



NJ FRAMES: New Jersey FOSTERING REGIONAL ADAPTATION THROUGH MUNICIPAL ECONOMIC SCENARIOS

Two Rivers, One Future



Regional Resilience Adaptation Action Plan
December 2019



Acknowledgement

This work was made possible with financial assistance from the Coastal Zone Management Act of 1972, as amended, as administered by the Office of Coastal Management, National Oceanic and Atmospheric Administration's (NOAA's) Program through the New Jersey Department of Environmental Protection, Coastal Management Program, Bureau of Climate Resilience Planning.

NJ FRAMES is funded through the National Oceanic and Atmospheric Administration (NOAA) Regional Coastal Resilience Grant issued to the New Jersey Department of Environmental Protection (NJDEP) Coastal Management Program.

Disclaimer

These environmental data and related items of information have not been formally disseminated by NOAA and do not represent and should not be construed to represent any agency determination, view, or policy.

Planning Team

The No Action Risk Assessment Report and its attachments are the product of a collaborative effort between members of the New Jersey Fostering Regional Adaptation through Municipal Economic Scenarios planning team, including NOAA, the New Jersey Department of Environmental Protection; the Jacques Cousteau National Estuarine Research Reserve; Louis Berger, A WSP Company; Binera Inc.; the Rutgers Climate Institute; and a representative from the Borough of Oceanport who provided guidance in the development of the report.

The Regional Action Plan and its attachments and appendices are the product of a collaboration among members of the NJ FRAMES planning team, including the Coastal Management Program; Louis Berger, A WSP Company; Perkins Eastman; Binera Inc.; Rutgers Climate Institute; the Jacques Cousteau National Estuarine Research Reserve; and a representative from the Borough of Oceanport who provided guidance in the development of the report.

Table of Contents

Executive Summary	5
1.0. Introduction	
1.1. Background of Region	9
1.2. What's at Risk?	11
1.2.1. Planning Scenarios	17
1.3. Four primary asset categories	19
1.3.1. Primary Challenges - Bayshore Waterfront	20
1.3.2. Primary Challenges - Shrewsbury River	22
1.3.3. Primary Challenges - Sea Bright / Monmouth Beach	24
1.3.4. Primary Challenges - Downtown Highlands	26
1.4. Moving Toward Regional Strategies	28
2.0. Six Strategies for Regional Resilience in the Two Rivers Region	
2.1. Introduction	29
2.2. The six strategies	29
1 New Coastal Protection Infrastructure Strategy	31
2 Protect Critical Facilities Strategy	39
3 Harden and Plan for the Future of Water-Dependent Assets Strategy	43
4 Neighborhood-level Adaptation Measures Strategy	49
5 Long-term Vision and Master Planning for Permanent Inundation Strategy	53
6 Strategy for the Development of the Monmouth County Coastal Resilience Committee	59
2.3. The Conceptual Scenario	63
2.4. Conceptual Adaptation Scenario	69
2.4.1. Bayshore Waterfront	70
2.4.2. Downtown Highland	72
2.4.3. Shrewsbury River, Sea Bright / Monmouth Beach	74
3.0. CONCLUSION	



Executive Summary

The Two Rivers Regional Resilience Adaptation Action Plan (Regional Action Plan) is the result of a 3-year risk assessment, outreach, and scenario planning process for the New Jersey Fostering Regional Adaptation through Municipal Economic Scenarios project. The project is based in the Two Rivers region of Monmouth County, New Jersey, and comprises 15 communities along the Shrewsbury and Navesink Rivers, as well as communities on the Sandy Hook Bayshore and Atlantic Ocean coastline. The project is funded by the National Oceanic and Atmospheric Administration (NOAA) Regional Resilience Grant Program, and its approach and key principles are based on the framework laid out in NOAA's *'What Will Adaptation Cost? An Economic Framework for Coastal Community Infrastructure.'*

As one of the final products of the project, this Regional Action Plan presents six strategies for achieving regional resilience, as well as one potential path for implementation of the strategies, called the conceptual scenario. The Regional Action Plan is intended to serve as a guiding document for the communities located in the Two Rivers

region to inform their planning and future development efforts.

The regional planning strategies listed below have been developed in response to a comprehensive risk analysis that considered the impacts of coastal storms and sea-level rise on the region, responds to the regional risk of total water levels (accumulation of floodwater above the mean higher high-water mark) and permanent inundation due to sea-level rise, and reflect the environmental, social, and economic principles that are the basis of the regional resilience goals, (Appendix A) set forth in the project.

- New Coastal Protection Infrastructure
- Protect Critical Facilities
- Harden and Plan for Future of Water-Dependent Assets
- Neighborhood-level Adaptation Measures
- Long-term Vision and Master Planning for Permanent Inundation
- The Monmouth County Coastal Resilience Committee

The strategies have been iteratively updated based on extensive outreach with the public, stakeholders, steering committee members, and technical and constituent advisors who served on the project advisory committees. While many of these strategies can be championed and integrated individually into the planning and development of the region, together these strategies provide a viable, approach to mitigate risk of loss from storm surge and permanent inundation.

The first strategy suggests a wide range of ecological (green) and structural solutions that can be applied across the region to protect from the flooding impacts caused from storm surge, and permanent inundation caused from sea-level rise. The second strategy focuses on critical facilities, promoting approaches to protect, adapt, and relocate important assets that are at risk. The third strategy creates a plan for the future of water-dependent assets that are economically and culturally important for the region.

The fourth strategy proposes measures that adapt current infrastructure and development to provide near- and-long term protection, while the fifth strategy provides

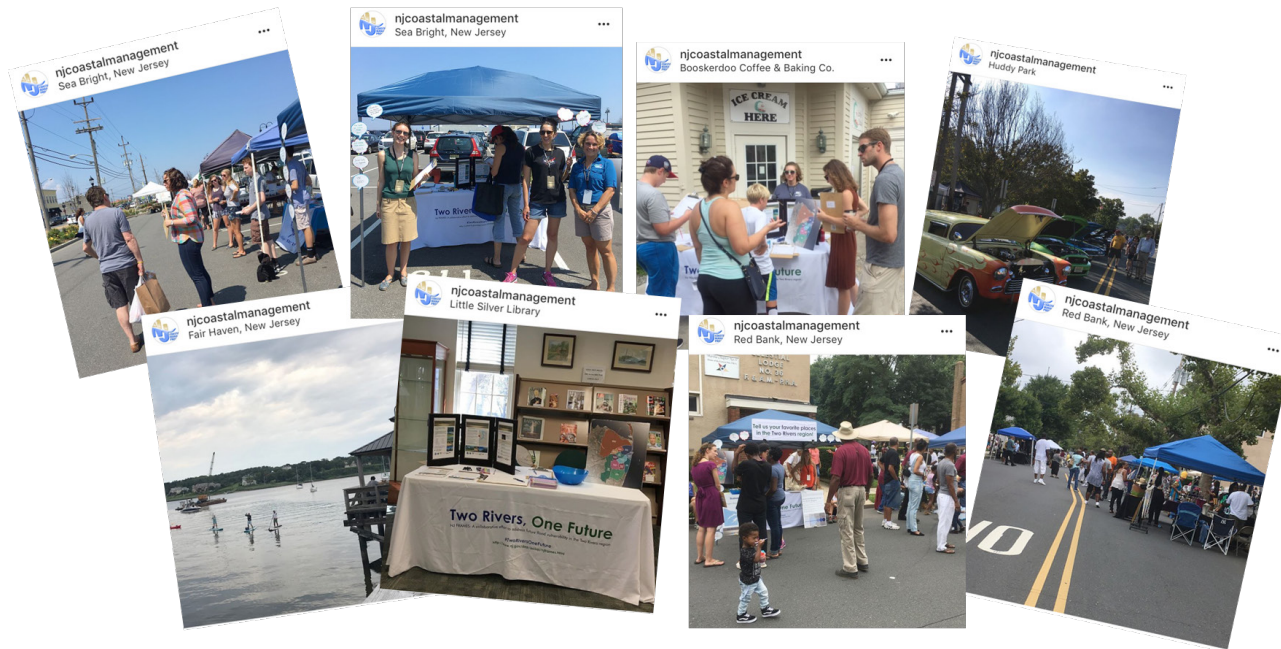
a long-term vision and master planning approach to promote a sustainable region and develop land use opportunities in light of permanent inundation. Finally, the sixth strategy proposes to initiate a regional planning forum, the Monmouth County Coastal Resilience Committee, to focus on regional approaches to resilience, including the promotion of strategies presented in this Regional Action Plan.

The Regional Action Plan is designed to guide current and future planning and development and does not provide a singular approach to reducing the risk of flooding to the region. To help visualize how these strategies might direct future projects and policies, the planning team created a conceptual scenario that applies the strategies to future planning years. The conceptual scenario has been developed based on stakeholder feedback and is just one future pathway of many that the strategies can help guide.

This Regional Action Plan is organized as follows:

- Section 1 provides an introduction and background information, including an overview of the region and a description of what is at risk.

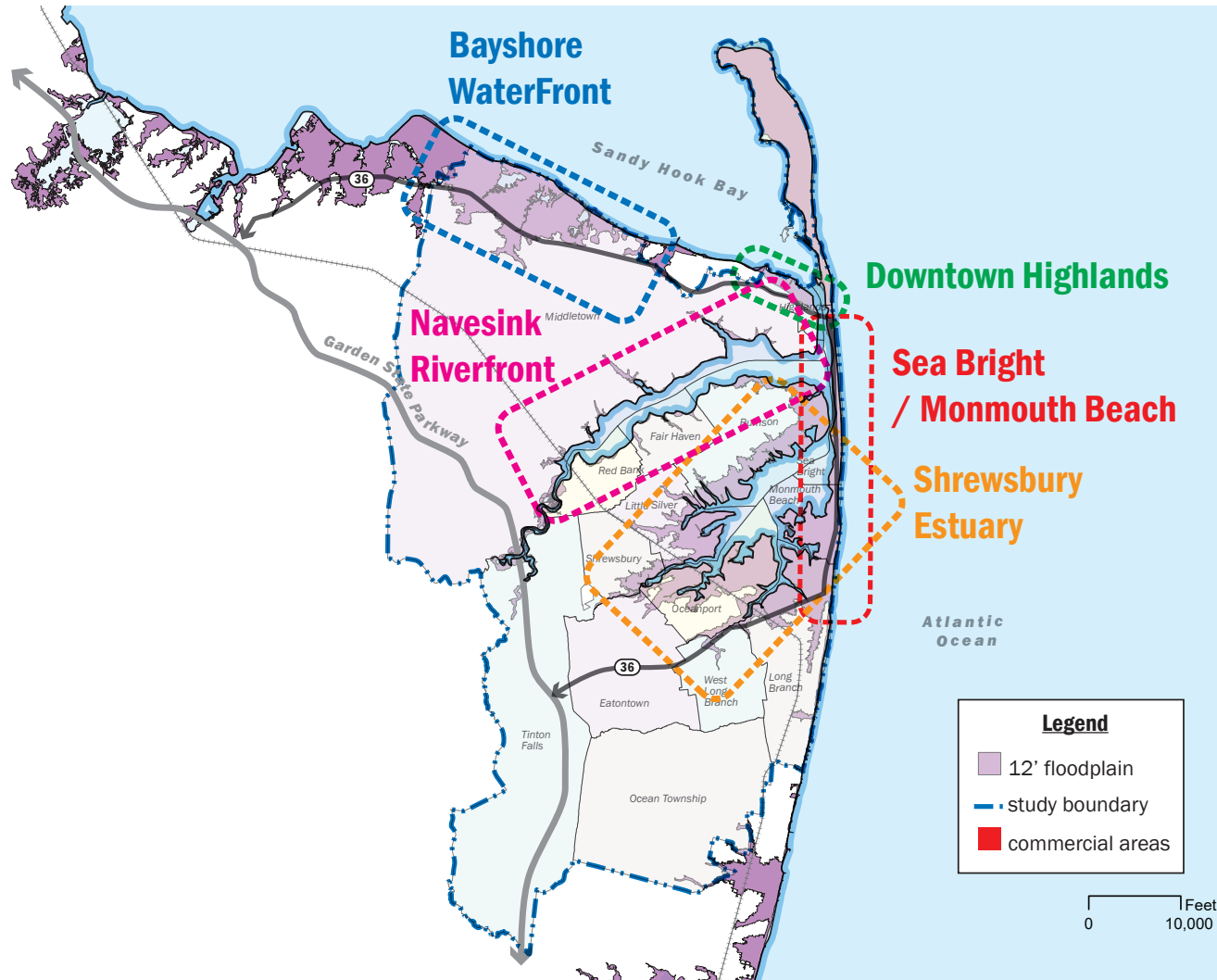
- Section 2 describes the six strategies and highlights the many pathways in which they can provide increase resilience in the Two Rivers region. It also includes a section outlining the conceptual scenario, in which one potential application of the strategies is described for the three future planning years, accompanied by conceptual graphics. Renderings for the conceptual scenario are shown in Appendix B.
- Section 3 concludes the Regional Action Plan with a detailed matrix of next steps for the region and its leaders, including starting steps to guide the development of the Monmouth County Coastal Resilience Committee.



Community Events, August - September 2017

1.0. Introduction

As part of the New Jersey Fostering Regional Adaptation through Municipal Economic Scenarios (NJ FRAMES) project, this Two Rivers Regional Resilience Adaptation Action Plan (Regional Action Plan) is intended to provide a coordinated approach to the future risk of coastal and tidal flooding and permanent inundation. The Regional Action Plan presents six strategies for regional resilience, coordinated as a regional plan that applies to 15 municipalities in the project area. The plan is the culmination of three years of dedicated focus, including a comprehensive review of assets, development of resilience goals, a baseline and future risk assessment, and a scenario-based planning study.



Leonardo community in Bayshore area



View of Sandy Hook Bay



View of Sea Bright from Atlantic Ocean towards Navesink River



Monmouth Beach residential area with private docks

1.1. Background of Region

The NJ FRAMES project area, called the Two Rivers region, consists of 15 municipalities across the Sandy Hook Bayshore (Bayshore), Navesink River, and Shrewsbury River in coastal Monmouth County, New Jersey. The project area (shown in **“Figure 1. Two Rivers Region”**) consists of 109 square miles of land, with a population of more than 215,000 permanent residents and includes many waterfront communities that are susceptible to coastal flood events and flooding from sea-level rise. Hurricane Sandy caused major damage in most municipalities in the project area, and perennial small flood events affect several vulnerable neighborhoods.

The region is culturally and economically connected to the water through its beaches, marinas, waterfront shops, and open spaces. Connection to the water is essential to the character of the Two Rivers region. The region contains several entities and assets that provide connection between its 15 municipalities and to areas outside the region, including:

- Multiple beaches and recreational areas, including Sandy Hook
- Two major hospitals
- Two major ferry terminals
- Five train stations
- Economically important state highways
- Regional water treatment and outfall facilities

List of Participating Municipalities in NJ FRAMES
(The Two Rivers Region)

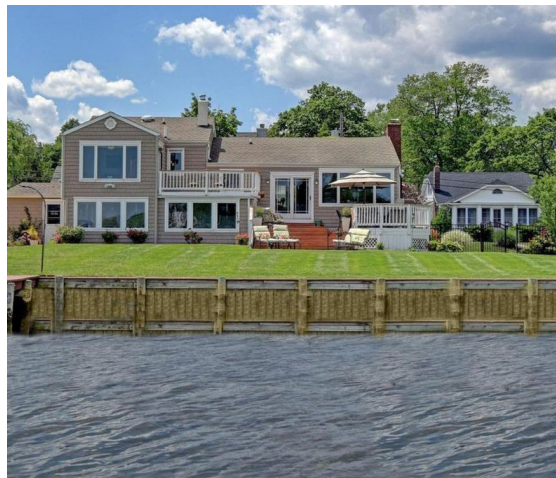
- Eatontown
- Fair Banks
- Highlands
- Little Silver
- Long Branch
- Middletown
- Monmouth Beach
- Ocean Township
- Oceanport
- Red Bank
- Rumson
- Sea Bright
- Shrewsbury
- Tinton Falls
- West Long Branch



Beach access in Leonardo community



Shore Drive commercial area



Riverfront residence in Oceanport



Sea Bright residential area in Warren Street



#mapwhatmatters Community Events, August - September 2017

1.2. What's at Risk?

To ensure that the NJ FRAMES project represents the regions' interests, advisory committees were established consisting of technical experts and stakeholders representing varied interests in the region. A separate steering committee served as a decision-making body and largely consists of municipal officials and select representatives from the advisory committee.

To understand what is at risk in the region, a comprehensive asset inventory campaign, marketed as #MapWhatMatters, gathered information with the assistance of advisory committee members and the public. This asset inventory included assets that traditionally are thought of as critical (e.g., evacuation routes, hospitals, police stations) but also highlighted assets that community members identified as important to the region. The planning team collected the data and digitized it into a web map for further spatial analysis. In addition, the planning team conducted interviews with local social service organizations to understand the needs of socially vulnerable populations who reside in the project area.

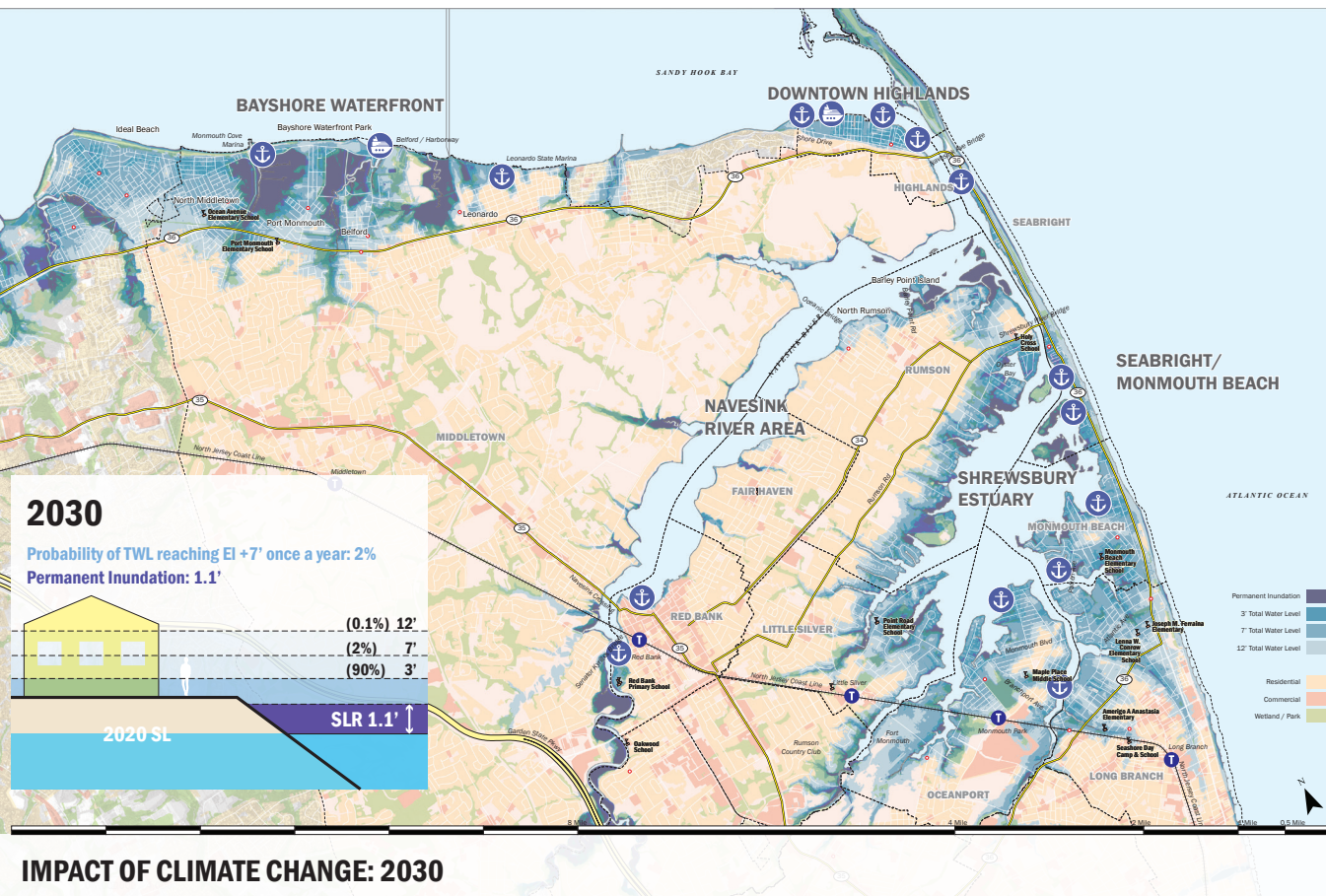


Figure 2. Flood Levels and Permanent Inundation: 2030

To guide the project and the development of the strategies outlined in this Regional Action Plan, the steering committee considered the vision, needs and desires of the region, and developed and agreed on regional goals (Appendix A). These goals represent environmental, social, and economic principles that are valued by the region.

