growth areas and density into some of these highly vulnerable areas, looking into these projections. And if we are going to allow density in these vulnerable areas what kind of adaptation strategies should we implement as part of the design of these structures and some of these uses that may be permitted in some of these areas? Again, a stepping stone for greater review looking at potential engineered aspects. Planning board is looking at rezoning the green enterprise overlay district, if you saw the maps, that area around York's Wild Kingdom, that area is touched by SLR, especially at the 3.9 level (and 6.1). Adds for greater review moving forward. Appreciate having this information.

Q: Is there a need for consistency among the coastal towns in York County regarding things like freeboard requirements?

Abbie: Because of Maine's home rule status, municipalities can adopt and enforce their own land use regulations as long as they meet the minimum requirements established by the state. Freeboard does not need to be consistent across towns, each town can have its own freeboard requirement as long as it is no less stringent than the state required minimum of 1 foot above the base flood elevation (BFE) of the 100-year storm event, which is shown on FEMA flood maps. For example, the City of Saco has a 3-foot freeboard requirement above the BFE, which gives buffer room between the 100 year storm event, which is what the freeboard floodplain management is based on, and future SLR. Towns can adopt their own provisions and regulations for land use they don't have to be consistent with other towns.

Q: How does the work done on long sands by the town support this issue?

Team Notes: Assuming the question is asking about the sea wall work that began in 2018. The work replaced an existing sea wall and means to curb wave impacts to beach erosion.

Q: Was FEMA involved and is the information you've gathered going to influence the P-FIRM maps?

Team Notes: No and No. (FEMA's mapping is based on historic trends.)

Q:-Besides incorporating this in the Comp Plan, can parts be incorporated in the Shoreland zoning section of the Town's Land Use Ordinance?

Team Notes: A major part of the project is the development of various adaptation, mitigation, and resilience strategies the towns can use to address coastal flood hazards. Strategies include policy options, land use considerations, mitigation projects, and funding opportunities. A spreadsheet of strategies, including specific land use and ordinance strategies, will be included in the final project report. Some examples of land use ordinances identified for inclusion of coastal resilience considerations are shoreland zoning, floodplain management, and general zoning.

Q: Can a dual SLR and Stormwater tax be proposed to fund projects to mitigate flooding and increased impervious coverage?

Team Notes: The example strategy spreadsheet noted above includes funding strategies (impact fees, bonding, TIF, etc.) to support municipal-level coastal adaptation and mitigation work. While there are definitely ways to generate municipal funds to support flood mitigation/adaptation work, I don't know if a dual SLR and stormwater tax/fee would meet requirements of a tax/fee program in terms of structure, administration, etc., but definitely something to investigate further.

Participant Comments

- Not sure what the storm surge was in the Mother's Day storm but seas were 30 feet at the buoy off Boon Island for three days

Team Notes: The Mother's Day storm of 2006 was primarily a rainfall event, up to 16 inches fell in areas along the York County coastline. The Patriots' Day storm of 2007 had a recorded storm surge of 2.5 feet, which is greater storm surge than the Mother's Day event.

- Just a recommendation as you make the charts public — add the years to the sea level rise charts



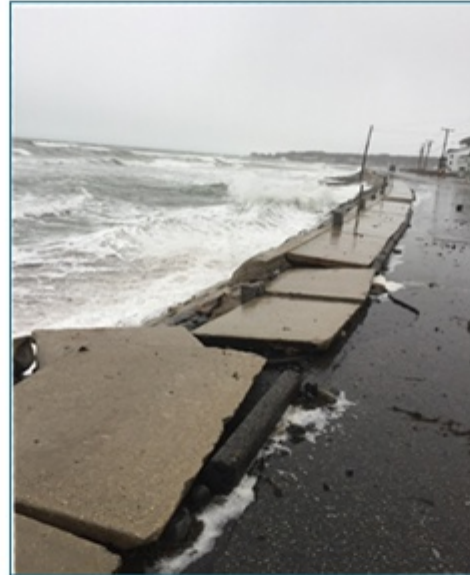
COASTAL RESILIENCE STRATEGIES

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?

- **\$1 in mitigation saves \$6**
- 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
 - 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				
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		Sea Level Rise, Precipitation and Stormwater, Storm Surge						

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	Land Use	Mitigation Projects	Funding
<ul style="list-style-type: none"> ✓ Consider sea level rise impacts in municipal expenditures ✓ Incorporate resilience criteria in CIP ✓ Address sea level rise in the Comprehensive Plan update and CAP 	<ul style="list-style-type: none"> ✓ Freeboard for structures through floodplain management ordinance; include sea level rise areas ✓ Coastal resilience overlay zoning district ✓ Include sea level rise impact areas in shoreland zone 	<ul style="list-style-type: none"> ✓ Strategically conserve floodable open space ✓ Improve stormwater management infrastructure ✓ Retrofit impacted structures using floodproofing measures 	<ul style="list-style-type: none"> ✓ Pursue external grant opportunities ✓ Establish a municipal resilience fund ✓ Establish an 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 York might want to consider. These strategies were identified based on conversations with town staff as well as the results of the project's assessment.

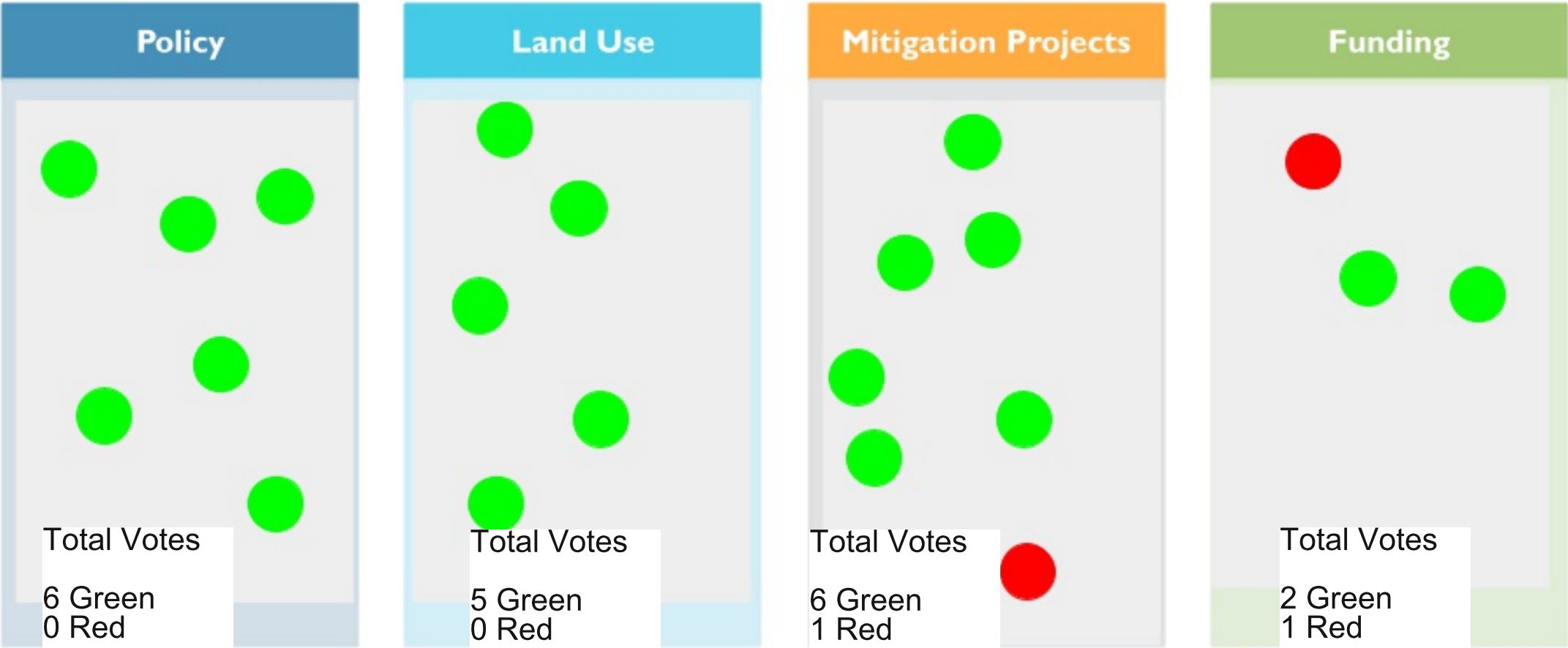


ENGAGEMENT ACTIVITY: RESILIENCE STRATEGIES

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 York should focus its work. A red dot could be placed if they felt a strategy should not be a focus for York. Using all dots was optional.

Directions: Each participants gets 2 green dots and 1 red dot. Place green dots in strategy categories where York should focus its work. Place a red dot if a strategy should not be a focus for York. 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

- Should align with comp plan and CAP (3 mentions)
- Standards for structures in flood zones/sea level rise impacted zones
- Building code matches future flooding considerations
- Consider sea rise impacts in capital improvement plan
- Revolving loan program to support buy, rent, or retreat (California is doing now)
- Combined SLR and stormwater tax to fund mitigation projects
- Incorporate clear and concise policy for building, land use, etc.
- The water needs to go somewhere, what does the community majority think about where it should go?