The asset inventory was then used to develop the baseline risk assessment, which assesses the risk of the accumulation of floodwater above the Mean Higher High Water (MHHW) mark, which is referred to as total water levels, on the region's assets at 3 feet above MHHW, 7 feet above MHHW, and 12 feet above MHHW* Appendix C contains the full methodology for the background on total water levels, and Appendix D provides the methodology for the baseline risk assessment.

An important assumption made when analyzing risk is the future impacts the region would face if no actions were taken to address anticipated conditions and the risk associated with them. This Regional Action Plan and the analyses used to develop it assume that areas in the region will be permanently inundated, which assumes a higher base MHHW level of 1.1 feet by 2030, 2.0

* In this document, when referring to water levels above 3 feet, 7 feet, and 12 feet, the terms flood event and water levels are used interchangeably.

Total Water Level

The NJ FRAMES project team evaluated water levels of 3, 7, and 12 feet above Mean Higher High Water (MHHW) to assess the people, places, and assets that flooding might affect now and in the future. The project team projected water levels associated with future events by adding 3 future projections

of Regional Sea Level Rise (SLR) to NOAA's Annual Exceedance Probability (AEP) levels and historic storm tide records using the Sandy Hook, NJ tide gauge through 2100.

To arrive at these water levels, the project team

followed one of the recommended processes discussed by the STAP panel and supported by NOAA's "What Will Adaptation Cost" guide to coastal resilience planning. See more in Appendix C.

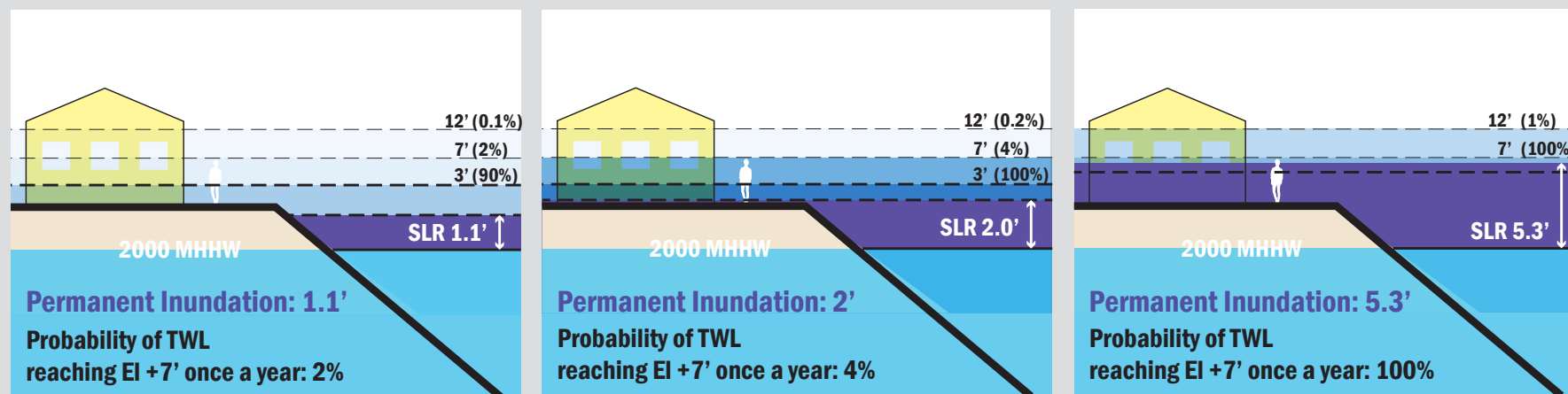


Figure 3. Total Water Level

feet in 2050 and 5.3 feet by 2100, with 2000 as the base year. For the purposes of visualizing risk, the Regional Action Plan notes that permanent inundation implies that during a high tide event, any land at these previously stated levels would be wet and therefore not viable for most daily functions. The permanent inundation projections not only accrue permanent loss but increase the frequency of reaching the three water levels of 3 feet, 7 feet, and 12 feet above MHHW. This in turn increases the risk of impact that will occur on an annual basis. Flood risk maps showing the

3-foot, 7-foot, and 12-foot water levels, as well as permanent inundation, are shown in the Figures below.

For this analysis, the planning team references water levels to the MHHW vertical datum to remain consistent with local and national exposure assessment tools (e.g., NOAA Sea Level Rise Viewer) for coastal flood hazard assessments. Different agencies and professionals may use different vertical datums when discussing the height of a given flood

event. The National Weather Service typically reports flood events as heights above Mean Lower Low Water in its forecasts and advisories. Construction code officials and engineering professionals often reference the North American Vertical Datum of 1988 (NAVD88) when designing to meet local base flood elevation and freeboard requirements. A comparison of vertical datums for the Sandy Hook tide gauge is available at NOAA website: <https://tidesandcurrents.noaa.gov/datums.html?datum=NAVD88&units=0&epoch=0&id=8531680&name=Sandy+Hook&state=NJ>

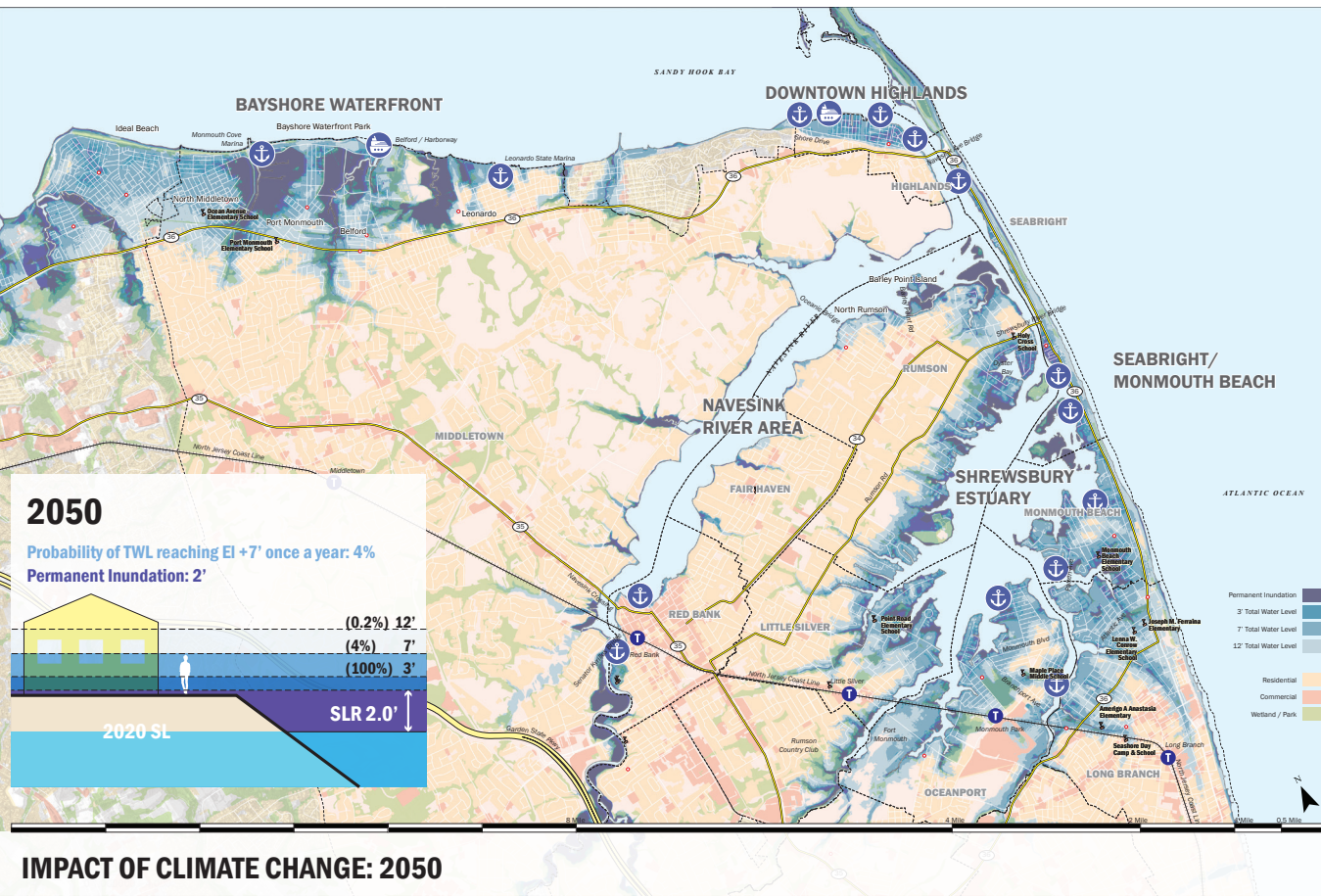


Figure 4. Flood Levels and Permanent Inundation: 2050

In general, the region has been subject to a significant flooding risk and permanent loss throughout the century. As the frequency in which the region experiences higher water levels increases, the cost of that risk quickly grows. **“Table 1. No Action Risk Assessment–Summary of Monetized Impacts”** shows this progression of risk and loss through time and notes how that risk is associated with the region experiencing more frequent events and increases in permanent inundation. Annualized risk is the cost that occurs from a storm event based on the likelihood that the event will occur in any given year and is represented by the equation frequency x total impacts. As sea-level rise increases in the later years of the project time period, the annual chance (the frequency) of a flood event occurring increases. As an example, in 2020 the impact of a 3-foot water level, or event that results in 3 feet of flooding, is about \$256 million. Because the chance of this event occurring in any given year is 72%, the annualized risk is 72% of the total impact, or \$184.6 million.

Table 1. No Action Risk Assessment–Summary of Monetized Impacts

Flood Event	Average Annual Frequency	Total Impacts (2017 U.S. Dollars [USD])	Annualized Risk (2017 USD)	Permanent Loss (Absolute Loss)
2020				
MHHW 3 feet	72%	\$256,350,519	\$184,572,374	N/A
MHHW 7 feet	1.5%	\$1,650,305,499	\$24,754,582	N/A
MHHW 12 feet	.10%	\$4,984,228,820	\$4,984,229	N/A
2030				
MHHW 3 feet	90%	\$144,036,395	\$129,632,755	\$232,121,024
MHHW 7 feet	2%	\$1,548,155,923	\$30,963,118	\$232,121,024
MHHW 12 feet	.10%	\$4,875,848,873	\$4,875,848	\$232,121,024
2050				
MHHW 3 feet	100%	\$80,240,583	\$80,240,583	\$458,048,822
MHHW 7 feet	4%	\$1,516,538,989	\$60,661,560	\$458,048,822
MHHW 12 feet	.20%	\$4,812,846,944	\$9,625,694	\$458,048,822
2100				
MHHW 3 feet*	100%	\$0	\$0	\$886,114,195
MHHW 7 feet	100%	\$683,415,441	\$683,415,441	\$2,597,858,119
MHHW 12 feet	1%	\$4,133,838,642	\$41,338,386	\$2,597,858,119

* The MHHW 3 feet is calculated from the summation of damage to 3 feet of permanently inundated assets.

In 2020, the highest annualized flood risk occurs from a 3-foot water level. In 2030 and 2050, a 3-foot flood event still presents the highest annualized risk for each year, mostly because of the high frequency of occurrence. However, as permanent inundation increases, some of the assets currently at risk become a permanent loss because they are permanently flooded. This in part accounts for why annualized risk of a 3-foot flood event goes down in 2030 and 2050, as much of this risk is captured as permanent loss. By 2050, the annualized risk of a 7-foot occurrence becomes a major risk as much of the 3-foot risk transitions to permanent inundation and the frequency of higher water levels rises. By 2100, risk from a 7-foot event is highest and there is no annualized risk from a 3-foot water level because permanent inundation is 5.3-feet and the risk is fully captured in permanent loss.

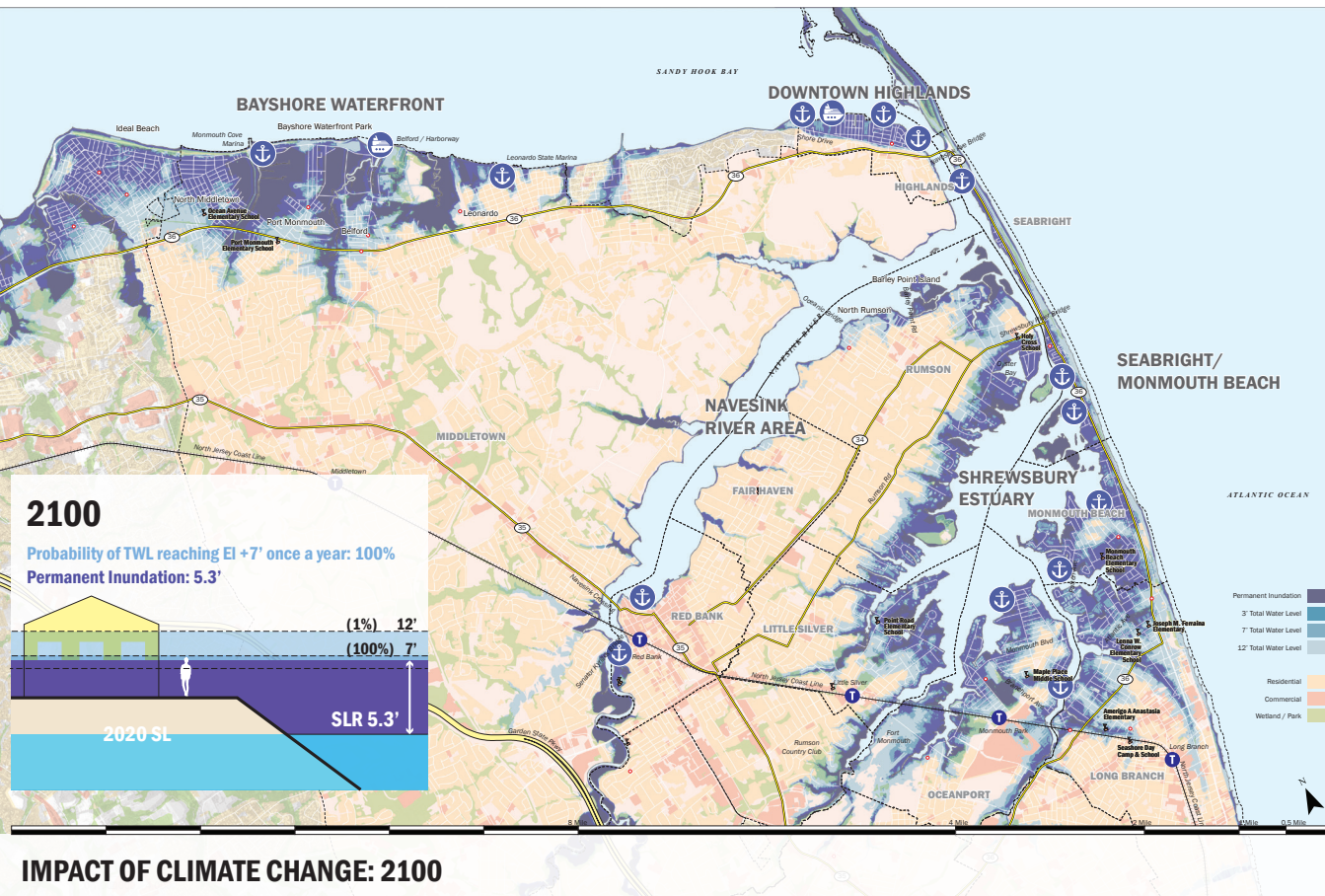


Figure 5. Flood Levels and Permanent Inundation: 2100

The risk assessment also reviewed non-monetized impacts on roads, parks, beaches, publicly identified assets, and other facilities to comprehensively gauge the extent of coastal risk, guided by the resilience goals (Appendix A), which informed the type of assets and risk that should be considered. Non-monetized impacts are the degree to which (severity to which) assets and resources are affected across the region. The full results are provided in Appendix E.



Sea Bright after Hurricane Sandy, November 2012

1.2.1. Planning Scenarios

Based on the output of the risk assessment, the planning team undertook a scenario-based planning exercise to determine actions that could mitigate, avoid, or adapt to the impacts that permanent inundation and increased flooding would have on the region. Three scenarios were developed that address the region's risk by implementing a group of mitigation and adaptation strategies designed to help the region adapt to future conditions. The scenarios address risk at the specific time periods of 2030, 2050, and 2100 and included planning actions, specific projects, or larger regional initiatives that would either allow the region and its communities to live with water, protect them from the water, or help them transition to a new use and vision for the land and waterways as areas are permanently inundated. The strategies could provide benefits on their own or could work together and be combined for additional benefits.

The three scenarios developed are the following:

- Living with the Water
- Protecting Communities from the Water
- Moving Away from the Water

The planning team developed the three planning scenarios based on specific areas of risk in the region and feedback from the advisory and steering committees. The planning scenarios were presented to the advisory and steering committee in a webinar and to the community at a public open house with the intent of gathering feedback from participating stakeholders to use to identify which strategies would provide the most benefit across the region and were also actions the region could support. The planning team heard support and criticism for the various strategies and the three scenarios as a whole, but several main take-a-way messages reoccurred. Overall, there was strong support for nature-based approaches; however, participants also expressed concern that these approaches might not work everywhere and should be combined with other structural approaches where necessary. The planning team also heard that large, structural projects and their implementation need to be well studied and should not restrict current access to water. Additionally, the planning team heard significant feedback that strategies that aim to transition land and waterfront use away from at risk areas should be structured to allow municipalities and residents to make these decisions when most appropriate for them.

The feedback gathered was used to refine which strategies would be included in the Regional Action Plan as discussed in **“2.0. Six Strategies for Regional Resilience in the Two Rivers Region”** From the feedback it was clear that strategies should include the following:

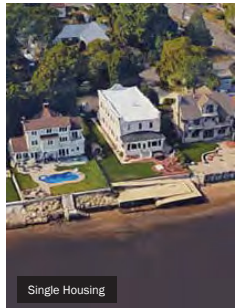
- Strategies are recommended approaches that the region should consider and are not a singular way to address coastal risk.
- Strategies should be tied directly to other planning processes, especially in the near- and middle-term (through 2050) when long-range regional planning would be occurring.
- Strategies should have multi-jurisdictional applications and region-wide benefits.
- Strategies should consider the specific unintended consequences that their implementation might cause.
- Strategies should not prescribe specific approaches to implementation and should be developed in a way that allows for variation, especially in the implementation of long-term approaches.

Through active, multi-stage engagement with the steering committee, advisory committees, and the public, the planning team selected strategies from each of the three planning scenarios. Final feedback on these strategies was collected from the steering committee before development of Regional Action Plan. The planning team recognizes the need for an open, collaborative approach to developing strategies and relied on the feedback received to guide the development of the Regional Action Plan as presented in Section 2. While the planning team was not able to meet individually with every committee member, and not all of the region’s municipalities participated to the same degree, continual efforts were made to make the Regional Action Plan the result of continuous engagement and collaboration with municipal leaders and engaged stakeholders in the Two Rivers region.

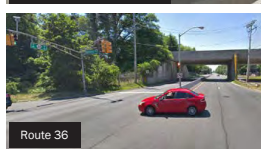


Regional economic drivers such as marinas and commercial corridor along Route 36

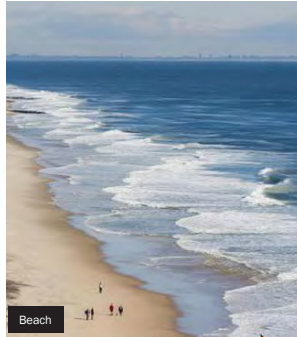
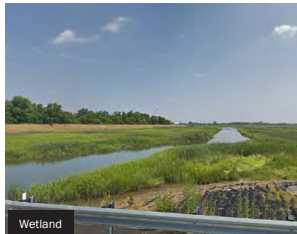
1.3. Four primary asset categories



Housing



Infrastructure



Natural Resources

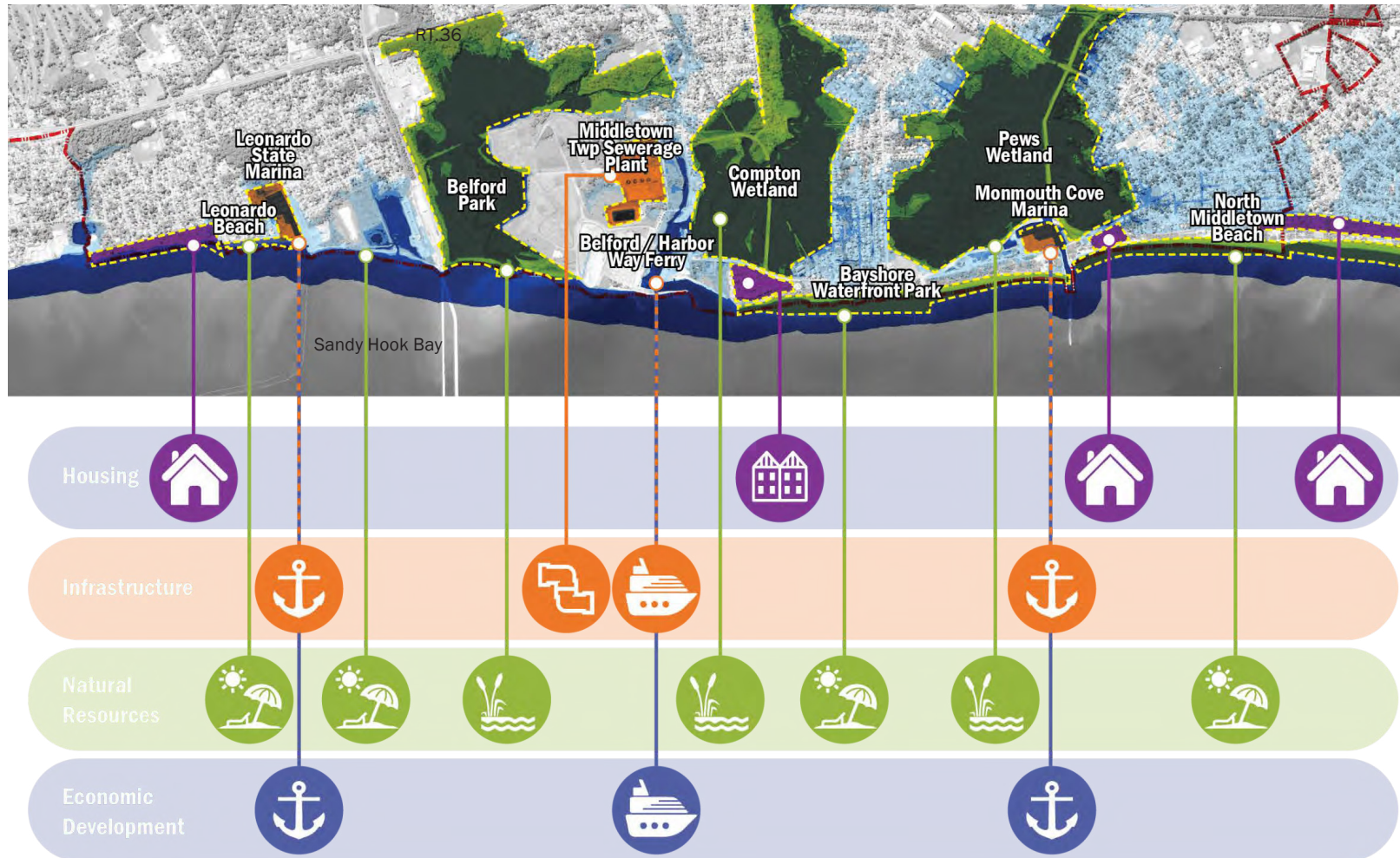


Economic Development

Looking at each of the At-Risk Areas individually enables the team to establish priorities and identify potential actions by the NJ FRAMES Team. Shoreline conditions within each of the study areas are comprised of a combination of private and public land, and varying types of conditions along the water's edge. The identified actions addresses the varied combinations of these conditions employing regulatory, policy, infrastructure upgrades, and natural resources management.

From the team's review of stakeholders input, the team identified four principle assets to be protected within the Two Rivers Area: housing, infrastructure, economic development resources, and natural resources.

1.3.1. Primary Challenges - Bayshore Waterfront



HOUSING	INFRASTRUCTURE	NATURAL RESOURCES	ECONOMIC DEVELOPMENT
Inundation of houses adjacent to wetlands or on waterfront	- Protection of Marinas and Ferry Terminals - Inundation of Middletown Sewerage Authority - Inundation of Route 36	- Eroding beaches - Impacted wetlands	Protection of Marinas and Ferry Terminals

The Bayshore Waterfront is composed of four waterfront communities within Middletown Township: North Middletown, Port Monmouth, Belford, and Leonardo. The shoreline is defined by a combination of private and public land, hard infrastructure, and natural edges like wetlands and beaches. The typologies to be studied includes private houses, beaches, marinas, wetlands, and ferry terminals.

There has been a number of studies and projects led by the US Army Corps of Engineers consisting of sand placement, dune crossovers, and terminal groins. This linear protection system has three major gaps: Ware Creek wetland, Shoal Harbor Condominium, and private residences facing Ideal Beach.

Characteristics

- Low-lying coastal plain
- Landscape: salt marshes, maritime shrub lands, tidal creeks, dunes, public beaches
- Land Use: single family homes, and low density condos, marinas
- Waterfront largely made up of public beaches, with some privately-owned sections with bulkheads



Compton Wetland

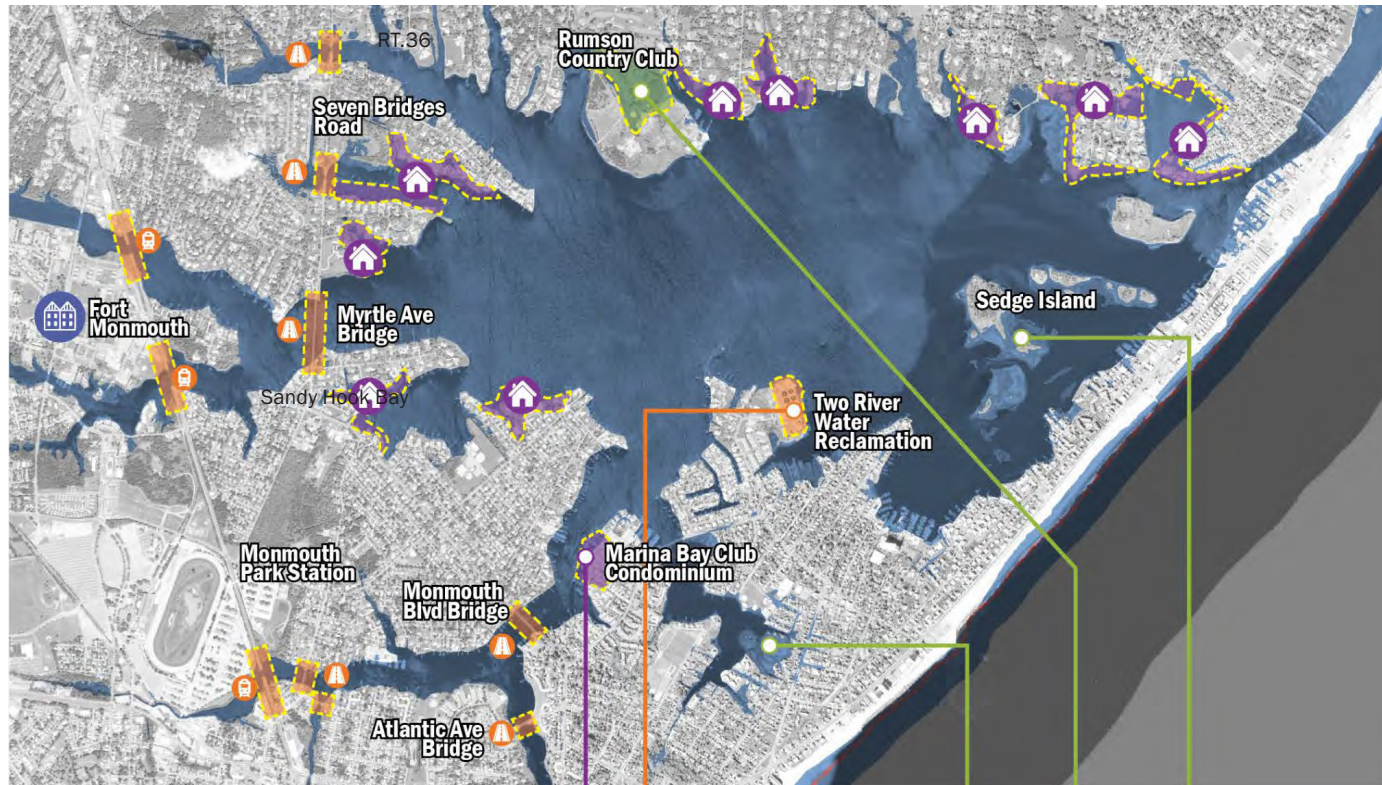


Port Monmouth Beach



Monmouth Cove Marina

1.3.2. Primary Challenges - Shrewsbury River



Housing



Natural Resources



Infrastructure



Economic Development



HOUSING	INFRASTRUCTURE	NATURAL RESOURCES	ECONOMIC DEVELOPMENT
Privately-owned single family houses dominate the shoreline	- Roads connecting to evacuation routes will be partially inundated in a 3' flood event - Vulnerability of railroad tracks at Parkers Creek and Oceanport Creek crossings	- Eroding wetlands - Exposed green edges	Fort Monmouth and Monmouth Park Racetrack are important economic developments



Shrewsbury River Yacht Club, Fair Haven

The Shrewsbury River is surrounded by the boroughs of Rumson, Little Silver, Shrewsbury, and Oceanport. It is a primarily residential area with important assets such as Fort Monmouth and Monmouth Park Racetrack. Fort Monmouth is the most significant economic development asset in this area. It is envisioned to become a hub of economic and community activity. The facilities will include the McAfee Complex, and a 50-acre innovation campus. Fort Monmouth represents a significant opportunity for a resiliency project. Wetlands in the area have been impacted by single family house developments, weakening the natural ecosystem and its

capacity to protect the shoreline.

The Two River Water Reclamation Authority is an important sanitary asset that serves the communities of Eatontown, Fair Haven, Little Silver, Monmouth Beach, Oceanport, Red Bank, Rumson, Tinton Falls, and West Long Branch. This facility needs to be protected from inundation. There are exceptions to the predominantly single family developments in this area. The presence of multi-family developments, located on Long Branch Borough on Pattern Avenue, could represent an opportunity where residents can organize to create and implement

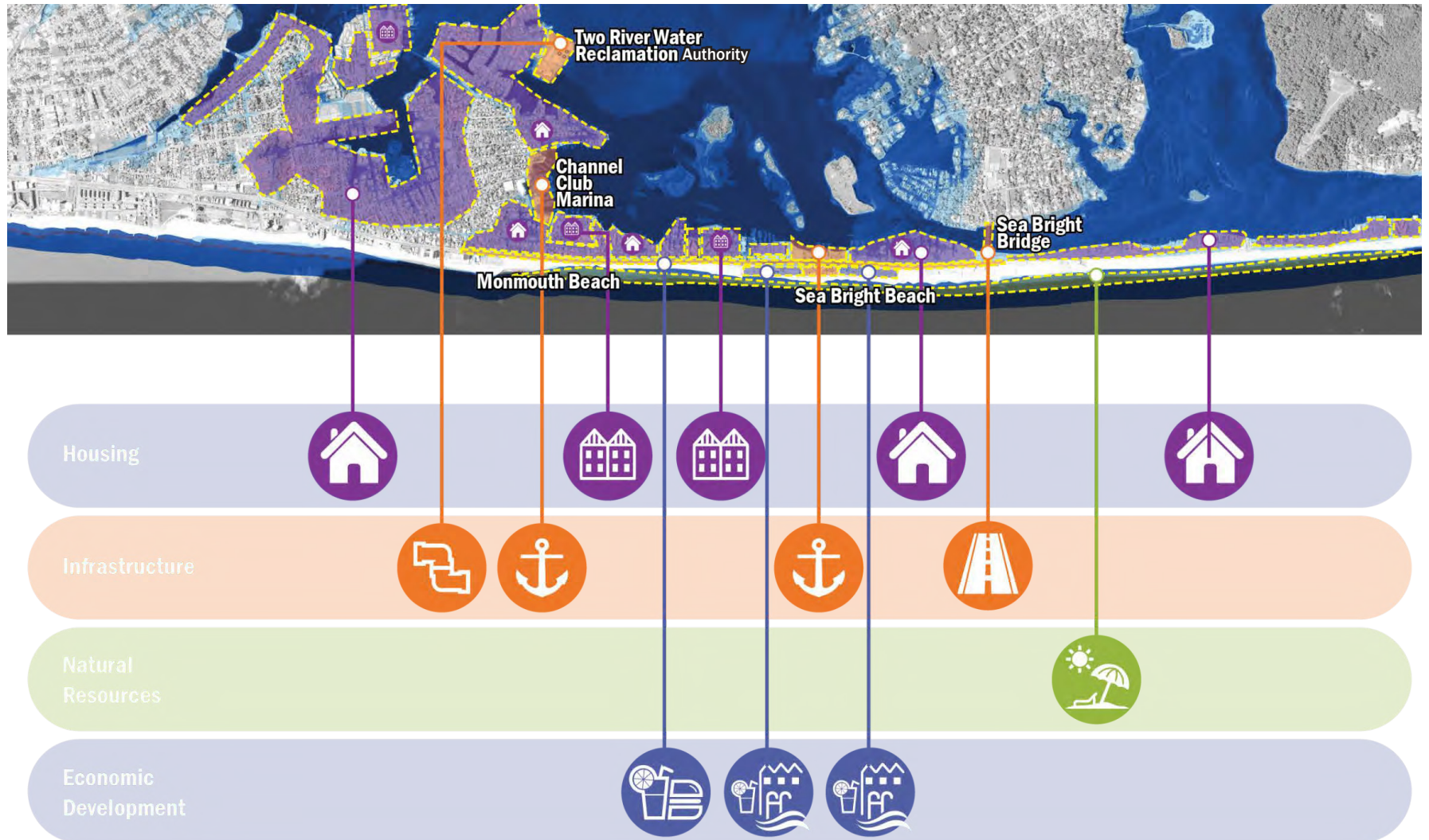
coastal resilience efforts.

The typologies that define the Shrewsbury River's water edge are: private houses, multi-family houses, marinas, parks, wetlands, and river clubs.

Characteristics

- Waterfront edge – primarily residential with wetlands
- Fort Monmouth – significant economic development asset
- Vulnerable roads and rails

1.3.3. Primary Challenges - Sea Bright / Monmouth Beach



HOUSING	INFRASTRUCTURE	NATURAL RESOURCES	ECONOMIC DEVELOPMENT
- The riverfront (east) is lined with single family houses with access to the water. - Challenge to implement mitigation strategies in private properties. The Borough of Rumson is looking into new ordinances and codes to make elevation of bulkheads continuous. - Over wash of sea wall during storm events and gap in the system	- Flooding of low lying streets due to coastal flooding and poor drainage during rain events - The Two Rivers Waste Reclamation Authority will be completely inundated in a 7' flood event - Bridges are important lifelines that connect these communities with less vulnerable areas. Constant flooding of Navesink Avenue bridge on Rumson side.	- Eroding wetlands in Monmouth Beach - Beach erosion	Beach clubs are vital economic assets to the community and are minimally protected



Seawall, Ocean Ave



Beach club house, Ocean Ave

Sea Bright / Monmouth Beach is dominated by private residences, marinas, and beach clubs, which represent a significant asset for the community because of the economy it generates, especially during summer months. The buildings are protected by a 17 foot tall sea wall that shields the east side of the barrier island from inundation from the Atlantic Ocean

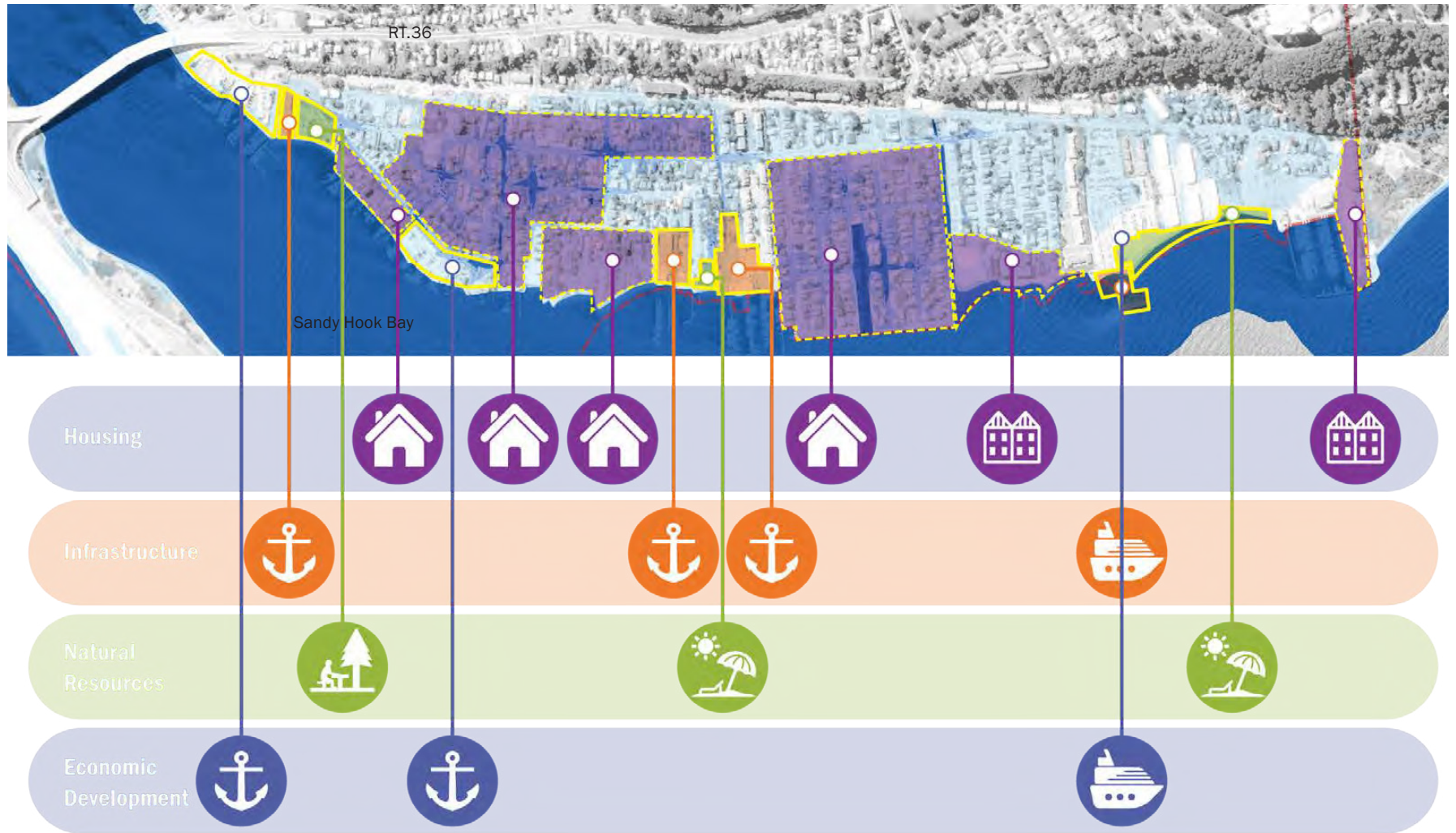
and bulkheads on the west side that protect from river inundation. Flooding on the bayside rises and fall because water infiltrates through the stormwater system.