Land Use

- Coastal resilience overlay district! (2 mentions)
- Land use approaches should flow from Comp Plan recommendations
- Maintain open space areas in order to limit damages to structures & enhance environmental resilience
- Look at restrictions for building and renovation
- Protect marsh migration areas through zoning/land use ordinances
- Design sidewalks to withstand storm surge
- Need to have flood channels in place
- Protecting and enhancing existing wetlands
- Incorporate findings in the Shoreland zoning section of the Town's Land Use Ordinance
- Educating people and builders so they understand what they can do to help
- Look at well water as many neighborhoods are turning over from seasonal to year round

Mitigation Projects

- All mitigation engineering projects at the beach should be mindful of the impacts to the quality of the surf breaks, which are natural and economic resources of the Town. Community engagement necessary.
- Review what needs mitigation
- Bring public onboard to understand and support
- Of importance in knowing what needs to be done
- Suggest creation of an inventory of specific adaptation measures to be taken under each of the three scenarios. Prioritize them. Apply some sense of likelihood to each list
- Will dredging the river and/or widening width and depth make a difference?
- Can the beach be expanded/moved inland incrementally over time

Funding

- Need to seek grant money for future studies
- Emphasis should be placed on funding to be sure monies are put aside perhaps each year "rainy day fund" for this or grant establishment for this
- Pursue grants for SLR projects

Other

- Understand beach erosion
- Need to educate the public in layman's term so it's easily understood

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

- Current business owners in the flood areas
- All residents in flood areas
- Engage the youth/schools
- All residents needs to be involved-questionnaire on their understanding of sea level rise
- Ideas on how to address this
- Highlight climate change impacts and societal costs in annual voter guide
- All business owner-How does all of this impact them
- Encourage citizens to participate in the Climate Action Plan and Comprehensive Plan to expand discussion of these issues.
- Include info in yearly mailing to flood prone properties
- Community workshops
- Monthly newspaper articles regarding climate change/sea level rise
- Consider doing community workshops by neighborhood so you can get very specific -- do them in the summer to get the seasonal people
- Engage builders and developers on strategies for buildings to tolerate higher water levels.
- The town should provide an annual assessment of likely financial risk over time due to sea level rise.
 - A kind of “financial exposure” disclosure.
- Include an interactive map accessible from the town webpage that illustrates the current estimates
- Do a separate workshop for store, inns, and restaurant owners
- Include estimates and years out to 3.9 sea rise. Be careful of over emphasizing 6.1 and that is going to seem too far out for a lot of people
- Be specific on town resources impacted -- example: York Beach Fire House and does it get flooded if nothing is done.

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 York 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 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: York](#)

[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

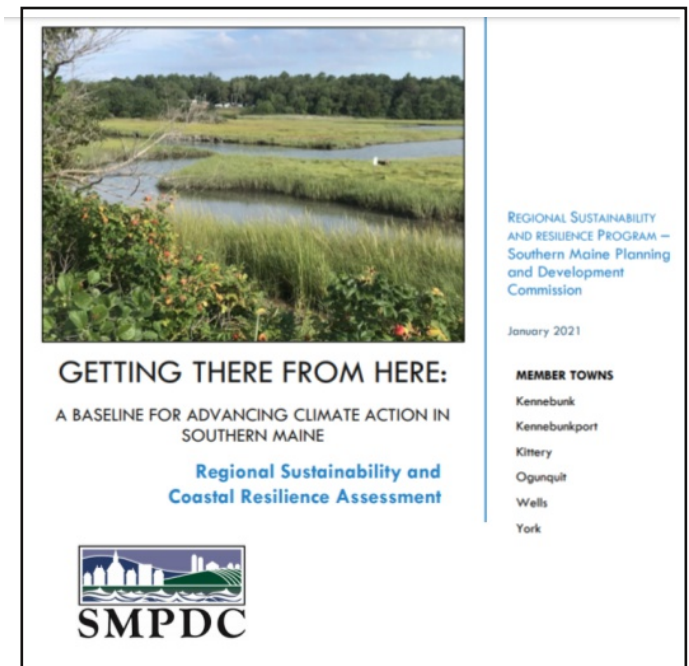
Regional Resilience and Sustainability Program
Kennebunk is one of six southern Maine communities in the Regional Resilience and Sustainability Program to help the towns address climate change impacts and advance sustainability and resilience efforts. Projects include municipal solar contracts to reduce 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 Kennebunkport, Kennebunk, Wells, Ogunquit, York, and Kittery



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](#)