The typologies that define Sea Bright / Monmouth Beach's water edge are: private houses, marinas, beaches, and beach clubs.

Characteristics

- Waterfront edge – primarily residential near wetlands
- Fort Monmouth – significant economic development asset
- Vulnerable roads and rails

1.3.4. Primary Challenges - Downtown Highlands



HOUSING	INFRASTRUCTURE	NATURAL RESOURCES	ECONOMIC DEVELOPMENT
- The waterfront is lined with single family houses with access to the water. - Topography is relatively flat	- Marinas and Seastreak Ferry terminal not protected - Constant flooding of Navesink Avenue bridge - Roads to Route 36 inundated - Vulnerable sewer system & sanitary pump stations	Eroding beaches	Inundation of marinas, Seastreakferry terminal, and local businesses on the waterfront. These are important economic assets to this community.



Bay Avenue, Highlands

Downtown Highlands is part of Highlands Borough and it represents the densest community within our study boundary. It is also the most impacted area during Hurricane Sandy. An approximate of 1,200 houses were lost from which 400 have been raised. In 2017 the US Army Corps of Engineers proposed a flood protection project consisting of a continuous flood wall from the Veterans Memorial Park to the Sandy Hook Bay Marina. At the time, the project was turned down by the community because they felt that the interventions will change the identity

of the waterfront. Earlier this year (February 1, 2018) the community decided to go forward with the USACE feasibility study of the flood wall.

The community developed a master plan which includes the extension of Shrewsbury Avenue. We believe that this could be a major opportunity in building a layer of protection for the Highlands community. The typologies that define Downtown Highland's water edge are: private houses, beaches, marinas, ferry terminals, and parks.

Characteristics

- Denser community, the most impacted area during Hurricane Sandy
- Strong community / cultural identity
- Waterfront—Private houses, beaches, marinas, ferry terminals, and parks

1.4. Moving Toward Regional Strategies

The Regional Action Plan and its component strategies and recommendations are the product of multiple years of engagement and risk assessment. The following sections provide a brief overview of the steps taken to get to this point. To produce this Regional Action Plan, the NJ FRAMES planning team completed a series of tasks that identified regional goals and assets, analyzed current and future risk, and developed a scenario-based planning approach to gain feedback on potential strategies.

Throughout the project and each step outlined below, opportunities were provided to gather feedback from the residents, visitors, and the members of the committees described below. The municipalities of the Two Rivers region provided a varying level of input. were all invited to participate throughout the length of the project to ensure opportunities to provide input and guide the direction of the project, some municipalities were more actively engaged.



February 8, 2016 Nor'easter Flooding Corresponds to a 3-foot flood level

2.0. Six Strategies for Regional Resilience in the Two Rivers Region

2.1. Introduction

This section presents six strategies that were developed for the purpose of inclusion in future planning and development in the Two Rivers region to reduce the impact of flooding and permanent inundation. The three planning scenarios, as described in **“1.2.1. Planning Scenarios”**, provided the basis for the actions in each of the six strategies. The six strategies offer guidance for actions that can be taken by the 15 participating communities and the region. As noted in **“1.0. Introduction”**, the strategies are the product of a series of community events, feedback and commentary periods, and comprehensive and iterative engagement with steering and advisory committee members. The strategies also reflect the resilience goals established during the project. These goals identify what was most important to the region and helped frame specific features of the Regional Action Plan, such as the importance of water access and the need for communities to be connected within and outside the region and to the waterfront. **“2.2. The six strategies”** describe the six strategies. The narrative for each strategy explains the potential approach that could be taken to plan for and implement the actions advocated for in each strategy. **“2.3. The Conceptual Scenario”** provides one example of what implementation of these strategies might look like using supporting visualizations.

2.2. The six strategies

- 1 New Coastal Protection Infrastructure**
suggests a wide range of green and gray solutions that could be applied across the region to protect from storm surge and coastal flooding.
- 2 Protect Critical Facilities**
promotes approaches to protect, adapt, and relocate important assets that are at risk.
- 3 Harden and Plan for Future Water-dependent Uses**
creates a plan for the future of water-dependent assets that are economically and culturally important for the region.
- 4 Neighborhood-level Adaptation Measures**
proposes measures that adapt current infrastructure and building stock to provide near- and long term protection
- 5 Long-term Vision and Master Planning for Permanent Inundation**
suggests a long-term vision and master planning approach to promote a sustainable region and development use opportunities in light of permanent inundation, which has significant impacts in the long-term.
- 6 Development of the Monmouth County Coastal Resilience Committee**
proposes the creation of a planning forum that focuses on regional approaches to resilience, including the promotion of strategies presented in this Regional Action Plan. The Monmouth County Coastal Resilience Committee is envisioned to be a leader in integrating the following strategies into current and future planning and development.



Figure 6. Suggested storm-surge barrier within this area of the Shrewsbury River



Stamford hurricane barrier, Stamford, CT

1 New Coastal Protection Infrastructure Strategy

The New Coastal Protection Infrastructure Strategy focuses on protecting areas of the Bayshore and the Navesink and Shrewsbury Rivers through infrastructure creation such as a storm-surge barrier, living shorelines, wetlands, and bulkheads.

This strategy aims to prevent lower level flooding events below 7 feet of water; focuses on areas presently at-risk along the estuaries of the Bayshore and Navesink and Shrewsbury Rivers; and addresses the need for ecological preservation and restoration by developing and maintaining wetlands, living shorelines, and other nature-based approaches. The use of green infrastructure and other nature-based approaches could also provide additional regional benefits through new economic opportunities in the future.

Assuming no action is taken to reduce the region's risk to flooding, the properties and assets around the Shrewsbury River have some of the highest concentrated risk in the region, with more than \$7 billion in net risk (between 2050 and 2100) for all assets south of the Shrewsbury-Rumson Bridge. Because of this high risk, the planning team recommends considering the use of a large public works project, such as a storm-surge barrier, to reduce the impacts of

storm surges that would cause significant impact (e.g., 7–12-foot flood events) in areas along the Shrewsbury River. To provide the most benefit for the most reasonable cost, the project should be located near the confluence of the Shrewsbury and Navesink Rivers between Rumson and Sea Bright, where the river is narrowest.

The planning team understands a storm-surge barrier could present ecological and waterfront use challenges, but it would not affect recreational boat traffic because it would act as a floodgate, with a default open position that would allow full access for boats under normal conditions. The default open position would also minimize the ecological impacts to the area. However, the full extent of the ecological and hydrologic impacts from a storm-surge barrier needs to be further studied and considered. This strategy could provide a cost-effective protection measure for storm surge events until 2100 but would not protect the area from permanent inundation or lower-level flooding events when the barrier would not be closed. The storm-surge barrier could also minimize the need for other storm-surge mitigation strategies in the area such as home raisings and retrofitting waterfront assets because it would be closed during larger events. The storm-surge barrier, along with the existing sea wall on the ocean side of Sea Bright

and Monmouth Beach, is envisioned to provide comprehensive protection against larger storm surges in the entire Shrewsbury River area.

This strategy also aims to protect assets that would regularly experience less than 7 feet of water from frequent storm-surge events or experience permanent inundation in the near-term. Measures proposed in this strategy would be implemented by 2030 and have a lifespan of 50 years. Two types of actions are recommended for consideration. The first action is a comprehensive analysis into the best options for preventing water backup into stormwater systems and streets; the second action is use and construction of floodwalls and associated green infrastructure that could adequately protect up to a 7-foot water level. In either case, a comprehensive overhaul of municipal codes should be considered to coordinate private and public properties to protect vulnerable areas. Any floodwall, bulkhead, or green infrastructure development, like home raisings proposed later in the Neighborhood-level Adaptation Measures Strategy, are intended to provide early-year protection from the increasing risk of storm surge and may not be adequate to provide long-term protection from larger storm surges or permanent inundation.

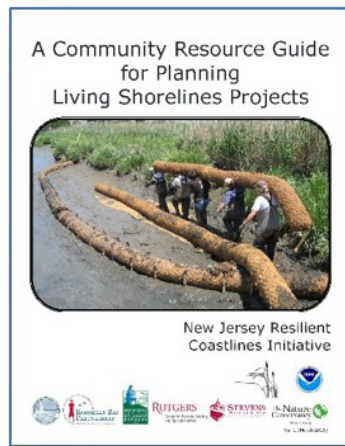
Implementation Strategy: 2030, 2050, and 2100

Following is a description of how the New Coastal Protection Infrastructure Strategy would be implemented across the region. Work would progress simultaneously in all the areas specified in this strategy.

Immediate Action

Beginning in 2020, this strategy recommends a region-wide study into the feasibility of nature-based approaches for waterways in the estuaries of the Bayshore and Navesink and Shrewsbury Rivers. The feasibility study would provide the information the region needs to immediately address the need for ecological preservation and enhancement by outlining the most effective nature-based approaches to protect against storm surge, recognizing practical locations for development, and identifying funding sources for public and private implementation. This strategy could be implemented by many different groups, but should incorporate the expertise at DEP, U.S. Army Corp of Engineers (USACE), local town engineers, and advocacy and academic groups in the region. It is recommended that the feasibility study consider how projects and ecosystems can respond to and/or survive sea-level rise, suggest specific projects that could be effective even after an area is permanently inundated, and produce guidelines for use in municipal and county decision making.

Starting immediately, planners in the Two Rivers region should work with engineers to understand the best options for adapting all utilities to frequent flooding and larger storm surge events up to a 7-foot water level, starting with the water and wastewater treatment plants in the region. Because many critical facility impacts generally manifest through public utility infrastructure (like stormwater or power systems), municipalities could study ways to collaborate with such utilities and fund mitigation of stormwater system to prevent backups. To provide the most benefit to the region, this action should to be implemented by 2030.



Living Shoreline

2030

In 2030, living shorelines could be constructed along public shorelines and participating private shorelines along the bay and estuaries of the region, and inland areas could be managed to allow marshes to migrate. To accomplish this, in areas where living shorelines and green infrastructure are feasible, municipal codes should require use of green infrastructure and design guidelines should be available so infrastructure is developed in an appropriate manner. In the Bayshore, the strategy would entail maintaining and restoring more than 650 acres of wetlands and using natural resource-based materials (levees, earthen berms) to protect Middletown communities that surround these wetlands. Municipalities would work with private homeowners to assess the potential for connecting nature-based approaches with public lands. Where possible, wetlands would be expanded in creeks and tributaries around the Shrewsbury River.

The potential storm surge barrier is scoped to be located between Rumson and Sea Bright in a location that would maximize the benefit while minimizing the size and cost. By 2030, preliminary environmental and engineering analysis should be underway to identify and comprehensively evaluate the risks,

opportunities, and unintended consequences of a storm-surge barrier. Preliminary feasibility and environmental assessments should include extensive consultation with stakeholders and potential agencies who would lead development (such as the USACE). The assessments should also review the specific design requirements to ensure adequate protection of up to a 12-foot water level, including added floodwalls that would be needed on both sides of the barrier to provide sufficient stabilization.

To address stormwater backing up in utilities and streets, municipalities should collaborate through the Monmouth County Coastal Resilience Committee (see Section 2.7) to understand current approaches to ease stormwater backup and explore best practices to mitigate or avoid future impacts. The committee should also study how permanent inundation would contribute to stormwater issues in areas that would be affected through 2100. Highlands, Sea Bright, the northern and eastern parts of Rumson, and Monmouth Beach would be the focus of this study and potential implementation because of their long-term exposure to permanent inundation, where large swaths of developed land would be affected by 2100.



Shrewsbury River bridge

2050

By 2050, efforts should be directed towards continuing maintenance of wetlands and living shoreline in the Bayshore to ensure the infrastructure's effectiveness in mitigating the impacts of storm surge. As the frequency of larger storm surge events increases, the need for additional mitigation projects to protect the region would increase. Assuming the studies discussed above are completed, a location for a storm-surge barrier will be identified, and the design and engineering plans should be progressing. Funding for the barrier should also be identified and pursued by this time, so construction could begin in the near future. The storm-surge barrier would be deployed every time a storm surge of 3 feet or more is projected, which is expected to be at least an annual event

in 2050. Other structural protection measures, such as bulkheads, floodwalls, or deployable protection devices, would be maintained to protect against storm surge up to a 7-foot water level. To maintain the health of the ecosystems in the region, green infrastructure and nature-based approaches should be integrated and added to structural plans and designs. Based on studies and best practices, new stormwater backup protection devices would be deployed where necessary to protect properties and infrastructure that are experiencing flooding as a result of higher water levels. Devices would be deployed to consider the impacts of current and future permanent inundation, especially where tides are expected to dramatically affect municipal infrastructure and systems.

2100

By 2100, because of increased frequency in major storm surges and expected sea levels to be 5.3 feet above 2000 MHHW levels, the wetlands and green infrastructure approaches currently in place would need to be significantly altered. Guided by the nature-based approaches feasibility study done in 2030, new areas where wetlands conversion could occur would be identified to mitigate the increased risk profile of higher water levels. By 2100, planning for a shoreline farther inland (described in Section 2.6) would include nature-based approaches along most of the shoreline of the Bayshore and estuaries of the Navesink and Shrewsbury Rivers. The storm-surge barrier would still be used to protect from storm surge up to a 12-foot

water level. Note that the storm-surge barrier would not be designed to mitigate permanent inundation, and therefore would not reduce damage caused by permanent inundation in 2100 (5.3 feet). Subsequent studies would be conducted to understand the storm-surge barrier's usefulness and operational capacity past 2100. These studies would need to consider the fact that currently known technical solutions for flood protection, including bulkheads, would be infeasible on their own to protect against 5.3 feet of permanent inundation. Other approaches should be considered and implemented to adapt shorelines with floodable open space and relocate the most affected assets away from water.

Connections to Other Strategies

Green infrastructure and nature-based approaches are vital to achieving the vision of a vibrant coast that can be sustained through exposures to incremental flooding and permanent inundation. Combining these approaches with bulkheads and other structural approaches located at critical points, road raisings, and other permanent inundation mitigation measures would provide a comprehensive mitigation strategy to storm surge. It should be noted, however, that this strategy alone would not provide a potent solution to permanent inundation.

The following tables provide examples of current planning initiatives and funding opportunities that the Regional Action Plan could coordinate with.

Table 2. New Coastal Protection Infrastructure Strategy: Planning and Development Initiatives

Strategy Component	Applicable Planning and Development Initiatives
Wetlands maintenance and development	The Wetlands Reserve Program by the U.S. Department of Agriculture https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=STELPRDB1049327
	NJDEP's New Jersey Wetland Program Plan 2019–2022 https://www.nj.gov/dep/dsr/wetlands/New Jersey Wetland Program Plan 2019-2022_Full Report.pdf
Green infrastructure and other nature-based approaches	The U.S. Environmental Protection Agency (EPA) Office of Sustainable Communities Greening America's Communities Program https://www.epa.gov/smartgrowth/greening-americas-communities
	Northeastern Regional Association of Coastal Ocean Observing Systems High Resolution Coastal Inundation Modeling and Advancement of Green Infrastructure and Living Shoreline Approaches in the Northeast https://us6.campaign-archive.com/?u=8dcea9cdf5&id=c529a710e5&e=%5BUNIQID%5D
	The Nature Conservancy's Increasing Resilience through Application of Nature-Based Infrastructure https://www.nature.org/content/dam/tnc/nature/en/documents/NBSWhitePaper.pdf
	Monmouth County-Naval Weapons Station (NWS) Earle Joint Land Use Study https://www.visitmonmouth.com/page.aspx?ID=4782
	Getting to Green: Paying for Green Infrastructure, Finance Options and Resources for Local Decision-Makers (Report) https://www.epa.gov/sites/production/files/2015-02/documents/gi_financing_options_12-2014_4.pdf
Storm-surge barrier	USACE Back Bay Study https://www.nap.usace.army.mil/Missions/Civil-Works/New-Jersey-Back-Bays-Study/
	USACE Shrewsbury River Basin, Sea Bright, New Jersey Coastal Storm Risk Management Feasibility Study https://www.nap.usace.army.mil/shrewsbury/
Bulk heads and flood walls	Federal Emergency Management Agency (FEMA) Flood Mitigation Assistance Grant Program https://www.fema.gov/flood-mitigation-assistance-grant-program

Table 3. New Coastal Protection Infrastructure Strategy: Potential Funding Sources

Strategy Component	Potential Funding Sources
Wetlands maintenance and development	EPA federal funding for wetlands, e.g., EPA Office of Wetlands, Oceans, and Watersheds funding, wetland program development grants https://www.epa.gov/wetlands/wetland-program-development-grants-and-epa-wetlands-grant-coordinators
	The National Fish and Wildlife Foundation (NFWF) Five Star and Urban Waters Restoration Grant Programs https://www.nfwf.org/fivestar/Pages/home.aspx
Green infrastructure and other nature-based approaches	Nature Conservancy's Living Shorelines Program https://www.habitatblueprint.noaa.gov/living-shorelines/
	EPA federal funding for green infrastructure https://portal.louisberger.com/usops/pfs/Frames/Shared Documents/Forms/AllItems.aspx?RootFolder=%2Fusops%2Fpfs%2FFrames%2FShared%20Documents%2F4%5FWORKING%20FILES%2FTask%204%2FTask%204B%20%2D%20Preferred%20Scenario&InitialTabId=Ribbon%2EDocument&VisibilityContext=WSSTabPersistence
	Federal Emergency Management Agency (FEMA) Flood Mitigation Assistance Grant Program https://www.fema.gov/flood-mitigation-assistance-grant-program
	Association of New Jersey Environmental Commissions (ANJEC) smart growth planning grant https://anjec.org/

Examples of Protected or Adapted Community-Identified Assets

The following assets would be adapted, protected, or generally considered in the implementation of this strategy (this is not a comprehensive list):

- Bayshore Waterfront Park
- Red Bank Primary School
- Sandy Hook Bay Catamaran Club
- Barley Point Island
- Bahr's Point restaurant
- Raccoon Island Fields
- Rumson Country Club
- Monmouth Park
- Monmouth Beach Cultural Center
- Sea Bright municipal facilities
- Monmouth Beach municipal facilities
- Oceanport municipal facilities
- Long Branch emergency services
- Fort Monmouth Economic Development Project
- Shrewsbury River and southern Sea Bright-based marinas and boat launches
- Two Rivers Water Reclamation Authority
- West Park Neighborhood and Community Assets
- Channel Club Tower

Figure 7. Protecting Middletown



2 Protect Critical Facilities Strategy



Middletown Township Sewage Authority Treatment Plant, 2020

This strategy aims to protect the functions provided by critical facilities to allow the region to continue to function through current and anticipated flooding conditions. To do this, critical facilities located in areas at risk from storm surge and permanent inundation would be protected in place using physical barriers, pumping systems, building and road raisings, or by building new facilities located in areas with lower risk to operate and maintain existing services. Two of the most important critical facilities in the region are the Middletown Township Sewerage Authority Treatment Facility and the Two Rivers Water Reclamation Authority, which are close to the shoreline in the Bayshore and Shrewsbury River, respectively. While the monetary benefits of relocating facilities would be lower than other strategies because the costs associated with this action would be high, critical assets provide many benefits to the region beyond those monetary benefits capture in the risk analysis performed in this project. The social importance of reliable emergency operations, water, and energy infrastructure systems are critical to maintaining use and function in the region.

Implementation Strategy: 2030, 2050, and 2100

This strategy focuses on ensuring that critical facilities are not hampered by storm surge and/or permanent inundation. Thus, a cohesive “inventory” of critical facilities would be mapped, and a plan for protection and/or relocation of each facility would begin. The most vulnerable of these facilities would be targeted for immediate protection from storm surge and permanent inundation. Protection from permanent inundation would be accomplished with continuous pumping systems to keep the critical, hard-to-move facilities continuously dry up to 2 feet of sea-level rise. To ensure continued operations within the region through the end of the century, substations, emergency operations assets, and major facilities would all need to be protected up to 7 feet of water. Plans and development for protection of critical facilities should consider providing protection measures to address higher than anticipated flooding levels because this infrastructure is vital to the continued resilience of the region. Critical facilities also have long lifespans, and the region should consider planning for the level of water expected to occur towards the end of the facility’s lifespan.

2030

By 2030, all critical facilities should be identified, and planning to provide the appropriate level of protection for each facility should begin. A feasibility study focused on two of the most important critical facilities in the region, the Middletown Township Sewerage Authority Treatment Facility and the Two Rivers Water Reclamation Authority, would commence to identify the options for protecting and/or moving these facilities to areas that are less at risk. These studies should also determine the impact on the operations and economic impacts to facilities when their service areas are impacted by permanent inundation. Currently, both facilities are directly on the water and are at risk from 2 feet of permanent inundation. Immediate measures should be taken to protect these facilities from 2-feet of permanent inundation and the storm surge impacts expected in 2050.

The other critical facilities in the region should be identified, and those most vulnerable should be given immediate protection up to 2-feet to protect against permanent inundation expected to occur in the short-term.

2050

By 2050, a plan should be in place for what actions need to be taken to protect the water and wastewater treatment facilities in the region. The relocation of these facilities may not be feasible given their need to be located in low-lying areas for operational requirements. If it were feasible to relocate the water and/or wastewater facilities to a new location, the moving process, which would include acquiring new property, planning for construction of a new facility, and connecting to existing infrastructure, would commence in 2050. If moving the facilities were not feasible, then a plan to protect the facilities beyond 2050, mainly a 12-foot total water level and 5.3 feet of permanent inundation by 2100, would be needed and should begin immediately.

For other critical facilities, plans should be developed to relocate those facilities that could no longer be protected in place and that could be relocated to areas that are not at risk from increased water levels. Where feasible, potential relocation areas outside the 7-foot exposure area should be identified, especially for those facilities that have no operational benefit from being located near the shoreline. Emergency operations and public works assets that may be in vulnerable positions would start to be constructed in locations that are not projected to be at risk to the 12-foot water level and developed to serve population growth through 2100 (considering movement due to permanent inundation of residential areas).

2100

By 2100, all critical facilities identified in the risk assessment, would be relocated to areas not at risk to flooding from a 12-foot water level. Further analysis would be conducted to ensure that these assets and systems would be protected past 2100.

Connections to Other Strategies

Protection of critical assets would have numerous social and economic benefits for the region. This strategy has little direct connection with other proposed strategies; however, it would address both permanent inundation and storm-surge effects on the most important assets in the region, which is necessary for the region to be sustainable. While this strategy calls for the movement of critical facilities to areas not impacted by a 12-foot water level, critical facilities that would be protected by other strategies that mitigate the impacts of storm surge may not need to move because all storm-surge related risk would be mitigated in another way. In these cases, permanent inundation would still need to be considered.

The following tables provide examples of current planning initiatives and funding opportunities that the Regional Action Plan could coordinate with.

Examples of Protected or Adapted Community-Identified Assets

The following assets would be adapted, protected, or generally considered in the implementation of this strategy (this is not a comprehensive list):

Table 4. Protect Critical Facilities Strategy: Planning and Development Initiatives

Strategy Name	Potential Funding Sources
Protection of critical facilities through structural raises, installation pumping systems, and physical barriers	USACE Shrewsbury River Basin, Sea Bright, New Jersey Coastal Storm Risk Management Feasibility Study https://www.nan.usace.army.mil/shrewsbury/
	Rutgers Community-based Green Infrastructure Initiative in New Jersey (for sewer facilities) http://water.rutgers.edu/Recent_Presentations/Obropta_PennStateGSI_03242017.pdf

Table 5. Protect Critical Facilities Strategy: Potential Funding Sources

Strategy Name	Potential Funding Sources
Protection of critical facilities through structural raises, installation pumping systems and physical barriers	FEMA Hazard Mitigation Grant Program https://www.fema.gov/hazard-mitigation-grant-program
	EPA Water Infrastructure and Resiliency Finance Center https://www.epa.gov/waterfinancecenter

- Middletown Township Sewerage Authority
- Two Rivers Water Reclamation Authority
- Long Branch Sewerage Authority
- Highlands Police and Fire Departments
- Sea Bright Police and Fire Departments
- Rumson Police, Fire, and Department of Public Works facilities
- Oceanport emergency services
- Long Branch emergency services
- Port Monmouth Fire Company
- Riverview Medical Center
- Monmouth Medical Center
- All at-risk schools and low-lying shelters

3 Harden and Plan for the Future of Water-Dependent Assets Strategy



Figure 8. Monmouth Cove Marina, 2020

The coastline and shorelines of the Two Rivers region are some of the most active waterfront areas in the state. From fishing co-ops and ferry terminals to private and public marinas, the region's coastal assets provide major economic and social benefits to the entire region. This strategy recommends adapting these coastal assets to permanent inundation and surge events to ensure their long-term operation. The strategy includes considering approaches that would allow water-dependent assets to both thrive with increased water levels and be protected through infrastructure. Infrastructure could include building bulkheads and green infrastructure to protect marinas to a 3-foot water level and ferry terminals and larger water-dependent economic assets, like the Belford Fishing Co-Op, up to a 7-foot water level in 2050. After 2050, these waterfront assets must be part of a larger movement to redefine the shoreline of the Two Rivers region, which are expected to experience 5.3 feet of sea-level rise by 2100.

The Regional Action Plan considers several water-dependent economic assets that are at risk from storm-surge and permanent inundation in the future. Among these assets are 20 marinas, comprising more than 1,400 slips. Many of these marinas experienced damage during Hurricane Sandy, and some have implemented resilience

measures to better handle the impacts of storms. Marinas are a major cultural attraction, providing direct access to the water for the region.

Some of the most important water-dependent assets that were considered in this project include the ferry terminals in Middletown and Highlands. The ferry terminal in Middletown is part of a larger waterfront area owned by Monmouth County that includes the Belford Seafood Cooperative and is adjacent to a planned Port Belford development. Naval Weapons Station (NWS) Earle, located on the Bayshore in Middletown, is also important to the regional economy and to national security interests.

These assets are major economic drivers and transportation assets that would have serious effects on the region if they were not operational. Accordingly, it is strongly recommended that the region consider higher levels of protection for these assets as part of the implementation of this strategy.

Implementation Strategy: 2030, 2050, and 2100

This strategy focuses on specific assets throughout the region and recommends that they be targeted for future adaptation, either through municipal and regional projects that protect shorelines and coastal areas or through municipal plans and funding partnerships that would help mitigate risk for private and public land owners and asset managers.



Figure 9. Protecting Monmouth Cove Marina, 2030

2030

Starting now, key regional stakeholders should immediately begin to consider options for the continued success of the region's waterfront assets to protect their economic and cultural importance. One of the largest components of the region's waterfront is its marinas. Regional officials should immediately begin to hold conversations with individual marina operators and the Marine Trades Association to discuss the risk of current and future storm surge and permanent inundation. This strategy is envisioned to protect marinas against nuisance flooding through 2050, which is expected to be up to 3 feet. Nuisance flooding would be a common source of financial risk through 2050. In 2030, the annual financial risk to marinas would be almost \$118,000; by 2050 the annual financial risk would be just over \$200,000. While these figures are small compared to other asset categories, these marinas generally represent smaller asset owners and provide regionally important cultural benefits. Individual risk assessments should be conducted for each marina to identify the level of effort needed to protect marinas from small-scale storm surge events and explore options to adapt to permanent inundation.

Additionally, regional officials (such as state, county, and municipal officials responsible for land use and waterfront access) should work with private owners of marinas to implement projects that would maintain public access to the water. Maintaining public access is a key goal for the region and working with both public and private marina operators to maintain this access would preserve critical cultural values and recreational opportunities for the region. The sort of projects envisioned include bulkheads where necessary to provide needed structural support against surge, the design and implementation of permeable road and building surfaces, and retrofits to water infrastructure to be more resilient to flooding. Other projects that would provide clear benefits include adaptations against nuisance flooding and frequent, low-level storms, the development of recovery plans that outline how a facility would respond after an event, and long-term plans for the future of marinas to help existing marinas adapt to permanent inundation.

Similar conversations should be held for other small water-dependent assets and larger assets such as ferry terminal operators and water-dependent economic facilities in the Bayshore, along the Atlantic coast, and along the shorelines of the Navesink and Shrewsbury Rivers. Because

these facilities serve an important economic function, they should work towards higher standards of protection. The type of protection envisioned at the ferry terminals and for land around NWS Earle would be to protect to at least a 7-foot water level through higher bulkheads, as well as the raising of any supporting piers, docks, and other facilities to avoid impact from permanent inundation and frequent coastal flooding through 2100.

Access to the terminals and water-dependent assets is a major transportation and economic need for the region. When planning for these assets, the roadways that provide access to them and stakeholders along the roadways should also be protected. Nature-based approaches, such as living shorelines and dune expansion, should be used around waterfront assets to the extent possible to provide a more environmentally friendly approach to mitigating storm surge. However, the facilities themselves should largely rely on structural approaches like increased bulkhead elevations to adapt to the increasing risk.

2050

Actions previously taken to protect water-dependent assets should be maintained so the region can continue to use the waterfront. Throughout this process, regional officials should continue to work with marina and ferry operators to understand the anticipated impacts from future conditions. As part of the long-term vision and master planning strategy (see Section 2.6), regional officials should continue to study how waterfront economic assets need to adapt to rising seas and the best ways to retrofit access to these facilities given permanent inundation. By 2050, any long-term visioning should detail specific adaptation and planning recommendations for these assets.

2100

By 2100, permanent inundation is expected to dramatically change the coast and shorelines of the region. As a result, waterfront assets should adapt to this changing coastline, and regional entities that provide transportation must improve assets. This strategy recognizes that future growth of waterfront assets would not occur along the current waterfront but in areas that are expected to be waterfront in 2100. Areas where current waterfront access points have been raised or adapted to the risks prevalent in 2100 should be the center of future waterfront-based growth. Downtown Highlands and Bayshore are examples of areas that should be prioritized for the development of specific corridors with long-term resilience and economic uses. This includes location planning for new marinas, waterfront residential and commercial development, and resilient mixed-use building types that acknowledge the importance of the region's relation to the water. Much of this long-term development is discussed below and in ***"5. Long-term Vision and Master Planning for Permanent Inundation Strategy"* on p. 53**

Connections to Other Strategies

This strategy focuses on the short-term impacts of waterfront-dependent assets and their adaptation to increasing sea levels. When cost analyses are performed for resilience projects that take place in the region, the benefits of protecting marinas, ferry terminals, and other water-dependent assets should be assessed to not only consider the monetized benefits of protecting waterfront assets, but the benefits to the region beyond those monetary benefits capture in the risk analysis performed in this project. If these larger regional projects (such as an USACE project) are designed to protect all assets from the impacts of coastal floods, then waterfront assets should focus on smaller-scale risks like nuisance flooding that larger projects might not cover. For example, if a major public works protection project like a levee system or a storm surge barrier is being considered to protect an area like the Shrewsbury River or the Bayshore, the benefits that would be provided to water-dependent assets should be considered along with the benefits to residents and other commercial properties.

The long-term recommendations in this strategy—namely the need for the ferry terminals and public and private marinas in the region to stay viable—would be incorporated into the vision for how a new inland shore and land could be used in light of future permanent inundation (see Section 2.6). This strategy stresses that any long-term visioning and planning should recognize the cultural and economic importance of waterfront access, plan for this access, and consider sea-level rise and frequent coastal flooding.

Currently, economic waterfront assets are being incorporated into planning and development processes in a variety of ways. NWS Earle has worked extensively with Monmouth County to address resilience concerns in its Joint Land Use Study and the subsequent resilience planning projects that are underway. This study has resulted in the planning and design of 11 ecologically based resilience projects for the Bayshore to implement flood mitigation, coastal restoration, and stormwater improvement. The study has also led to regional partnerships for shared services, microgrids, and land use review.

Table 6. Water-dependent Asset Strategy: Potential Funding Sources

Strategy Component	Applicable Planning and Development Initiatives
Marina retrofitting and protection	Wildlife and Sport Fish Restoration Boating Infrastructure Grant Program https://wsfrprograms.fws.gov/Subpages/GrantPrograms/BIG/BIG.htm
	Wildlife and Sport Fish Restoration Boating Access Grant Program https://wsfrprograms.fws.gov/Subpages/GrantPrograms/BoatAccess/BA.htm
Ferry terminal retrofitting and protection	Department of Housing and Urban Development Community Development Block Grants https://www.hud.gov/program_offices/comm_planning/communitydevelopment/programs
	United States Department of Transportation (USDOT) Better Utilizing Investments to Leverage Development (BUILD) grants https://www.transportation.gov/BUILDgrants/about
Long-term planning for economic waterfront assets	Private investment (public-private partnership) opportunities for new waterfront facilities

For marinas, many facilities such as the Leonardo State Marina or the Belford/Harbor Way ferry terminal are on public property and should be considered in capital planning processes, county master planning, and as part of larger resilience initiatives such as USACE plans. Private and public marinas have separate planning dilemmas. Many of these entities are represented through the Marine Trades Association that voices the needs and concerns of these facilities. As part of this strategy, planners and developers should be in contact with individual operators and the Marine Trades Association to discuss access issues and options for private marinas to retrofit their properties and maintain access.

The following tables provide examples of current planning initiatives and funding opportunities that the Regional Action Plan could coordinate with.

Examples of Protected or Adapted Community-Identified Assets

The following assets would be adapted, protected, or generally considered in the implementation of this strategy (this is not a comprehensive list):

- Belford/Harbor Way Terminal
- Naval Weapons Station Earle
- Highlands Ferry Terminal
- Bayshore-based private marinas and boat launches
- Lower Navesink-based private marinas and boat launches
- Shrewsbury-based private marinas and boat launches
- Wharfside Marina
- Monmouth Sailing Center
- Belford Seafood Cooperative Association
- Navesink Yacht Sales & Marina
- Irwins Yacht Works Inc.
- Surfside Marina
- Covesail Marina
- Monmouth Cove Marina
- Shrewsbury River Sailing Center
- Leonardo State Marina

Table 7. Water-dependent Asset Strategy: Applicable Planning and Development Initiatives

Strategy Component	Applicable Planning and Development Initiatives
Marina retrofitting and protection	Coordination with individual marinas and the Marine Trades Association http://www.mtanj.org/
	Incorporation of resilience protection for public marinas in capital planning processes
	Land use planning updates for public properties that lease marina space
	Municipal resilience planning and engineering
	Incorporation of resilience needs and studies as part of the New Jersey Clean Marinas Program. https://www.nj.gov/dep/njcleanmarina/
	Incorporation of benefits and avoided costs to marinas in analysis for regional projects, such as a USACE plan
Ferry terminal retrofitting and protection	Land use planning updates for public properties (such as the Belford/HarborWay ferry terminal) that lease terminal or other space
	Impacts on terminals in from regional transportation planning, like North Jersey Transportation Planning Authority's Long-range Transportation Plan
	Detailed study of the value of the ferry terminals for the regional economy, similar in scope to economic impact studies conducted by industry groups like the Marine Trades Association; detailed transportation and economic study should be conducted in conjunction with county planning processes or state economic development planning
	Municipal planning board statute for Middletown and Highlands that requires storm-surge protection be implemented when ferry terminal retrofits are made
Long-term planning for economic waterfront assets	Consideration of waterfront assets in future regional risk analyses
	Statute requiring public waterfront access in future developments. A model approach for considering permanent inundation has been taken at other ferry terminals, including in the preferred alternative for the Washington State Department of Transportation Mulkiteo Multimodal Ferry Terminal (https://www.wsdot.com/NR/rdonlyres/37DF8991-5E43-4007-AA33-2CDC70A5EB90/0/AppHCoordinationPlan.pdf); this consideration was made as part of the state-integrated climate response strategy (https://fortress.wa.gov/ecy/publications/publications/1201004.pdf)
	Incorporation of site plans and adaptation of current facilities in a Permanent Inundation Master Plan

4 Neighborhood-level Adaptation Measures Strategy

This strategy deals with adaptation to address near-term risk of storm surge by means of home raisings and targeted road raisings. Home raising is a strategy commonly seen throughout New Jersey's coastal communities. While it provides protection against storm surge, it does not provide protection against permanent inundation so should be used where appropriate and where property owners find it practical in the near-term. In the long-term, homes that may not be at risk today (i.e., homes located in areas not at risk to a 7-foot water level but to a 12-foot water level, and therefore have not been raised yet) will be at risk in the future. This strategy suggests a region-wide policy to plan for home raisings to mitigate damage from current and future storm surges. Areas where home raisings may be necessary in the future (after 2050) include Red Bank, Rumson, Little Silver, Oceanport, and parts of Long Branch near the Shrewsbury River.

Road raisings may also provide a short-term solution for permanent inundation up to 2050, for areas identified as the most vulnerable in the project area. These areas include downtown Highlands, Sea Bright, Monmouth Beach, sections of the Bayshore, and neighborhoods in eastern Rumson. It should be noted that road raisings will act only as a temporary measure and should only be considered for the most vulnerable areas or to protect roadways that connect critical facilities or critical areas within the region. For targeted road raising to be most effective, areas that will be significantly impacted by permanent inundation in 2050 (2-feet of water) should be identified now so it can be determined if road raisings are feasible and an appropriate response so plans and designs can be developed and implemented by 2030. Additional analysis will be needed to determine if it is feasible for municipalities or the county to raise specific roadways. One of the biggest factors to consider

in this analysis is the size of the public right-of-way associated with each road, since a smaller roadway, particularly residential non-arterial streets, are unfeasible due to their small size and proximity to homes on adjacent lots. On a local level and for smaller areas affected by permanent inundation, there are technical solutions that may be more applicable than road raisings, including raising of infrastructure to be above permanent inundation.

Implementation Strategy: 2030, 2050, and 2100



2030



2050



2100

Figure 10. Raising homes and targeted roadways

2030

The region should consider an aggressive standard for home raisings and begin to identify select roadways where it would be feasible to raise in order to protect residential and commercial communities from permanent inundation expected by 2050. As the frequency of higher storm surges increases, municipalities should develop and enforce their own standards for elevation based on state and national data. Municipalities should consider their level of risk and set standards for home elevations to address the likelihood of storm surges at the present time and into the future. For example, municipalities could require homes to be elevated to the base-flood elevation of +4-feet, which would provide additional protection as base-flood elevations increase into the future. Additionally, the region should begin to consider elevating homes that are currently outside mapped flood zones and are at a risk of a 7-foot storm surge. Where it is determined that it is feasible to raise a roadway, preliminary elevation designs should begin. Designs should include electrical, communications, water and wastewater systems, and other utilities. Particular attention should be paid to the feasibility of raising narrow roadways or roadways in areas where raising them may cause or increase flooding to adjacent areas as water gravitates away from the newly raised roads.

2050

As the region sees a higher frequency in major storm surges, it will be particularly important for homes on higher elevation to consider raising their homes, or for municipalities and planning boards to pass stricter home raising ordinances. These communities include West Long Branch, Eatontown, Tinton Falls, and Ocean Township. If not already required, all homes that do not have storm-surge protection should be raised if damaged or undergoing renovation that would require a building permit from the municipality. Road raisings should continue to be considered and, where already in place, should continue to provide protective measures in the region. However, these raisings would act only as a temporary measure and should only be considered for the most vulnerable areas or to protect roadways that connect critical facilities or critical areas within the region.

2100

Home and road raisings would no longer be a feasible adaptation strategy in those areas experiencing permanent inundation, but both measures would continue to be part of the larger regional adaptation strategy for areas where it would be viable to stay in place and live with new water conditions. By 2100, homes that are located in areas that could experience a 12-foot water level should be elevated or targeted for elevation to protect against storms and other flooding not associated with permanent inundation. Municipal standards should reflect the appropriate level of elevation, and new construction should require homes to be raised to a level that reflects the latest flood maps. The feasibility of raising roadways should continue to be assessed and planned for where appropriate.

Connections to Other Strategies

This strategy would provide a major benefit to curbing residential building loss from storm surge but does not address permanent inundation. Because this strategy alone would not protect infrastructure for public utility systems, it must be combined with other strategies that address other assets, such as commercial facilities, ecosystem services, utilities and infrastructure, or social vulnerability to contribute to a more resilient and connected region. Road raising would most likely occur on a smaller geographic basis but could provide a temporary solution before long-term plans are implemented. This approach could be combined with other strategies to support residents and municipalities to stay in place until permanent inundation makes it unfeasible. This strategy would allow for ingress and egress when viable and would provide a sustainable solution for maintaining the region as a viable place to live and recreate.

The following tables provide examples of current planning initiatives and funding opportunities that the Regional Action Plan could coordinate with.

Table 8. Neighborhood-level Adaptation Measures Strategy: Planning and Development Initiatives

Strategy Component	Applicable Planning and Development Initiatives
Home raisings	FEMA Hazard Mitigation Grant Program https://portal.louisberger.com/usops/pfs/FRAMES/Shared Documents/4_WORKING FILES/Task 4/Task 4B - Preferred Scenario/Federal Emergency Management Agency (FEMA) Flood Mitigation Assistance Grant Program
	Blue Acres Program https://www.nj.gov/dep/greenacres/blue_flood_ac.html

Table 9. Neighborhood-level Adaptation Measures Strategy: Potential Funding Sources

Strategy Component	Potential Funding Sources
Home raisings	FEMA Hazard Mitigation Grant Program https://portal.louisberger.com/usops/pfs/FRAMES/Shared Documents/4_WORKING FILES/Task 4/Task 4B - Preferred Scenario/Federal Emergency Management Agency (FEMA) Flood Mitigation Assistance Grant Program
	National Flood Insurance Program https://www.fema.gov/national-flood-insurance-program
Road raisings	FEMA Hazard Mitigation Grant Program https://portal.louisberger.com/usops/pfs/FRAMES/Shared Documents/4_WORKING FILES/Task 4/Task 4B - Preferred Scenario/Federal Emergency Management Agency (FEMA) Flood Mitigation Assistance Grant Program

5 Long-term Vision and Master Planning for Permanent Inundation Strategy

This strategy aims to create a long-term, coordinated approach the region can take to address the 5.3 feet of permanent inundation that is anticipated to occur by the end of the century. This strategy recommends developing a regional vision and specific policies, actions, and plans that mitigate the losses caused from permanent inundation. To ensure that the region remains a viable place to live and recreate, this strategy recommends that either all planning initiatives and public and private development account for permanent inundation, or a new master plan for permanent inundation be developed for the region. This master plan would include a vision for the region and should incorporate three major planning initiatives: land and waterfront use based on permanent inundation, socioeconomic considerations, and resilient smart growth. Resilient smart growth focuses on sustainable development outside the flood plain that would account for some of the assets that may be lost or moved as a result of permanent inundation.

This strategy recognizes the fact that 5.3 feet of sea-level rise and an increased frequency of storm surge events would alter the physical characteristics of the ocean coastline and shoreline of the bay and estuaries and cause significant financial losses. It is anticipated that

the region would experience more than \$2.7 billion in permanent inundation loss by 2100 (2018 USD). Therefore, long-term changes should be considered and should incorporate existing municipal- and county-level mitigation plans and draw from relevant studies performed for the region. A core component of the master plan aims to create a vision for new inland shores in the region that are vibrant and sustainable through the most appropriate use of the land and waterfront as more areas are permanently inundated. Some areas, such as the barrier island, would need a new vision for use and maintenance as water levels rise, but it would still be part of the new vision for the coastline. The region should consider where development may not be feasible in the future because of permanent inundation and think about new uses such as converting areas to open and recreational spaces. Public lands can provide ecological, recreational, and resilience benefits if they are devoted and designed for frequent flooding of up to 7 feet of water. For example, areas south of Sandy Hook could be used in 2100 to promote improved public access and recreation on the portions of the barrier islands where development is no longer feasible. Additionally, the region will need to consider which existing permanent uses will no longer be

feasible and should be move to new areas by 2100.

The new inland shores in the Two Rivers region should also consider the actions private property owners can take to maintain viable waterfront parcels. This could include new or modified municipal codes to require ecological land use directly along the water and guidance for how zoning could be updated to restrict land uses in areas that would be permanently inundated in the near future. When considering this new vision and how land and waterfront uses may need to be altered, it is important to consider how the residents, businesses, and other stakeholders of the region will be affected by these changes. Another core component of the strategy is for the master plan to create a framework for the region to deal with permanent inundation through the end of the century and specifically address the social impacts that permanent inundation would engender, setting forth community-supported actions that help residents, businesses, and other stakeholders adapt to rising waters. These actions will help prepare and support the communities in the region for the difficult decisions that will need to be made about the future uses of the land and waterfront as sea levels rise.

Along with socioeconomic and land use planning, this strategy also considers sustainable development. As further development is curbed in areas that are expected to be permanently inundated, it is vital to keep the region economically vibrant through sustainable development projects in locations that present less risk. The approach should focus on creating density, housing, and appropriate amenities in upland areas that would not be affected by permanent inundation and would be less affected by coastal storm surge. A partnership between municipalities and region-wide housing and economic development goals is recommended. Although, certain development mechanisms such as allowing increased density or the subdivision of underutilized lots should be local decisions, these actions need to be coordinated on a regional level. This could possibly be accomplished through a regional planning body (as proposed in the Monmouth County Coastal Resilience Committee Strategy).

Implementation Strategy: 2030, 2050, and 2100

The process to develop a vision and a master plan to address permanent inundation should begin in 2020 to address how permanent uses of land could be modified in the future or potential moved to areas not at risk of being permanently inundated. Planning approaches should target near-term impacts and develop a framework to address the long-term impacts the region will face. Simultaneously, in-depth studies that further dissect the impacts of flooding to current and future at-risk areas need to complete by 2030, including technical reports like a hydrology study for the Navesink and Shrewsbury Rivers. Reports should build from existing plan, such as the Regional Action Plan and the Monmouth County Hazard Mitigation Plan, which identify areas most at-risk to flooding and permanent inundation (2.0 feet of sea-level rise by 2050).

2030

To ensure successful planning for permanent inundation, governing bodies and decision-makers in the region need to work together to discuss shared approaches to both permanent inundation and storm surge, share lessons learned, discuss residential, commercial, and environmental concerns, and describe municipal and county plans that can address these issues. This coordination can be conducted through an extension of the Two Rivers Council of Mayors or some other coordinating body (see the Strategy for the Development of the Monmouth County Coastal Resilience Committee). By 2030, the region's officials and decision-makers should work with residents to envision the future of the area in terms of land and waterfront use. Upland communities should review their individual plans to better understand the potential for further density to accommodate consolidated growth in the future. This process should coordinate and consider recommendations and processes from existing plans, such as the Monmouth County Hazard Mitigation Plan and the Monmouth County Joint Land Use Study for NWS Earle. The process should also consider including potential mitigation projects to address those areas that have been identified as being most vulnerable through 2050.

2050

By 2050, planning for permanent inundation will be fully integrated into region-wide planning initiatives or through a first version of the master plan for permanent inundation. 2050 is an important year, as it is the pivot year between short-term planning and projects, and long-term planning. It is also an important pivot year when permanent inundation begins to have a large region-wide impact, and permanent loss begins to account for almost \$500 million (2018 USD). The majority of the almost \$500 million in permanent inundation losses occurs on the back side of Sea Bright and Monmouth Beach, as well as the lowest-lying areas of Rumson, particularly the West Park neighborhood. Downtown Highlands and small portions of Middletown's Bayshore also see impacts. It is important that by 2050, the region coordinates socioeconomic planning, private and public development planning, and infrastructure planning before permanent inundation creates serious impact.

Any planning for permanent inundation, whether through separate planning initiatives or in a new master plan, should provide context for how new inland shores can be development so municipalities can decide the type of recreation and economic opportunities to adopt. The master plan should provide guidance so municipalities

can determine the approaches most appropriate to take so the new inland shores can foster the ecological benefits that will provide the most protection and economic resilience for the region. By 2050 the region should have specific plans or be in the process of identifying where future development will not be feasible due to permanent inundation, and provide alternatives for similar development within the Two Rivers region. Areas should be identified that may be able to take on additional development including communities like Red Bank and Long Branch, which have high levels of density already and the structures in place to potentially handle further development, and communities that do not include dense development and potentially have physical space to handle new building such as Tinton Falls. In either case the feasibility of shifts in development need to be assessed and these decisions must come from the municipalities themselves.

Through this planning areas that will be severely impacted by permanent inundation in later years should be identified so decisions can be made where green infrastructure and structural solutions are appropriate and where they may not be feasible to maintain. For those areas where they are not feasible, a long-range plan for

moving away to higher grounds will be needed. By identifying these areas early, it is possible to allow affected residents, municipalities, and the region to remain vibrant and to provide support to residents and municipalities to make decisions about what is sustainable and would mitigate the social and cultural impacts that permanent inundation can have.

2100

By 2100, areas around the Shrewsbury River, in Highlands, and in communities along the Bayshore will face very frequent flooding or be inundated by normal tides. These areas accounts for about 83% of the combined \$2.7 billion in projected permanent inundation loss in the area as well as 82% of \$683 million in annual risk of 7-foot floods. At this time, it is unlikely that hard structures will be useful to protect areas from 5.3-feet of permanent inundation and the expected frequency in which storm surge events will occur. Given this assumption, shorelines will need to be adapted further inland. Economic assets like ferry terminals, private and public marinas, storefronts, restaurants, and tourist accommodations will need to be adapted, and potentially redeveloped in new locations well before 2100.

Coordinated planning for permanent inundation should guide the movement of communities further inland where moving remains the most feasible option. This transition should occur over a long period of time - 50-years in the context of this project - thus providing enough time to property owners and municipalities to assess and determine for themselves when it is no longer feasible to stay in place. The permanent inundation master plan should provide

recommendations on costs, funding sources, and explain how moving away should be completed in conjunction with other resilience measures such as natural and structural projects. The monetary benefit of moving away from all properties affected by 5.3 feet of permanent inundation in the project area in 2100 (with cost assumptions reflecting typical buy-out programs) was determined to be cost effective, that the benefits of moving away outweigh its cost by at least twice the total amount. Sustainable development should continue past 2100 and will be an integral part of municipal and regional planning.



Figure 11. Long-term Route 36 Commercial Corridor Sustainable Development Plan

Connection to Other Strategies

This strategy acts as an anchor for other planning and policy strategies that together can create a sustainable path for dealing with permanent inundation in 2100. Implementation of the permanent inundation master plan in conjunction with the planning body is mentioned in **“6. Strategy for the Development of the Monmouth County Coastal Resilience Committee” on p. 59**

The following tables provide examples of current planning initiatives and funding opportunities that the Regional Action Plan could coordinate with.

Table 10. Long-term Vision and Master Planning for Permanent Inundation Strategy: Planning and Development Initiatives

Strategy Component	Applicable Planning and Development Initiatives
Socioeconomic Planning	NJDEP Coastal Resilience Plan https://www.nj.gov/dep/coastalresilience/
	North Jersey Transportation Planning Authority Long Range Plan https://www.njtpa.org/Planning/Plans-Guidance/Plan-2045.aspx
Land Use Planning	NJDEP Coastal Resilience Plan https://www.nj.gov/dep/coastalresilience/
	Private Site Development Planning
	Louisiana 2017 Coastal Master Plan http://coastal.la.gov/our-plan/2017-coastal-master-plan/
	Municipal zoning for stormwater (like the City of Norfolk, VA’s establishment of a Coastal Resilience Overlay zone https://www.adaptationclearinghouse.org/resources/building-a-better-norfolk-a-zoning-ordinance-of-the-21st-century.html
	New Jersey Transit Capital Planning on the Coast Line https://www.state.nj.us/transportation/capital/tcp20/
Smart Resilient Growth	100 Resilient Cities https://www.100resilientcities.org/

Table 11. Long-term Vision and Master Planning for Permanent Inundation Strategy: Potential Funding Sources

Strategy Component	Potential Funding Sources
Socioeconomic Planning	Multiple Private and Public Foundations that give to Resilience-based social planning
Land Use Planning	New Jersey Transfer of Development Rights Bank https://www.nj.gov/agriculture/sadc/tdr/tdrbank/ U.S. Fish & Wildlife Service's National Coastal Wetlands Conservation Grant Program https://www.fws.gov/coastal/NCWCGPcontacts2.html
Smart Resilient Growth	EPA Smart Growth Grants https://www.epa.gov/smartgrowth/epa-smart-growth-grants-and-other-funding ANJEC Smart Growth Planning Grant https://portal.louisberger.com/usops/pfs/FRAMES/Shared Documents/4_WORKING FILES/Task 4/Task 4B - Preferred Scenario/ANJEC Smart Growth Planning Grant

Examples of Protected or Adapted Community-Identified Assets

- Downtown highlands residential and commercial assets
- Dunes at Shoal Harbor Condos
- Belford Seafood Cooperative Association
- Belford/Harbor Way Terminal
- Highlands Ferry Terminal
- Bayshore-based private marinas and boat launches
- Lower Navesink-based private marinas and boat launches
- Shrewsbury River-based private marinas and boat launches
- Middletown Township Sewerage Authority
- Two Rivers Water Reclamation Authority
- Red Bank Primary School
- Locust Point apartments
- Sand Point south Condos
- Manhasset Park
- Channel Club Tower

6 Strategy for the Development of the Monmouth County Coastal Resilience Committee

Inspired by the regional approach to shared services and the collaborative nature of the Two Rivers Council of Mayors, NJ FRAMES created a steering committee to coalesce the diverse views of the 15 participating communities and other regional constituent representatives like the Monmouth County Division of Planning, Office of Emergency Management, the Sea Grant Consortium, and the American Littoral Society. As advisors and decision makers, this group helped the planning team craft strategies that align with the resilience goals (see Appendix A) and risk to the region. As this Regional Action Plan has been developed, there has been agreement from all steering committee members who were actively engaged throughout the project that continuing the conversations that have started during

this project is critical to the implementation of a regional resilience plan. This final strategy advocates for the creation of a committee that can further champion these strategies and ensure regional resilience throughout the region's plans and development. This planning committee is henceforth referred to as the Monmouth County Coastal Resilience Committee.

There are several potential approaches to developing a regional planning body to advocate for regional resilience. The following presents three brief case studies on the roles, responsibilities, and authorities of other regional environmental bodies:



North Carolina Coastal Federation Headquarter, North Carolina



Environmental Protection Agency PA Administrator William Ruckelshaus addressing a Chesapeake Bay Commission conference on December 9, 1983. The 1983 Chesapeake Bay Agreement was signed at the conference. (from Wikipedia)

North Carolina Coastal Federation

501(c)(3) organization with advocacy and small-scale project implementation

A non-profit that represents the coastal community and environmental interests across the state. The federation's approach works to advocate for sustainable land and water uses through lobbying and on-the-ground project development. The federation's Coastal Resilience Initiative is a collaborative approach to implement nature-based approaches for coastal protection and help develop watershed restoration plans. Through the North Carolina Climate Risk Assessment and Resiliency Plan, the federation acts an outreach and stakeholder engagement to elicit feedback on the plan.*

The North Carolina Coastal Federation's approach to resilience is one of advocacy and project development. While its geographic scope is much larger than the Two Rivers region, it provides a potential route for the region to coordinate and implement small projects and advocate for resilient solutions.

Chesapeake Bay Commission

Multi-state agency with clear and influential advisory powers on state legislation around the Bay

The Chesapeake Bay Commission is a three state-appointed commission that leads regional policy development for the Bay. Inspired from EPA's landmark study on the decline of the Bay and created through legislative action of the three member states of Virginia, Maryland and Pennsylvania, the primary focus of the Commission is on clean water. While members of the 21-person commission represent elected officials and cabinet-level leaders in the surrounding states of the three member states, the Commission itself does not legislate or enact policy for the Bay; however, it acts as one of the major advisors for policy development and has a direct connection to the Chesapeake Executive Council and state legislatures that enact and enforce clean water policy**.

While the Commission's scope is focused on water quality and less on coastal resilience, its success in multi-lateral policy development through official representation and consultation serves as a model for jurisdictions to protect and enhance a shared waterfront.

* North Carolina Coastal Federation, Coastal Resilience Initiative, 2019 <https://www.nccoast.org/coastal-resiliency-initiative/>

** Chesapeake Bay Commission, Mission Statement <http://www.chesbay.us/mission.html>

New Jersey Highlands Council

State agency with direct authority from state legislation with land use and regulatory powers

The Highlands Council is a 15-member body created by the Highlands Water Protection and Planning Act of 2004. The Highlands Council has broad administrative and regulatory powers that are informed and advised by an Executive Director and staff. Council members are appointed by the governor on the advice of the State Senate, and the council oversees the Highlands Regional Master Plan, whose goal is to protect and enhance the significant values of resources [of the region]*.”

The Highlands Council presents a model for a planning body that incorporates direct land regulatory powers specific to the region, as well as representation and dedicated staff that assist in the implementation of regulation and planning. Its existence within the state shows that there is precedence for regional planning, but its approach as a regulatory agency is not entirely in line with comments heard during outreach with the Two Rivers region.

* New Jersey Highlands Council, Regional Master Plan, 2008 <https://www.nj.gov/njhighlands/master/>

Although the models for a regional planning body are vast, the planning team has heard support for the idea that leadership of this committee should come from the region and not from the state, while representation should include regional leaders and state representation. The planning team also recognizes the current initiatives and bodies that already exist to coordinate regional planning, particularly on the county-level. These have been mentioned in specific strategy narratives and includes the Monmouth County Master Plan, the Monmouth County and municipal level Hazard Mitigation Plans, capital planning by public authorities in the region such as NWS Earle, and more.

To that end, this strategy calls for the NJ FRAMES steering committee to make a recommendation for most appropriate functions and members of the Monmouth County Coastal Resilience Commission. The steering committee should work closely with stakeholders such as the state and county, and consider how other regional planning bodies within the state function, such as the NJ Coastal Coalition, to determine the best mechanisms that exist for committee to form. These recommendations should be developed in a report that outlines the vision, goals, proposed roles and responsibilities, and next steps for the committee. This strategy recommends that

the committee should use the Regional Action Plan to guide the focus of the body’s advocacy, coordination efforts, and other potential roles.



New Jersey Highlands Council

Connection to Other Strategies

The Monmouth County Coastal Resilience Committee could be a major tool for implementation of the strategies in the Regional Action Plan. As a planning entity, the committee could champion, coordinate, seek funding, or even lead the development of the projects, policies, and plans that are recommended in the Regional Action Plan. There are a number of examples of regional planning beyond the NJ FRAMES project that could provide a starting point for formal regional approaches to coastal resilience. Groups like the Two Rivers Council of Mayors, County-based planning initiatives, including the County Hazard Mitigation Plan, and other local, multi-municipality groups could provide significant support to develop the committee suggested in this strategy. The following tables provide examples of current planning initiatives that the Regional Action Plan could coordinate with.

Table 12. Strategy Components and Planning and Development Initiatives

Strategy Component	Potential Funding Sources
Determination of Monmouth County Coastal Resilience Committee Roles, Responsibilities, and Members	Agreement of the Two Rivers Council of Mayors
	Planning Initiative of the County
	Initiative of local climate-focused non-governmental organization

2.3. The Conceptual Scenario

The six strategies described in the Regional Action Plan are recommended actions that should be considered by the region and its municipalities. While each strategy is beneficial on its own, when combined, the strategies work together to provide additional benefits. The conceptual scenario describes one potential approach to implementing the six strategies in the near, medium, and long term. Projects, plans, and policies that are potential outcomes of strategy implementation are shown for 2030, 2050, and 2100. These actions align with how risk was assessed by planning years

throughout the project as outlined in Section 1. This section provides conceptual graphics and an accompanying narrative to demonstrate how the six strategies could be implemented. Appendix B provides detailed renderings of potential projects and development throughout the region that would be in line with how the six strategies could be implemented to address the increased risk throughout the end of the century.

This is just one way the six strategies within the Regional Action Plan can be combined and implemented throughout the region over the next 80 years. While the planning team received ample feedback regarding content, the conceptual scenario is not the only suggested approach.

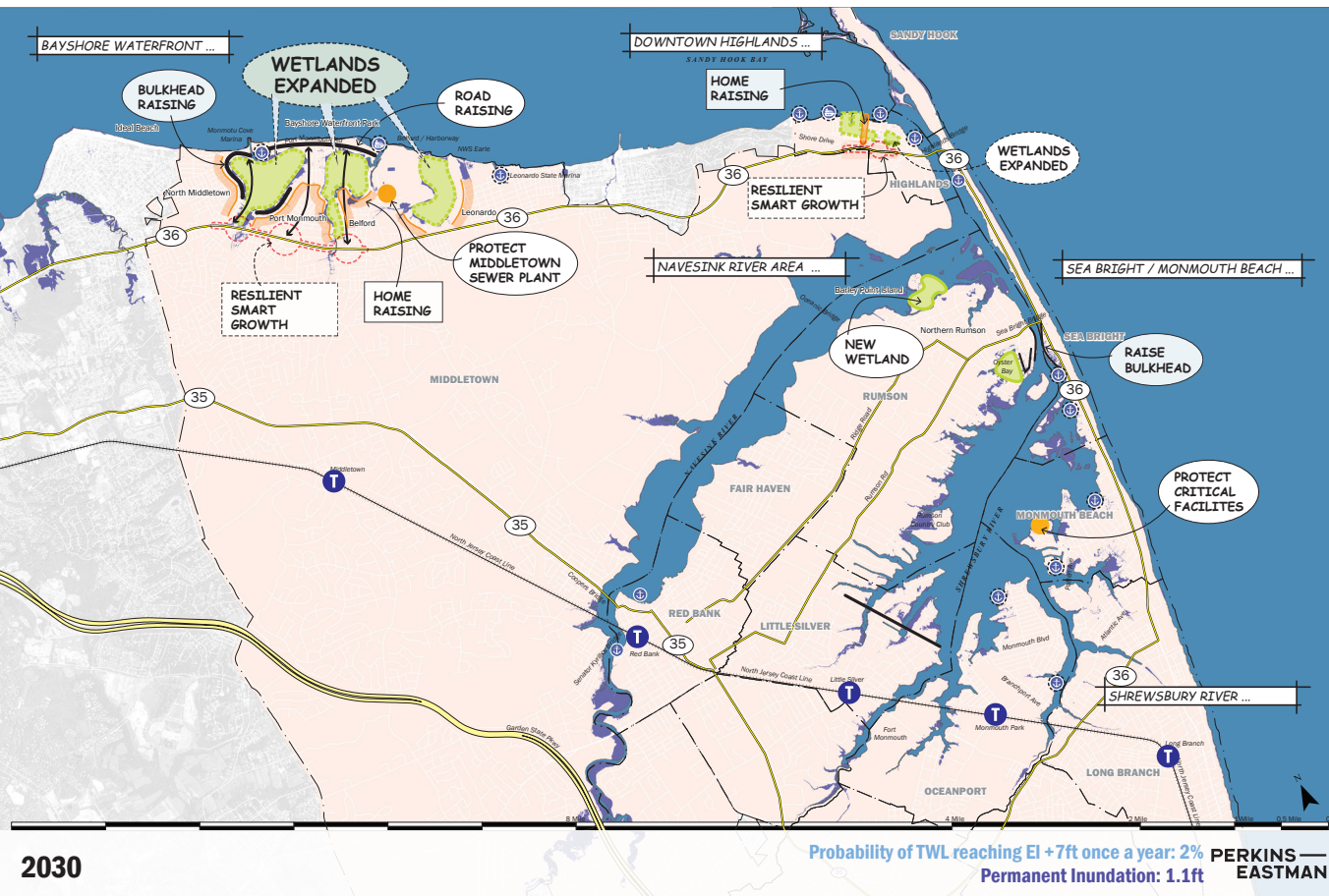


Figure 12. Conceptual scenario - 2050

Note: Floodgate shown at this location for illustrative purposes only. As described in "New Coastal Protection for Infrastructure Strategy" a flood gate would be built in a location that provides the most benefit for the most reasonable cost.

2030 is considered the near-term for this plan. In order to reduce near-term risk over the next decade, many projects could be designed and implemented to address inundation caused from the 1.1- feet of sea-level rise that is expected, as well as frequent coastal storms that result in 3-foot water levels. Many planning and policy measures could also be put in place in the near-term that are designed to start the initial planning for larger projects and initiatives that will address the impacts of permanent inundation and frequent, high-impact storm surge in the future. In order to properly address this risk, the region needs to make decisions soon to mitigate these near-term impacts and better prepare for long-term impacts.

By 2030, protection measures should be introduced for some of the most vulnerable areas in the region. These protection measures would generally be shoreline-based and provide protection or mitigation to assets and properties directly on the water. Wetlands and bulkheads could be developed in areas where frequent flooding and risk of storm surge is common (New Coastal Protection Infrastructure Strategy), and home raisings (Neighborhood-level Adaptation Measures Strategy) would

continue to be completed in areas not already addressed. Critical facilities, particularly the water treatment plants, will need to be the focus of study and action to protect against near-term impacts (Protect Critical Facilities Strategy). Major economic waterfront facilities like the ferry terminals will also have protection, including bulkheading to protect the assets as well as green infrastructure and nature-based solutions to provide protection for access roadways (Harden and Plan for the Future of Water-Dependent Assets Strategy).

2030 is also a kick-off year for long-term planning, when the region will use the Monmouth County Coastal Resilience Committee to help coordinate and potentially lead efforts to mitigate impacts based on strategies of the Regional Action Plan. The committee will be responsible for taking steps to set the vision for regional resilience that will now be the basis for the long-term planning that is needed (Long-Term Vision and Master Planning for Permanent Inundation). This long-term planning effort will not only have begun to consider the resilience needs of the region, but also will provide a list of specific projects that have been informed by the strategies in the Regional Action Plan. A plan

for how critical facilities will be sustained will be developed (Protect Critical Facilities Strategy), and a detailed benefit-cost analysis will help the region determine whether pump stations and other low-lying critical infrastructure like schools, regional transportation infrastructure, and communications infrastructure should be protected in place or be relocated to low-risk areas. Further long-term resilience planning will continue to be informed by the latest science, and officials working on planning will continue to use the latest sea-level rise guidance for the state.

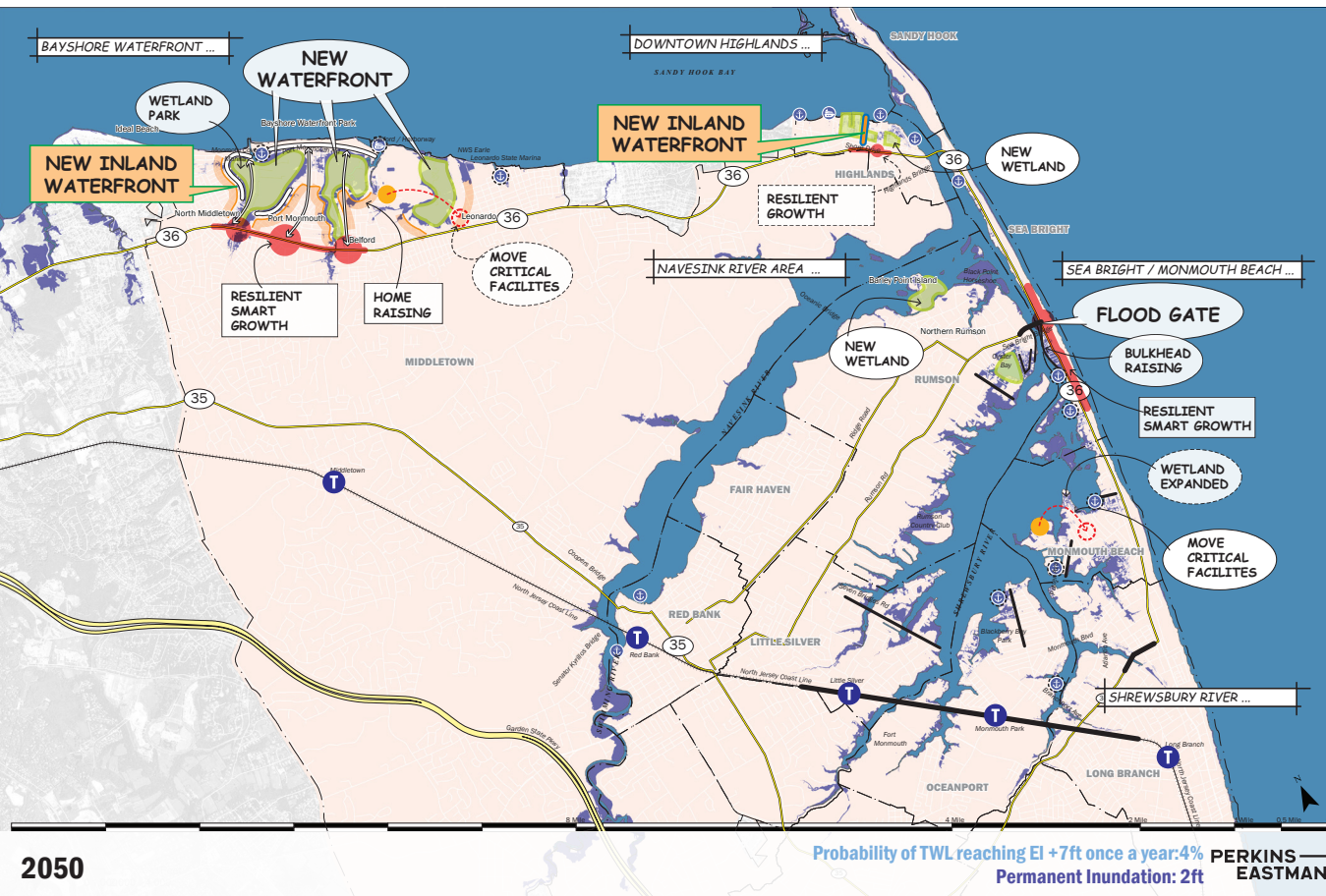


Figure 13. Conceptual scenario - 2050

Note: Floodgate shown at this location for illustrative purposes only. As described in "New Coastal Protection for Infrastructure Strategy" a flood gate would be built in a location that provides the most benefit for the most reasonable cost.

2050 is a pivot year for the region because by this time mitigation and adaptation measures need to be integrated into plans and project development for the region to successfully reduce its risk from sea-level rise and increase storm events.

By this time, sea levels are expected to be 2 feet above 2000 levels, which means there is likely to be a 100% chance that the region will experience an event that results in 3-feet of water at least once a year, a 4% chance of experiencing 7-feet of water, and a 0.2% chance of 12-feet of water. At this time, permanent inundation has impacts in small but populated areas of the region, such as in downtown Highlands, parts of the West Park neighborhood in Rumson, and some of the other low-lying streets in the region. As the end-point of a 30-year mortgage and the end point of our current long-range planning initiatives, 2050 acts as a transition from near-term planning and near-certain risk to a period of long-term planning that carries more uncertainty.

To target long-term risk, the conceptual scenario calls for the expansion of nature-based infrastructure to be a common, encompassing feature of the region's non-ocean-facing shoreline. To account for the large degree of risk located in the Shrewsbury River, the

planning team proposes a storm surge barrier to be built between Rumson and Sea Bright in order to nullify the impacts of large storm surge events, which could result in 7-foot and 12-foot total water levels (New Coastal Protection Infrastructure Strategy). By 2050, the identified critical facilities at risk will be either fully protected from the impacts of storm surge and permanent inundation or planned to be relocated away from areas at risk (Protect Critical Facilities Strategy).

By 2050, the region will have official plans in place to deal with impactful levels of permanent inundation in the long-term, codified through a regional master plan for permanent inundation. The region and its communities will begin to develop adaptation plans that account for permanent inundation of individual assets or neighborhoods and continue to engage in socioeconomic planning to develop specific adaptation, protection, and policies in consideration of the assets, people, and institutions at risk. The region will also begin to implement development plans for residents, businesses, and others who may need to move, and work together to form a vision for a new shoreline that considers the daily impacts of inundation.

2050 is an important year for community officials, property owners, and asset managers to determine the best approach for their individual assets. At this point, community plans and property owners must make a concerted decision for areas that will be impacted by permanent inundation to either protect in place or move away from the water. While planning and protection can leave this option open in the early years, 2050 will become a major decision year in order to adequately account for the mitigation of permanent loss, especially for regional assets.

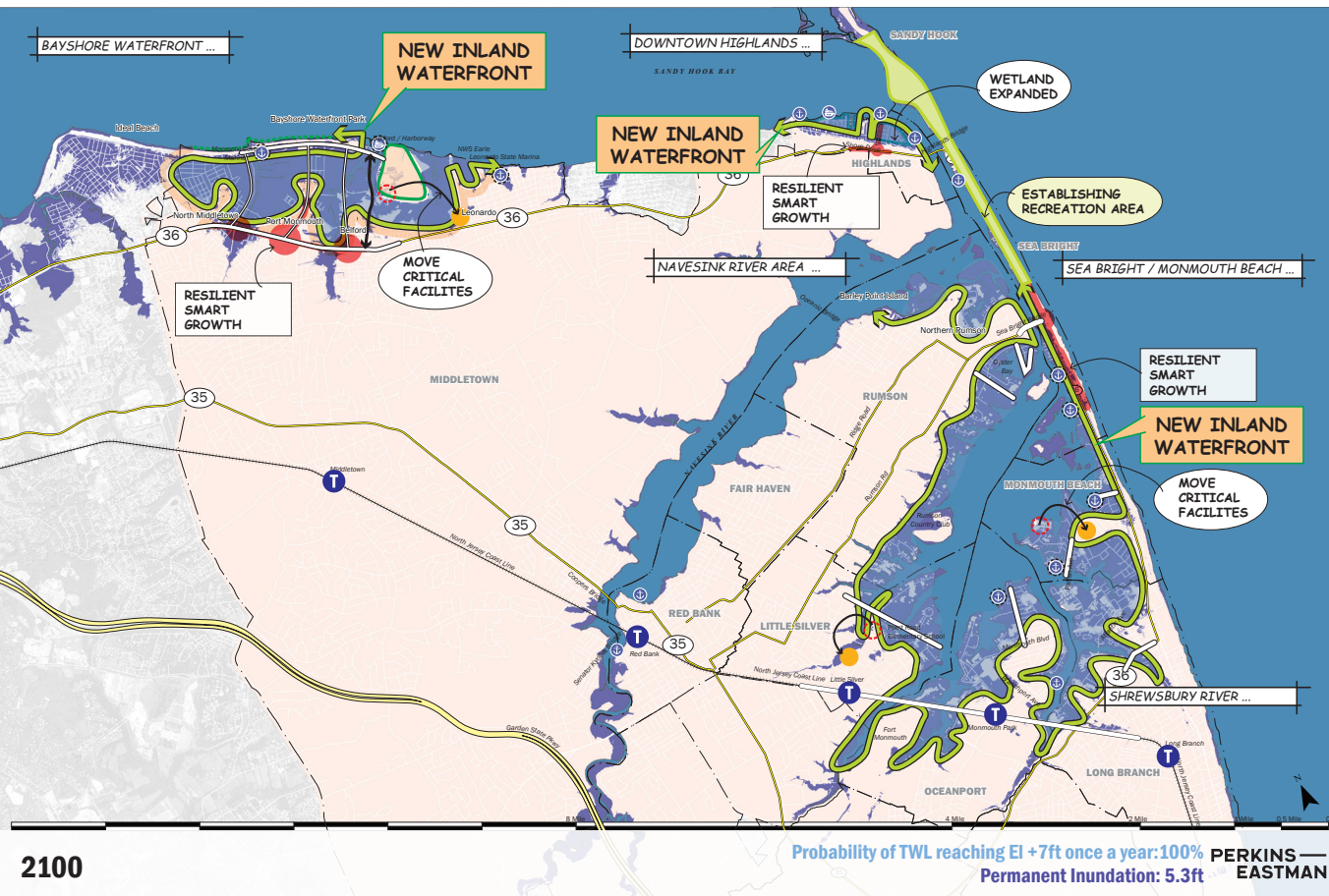


Figure 14. Conceptual scenario - 2100

Note: Floodgate shown at this location for illustrative purposes only. As described in "New Coastal Protection for Infrastructure Strategy" a flood gate would be built in a location that provides the most benefit for the most reasonable cost.

While the level of risk in 2100 is more uncertain than near-term risk, the NJ FRAMES risk assessment analyzes the conservative and plausible scenario for 2100 presented in this project. The Regional Action Plan addresses this risk, which assumes permanent inundation due to 5.3 feet of sea-level rise, a 100% chance that the region will experience 7 feet of water on an annual basis, and a 1% chance it will experience 12 feet of water. To adequately account for this high level of risk, the Regional Action Plan assumes the ongoing operations and maintenance of large projects that were developed around or after 2050, including storm surge protections on shorelines, the storm surge barrier between Rumson and Sea Bright, and the maintenance of levees and storm surge protections on the shoreline in Middletown. By 2100, permanent inundation will have major impacts on the built environment, including in the Shrewsbury River, the bayside of Sea Bright and Monmouth Beach, Downtown Highlands and the Bayshore. The implementation of a long-range vision will adequately account for this inundation through the creation of floodable development, waterfront development in line with the new shoreline, and the further development of open space along the coast.

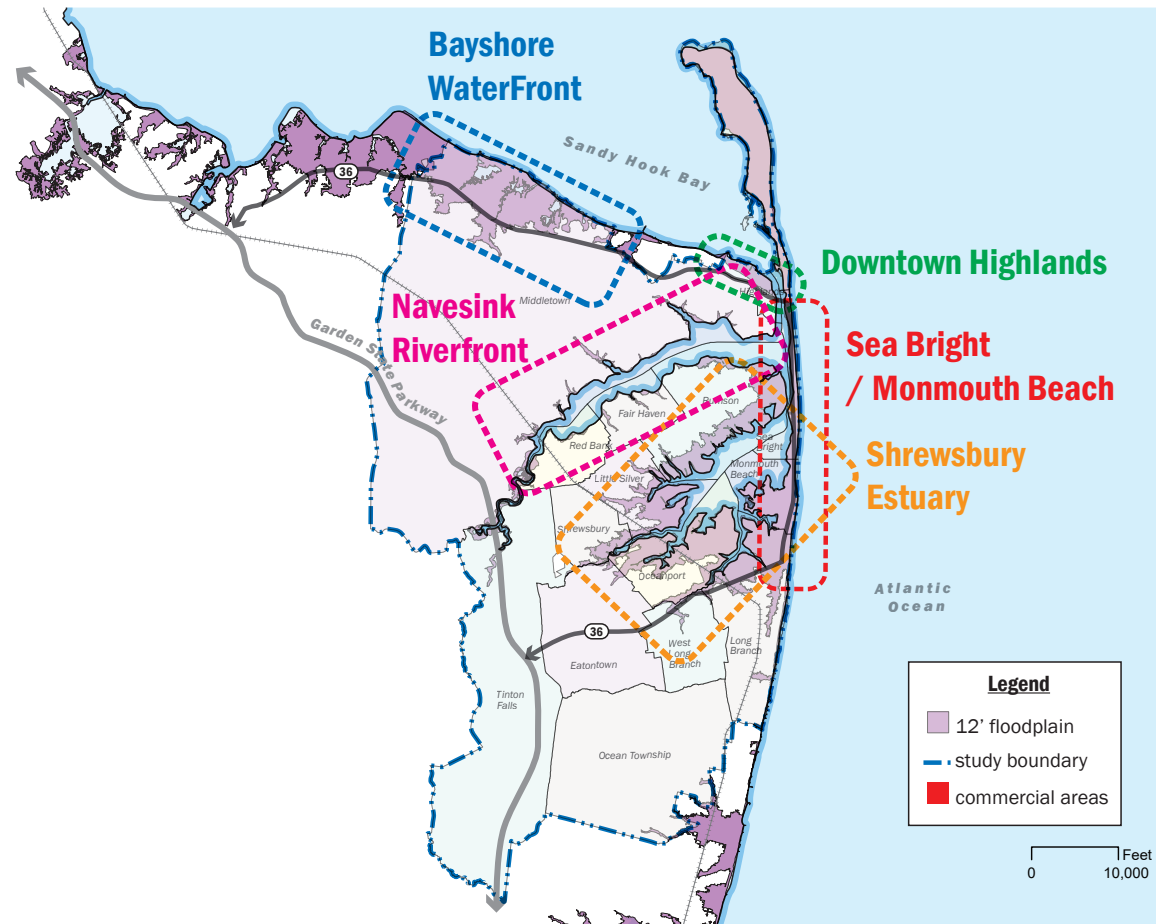
2.4. Conceptual Adaptation Scenario

As previously mentioned “**2.3. The Conceptual Scenario**” described one potential approach to implementing the six strategies. This section will now show specific actions that could be taken consistent with that description and in recognition that the Two Rivers Region is a diverse range of the landscapes, land uses, and demographics.

Taking into account the five primary “at-risk areas”: Bayshore Waterfront, Downtown Highlands, Sea Bright/Monmouth Beach, the Shrewsbury River, and the Navesink River waterfront, it was determined that each area is characterized by:

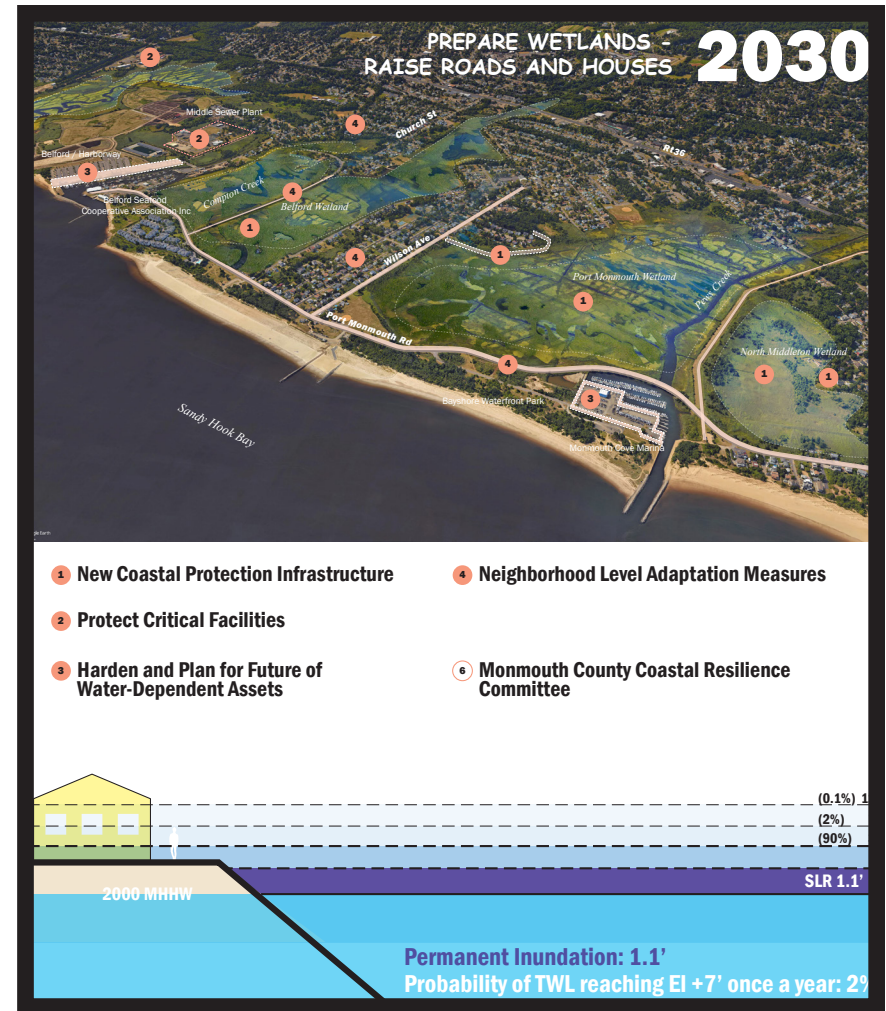
1. Its own distinct landscape, character, land use patterns, and vulnerabilities.
2. A size that is relevant on a regional scale.
3. Distinct types of challenges related to sea-level rise and climate change.
4. Vulnerabilities in different sectors that are interrelated.
5. Trends that may help provide an understanding of risks for the region at large.

These Characteristics were considered in development of the following Conceptual Adaptation Scenario.



2.4.1. Bayshore Waterfront

The Bayshore Waterfront encompasses four waterfront communities within Middletown Township; North Middletown, Port Monmouth, Belford, and Leonardo. Salt marshes, shrub lands, tidal creeks, and dunes characterize the area's landscape. The shoreline is a combination of beaches, marshes and shrub lands that are largely under private ownership, with the exception of the Leonardo State Marina. The main problems to be addressed include fortifying transportation and economic development infrastructure such as ferry terminals and marinas, protecting and enhancing salt marshes, beaches, and other natural resources important to the functioning of the area's coastal protection systems, and addressing the exposure of privately owned lots.



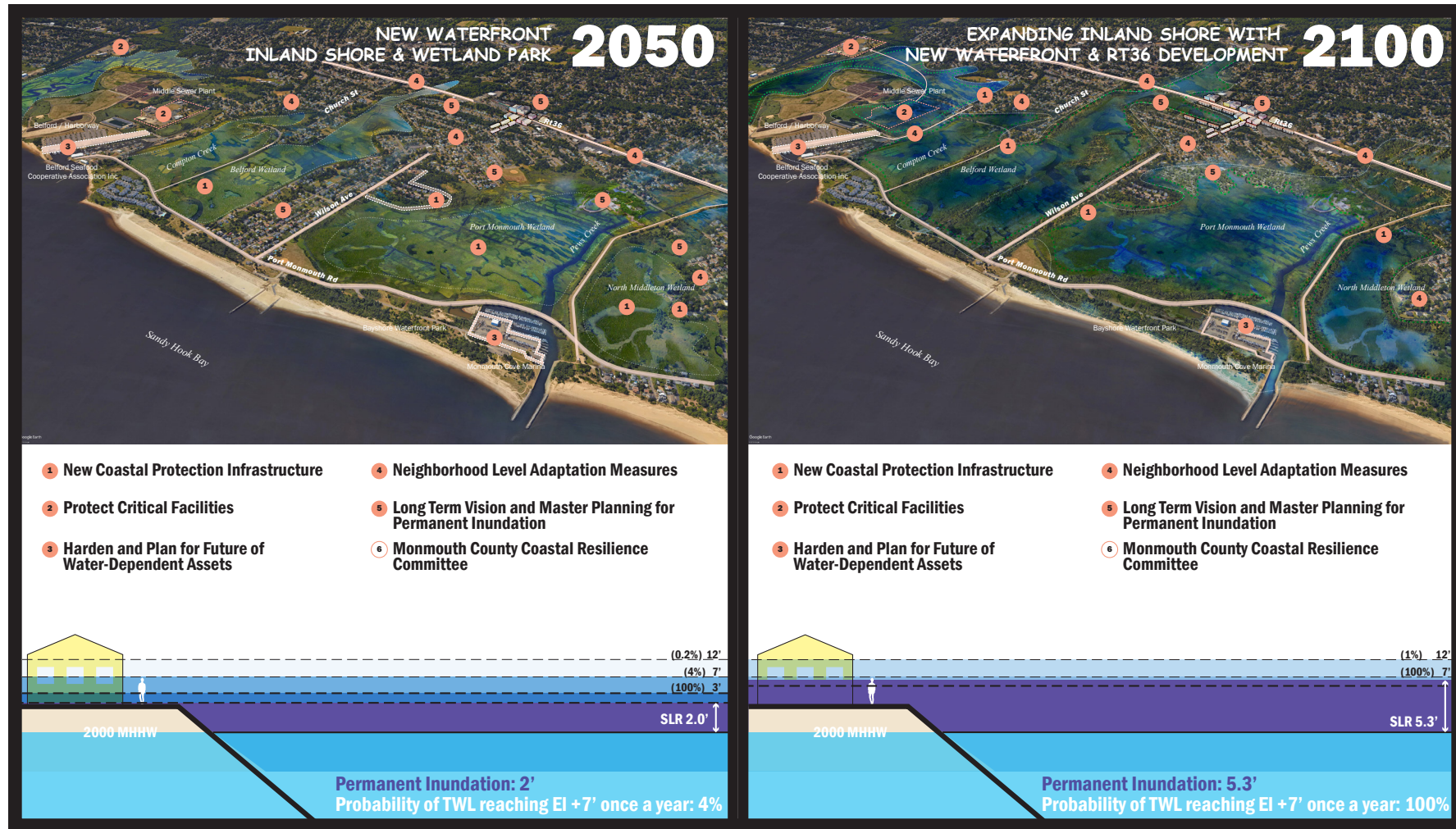
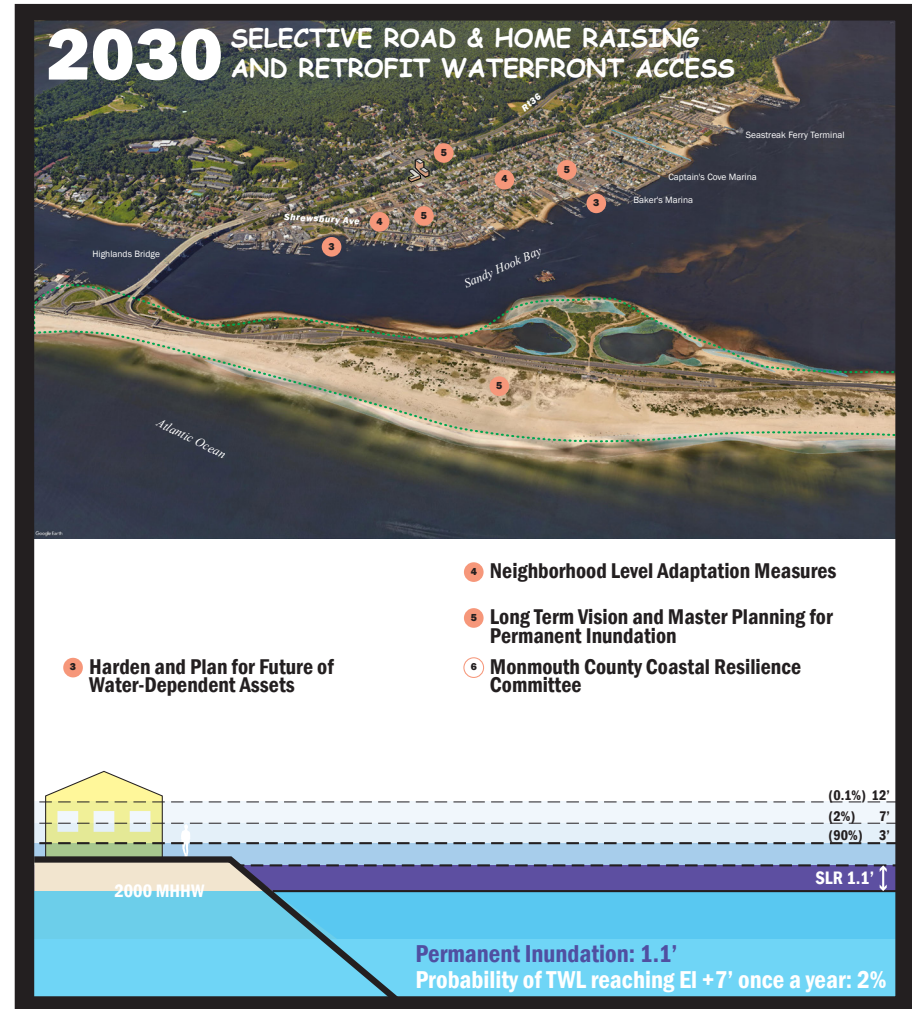


Figure 15. Conceptual Adaptation Scenario - Bayshore Waterfront

2.4.2. Downtown Highland

Located at the “pinch-point” of Sandy Hook Bay, Downtown Highlands has the highest level of vulnerability of any community in the Two Rivers Region. It sits at the south-east end of the low-lying coastal plain occupied by the Bayshore Waterfront, but is backed up against the Highlands bluffs. As the densest community within the region, Downtown Highlands was also the most impacted area during Hurricane Sandy. Approximately 1,200 houses were lost; of these, 400 have been raised. Private houses, beaches, marinas, ferry terminals, and parks dominate Downtown Highland’s shoreline conditions.

The main problems to be addressed include addressing the exposure to the ocean of privately owned lots, fortifying the stormwater and sewer infrastructure systems, and protection of marinas and Seastreak Ferry Terminal. Solutions and flood protection projects have been proposed by the US Army Corps of Engineers, but initial community reaction has been negative.



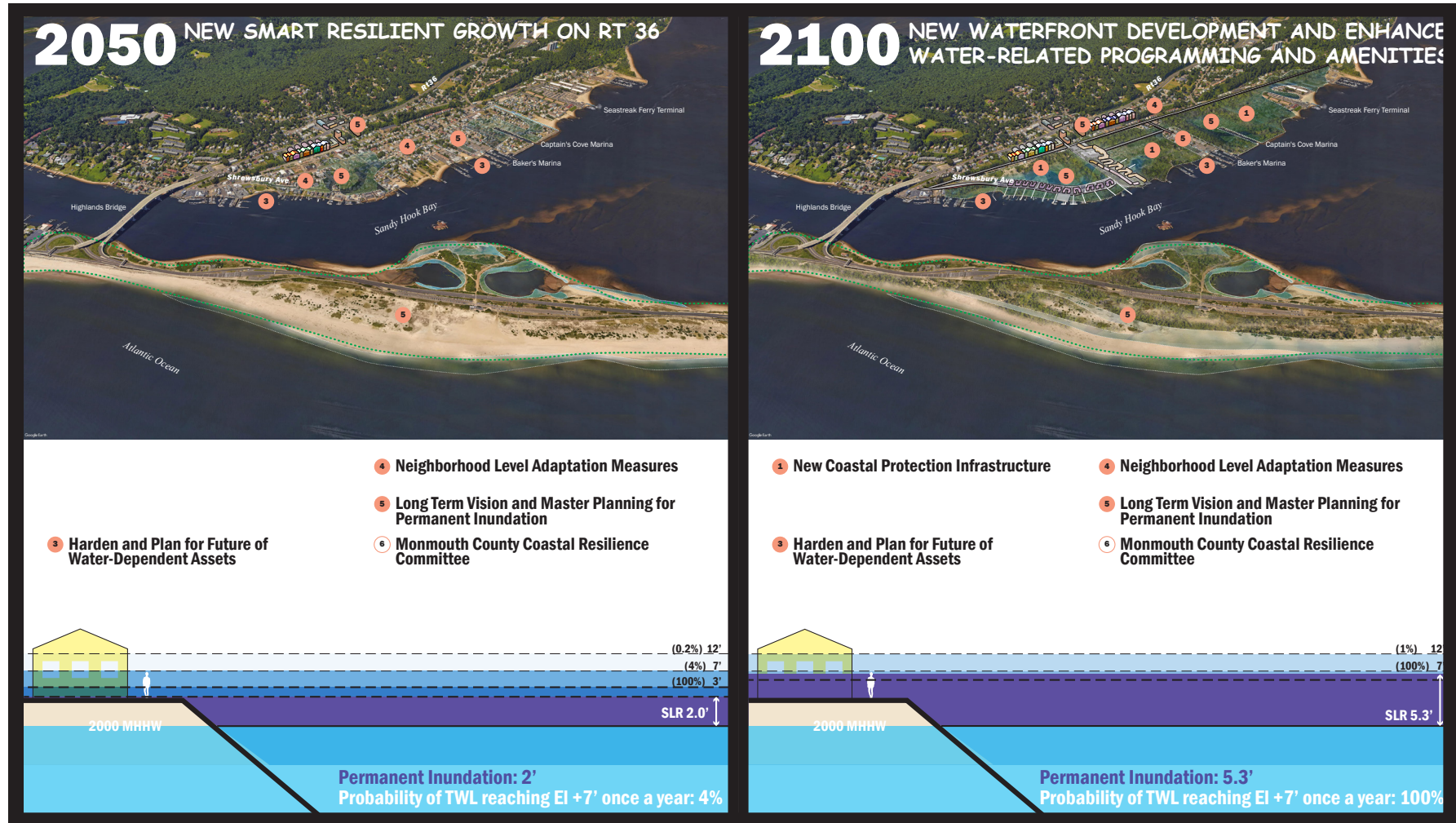
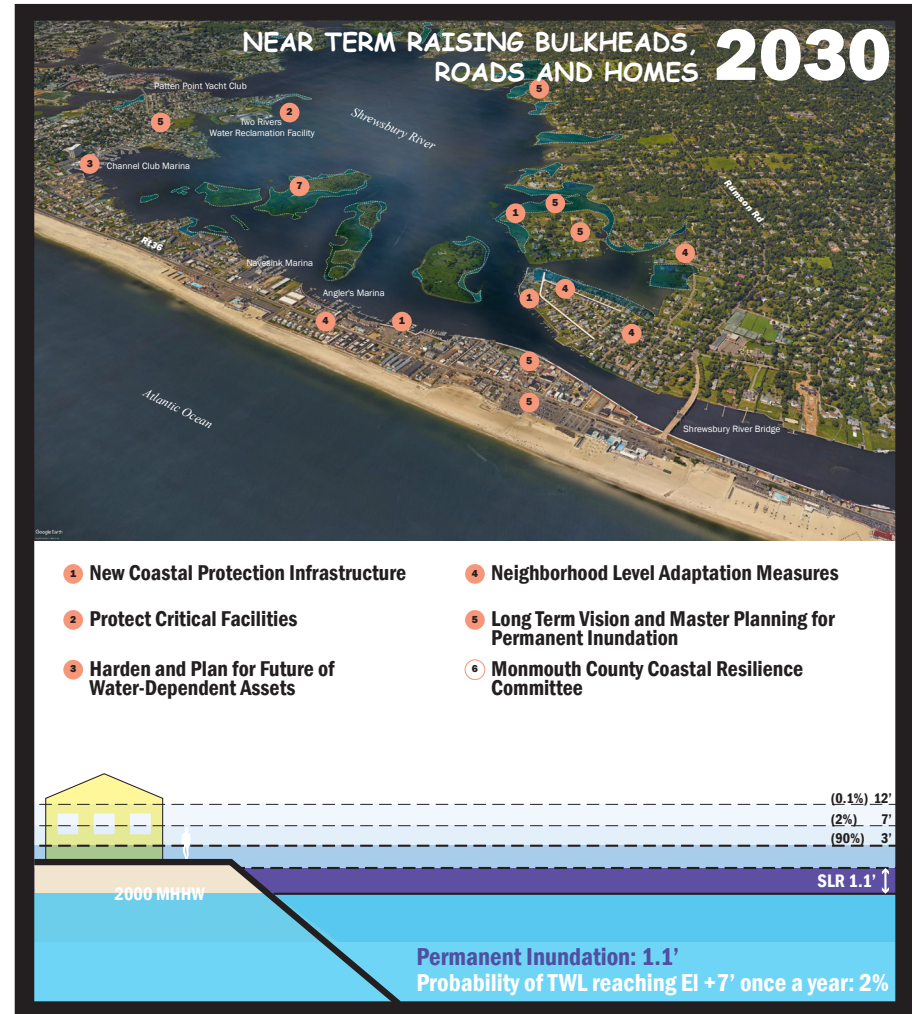


Figure 16. Conceptual Adaptation Scenario - Downtown Highland

2.4.3. Shrewsbury River, Sea Bright / Monmouth Beach

The Shrewsbury River area is composed of the boroughs of Rumson, Little Silver, Shrewsbury, and Oceanport. The landscape is characterized by wetlands and vegetated zones on the riverfront. The shoreline is primarily residential, interspersed with a few river clubs, parks, and marinas. The area's most significant economic development asset is Fort Monmouth. It is envisioned to become a hub of economic and community activity, including the McAfee Complex, a 50-acre innovation campus. Plans to address Fort Monmouth's resiliency are to be determined.

Sea Bright / Monmouth Beach occupies a barrier island at the mouth of the Shrewsbury River Estuary. Beaches on the ocean side and a few islands and wetlands on the bay side characterize the landscape. Housing in the two towns is primarily comprised of single-family homes. Marinas and beach clubs make up the area's chief economic assets. One of the most critical infrastructure assets in these areas is the Two River Water Reclamation Authority, which serves the communities of Eatontown, Fair Haven, Little Silver, Monmouth Beach, Oceanport, Red Bank, Rumson, Tinton Falls, and West Long Branch, but sits in a low-lying area. Bay side flooding is exacerbated by the stormwater system.



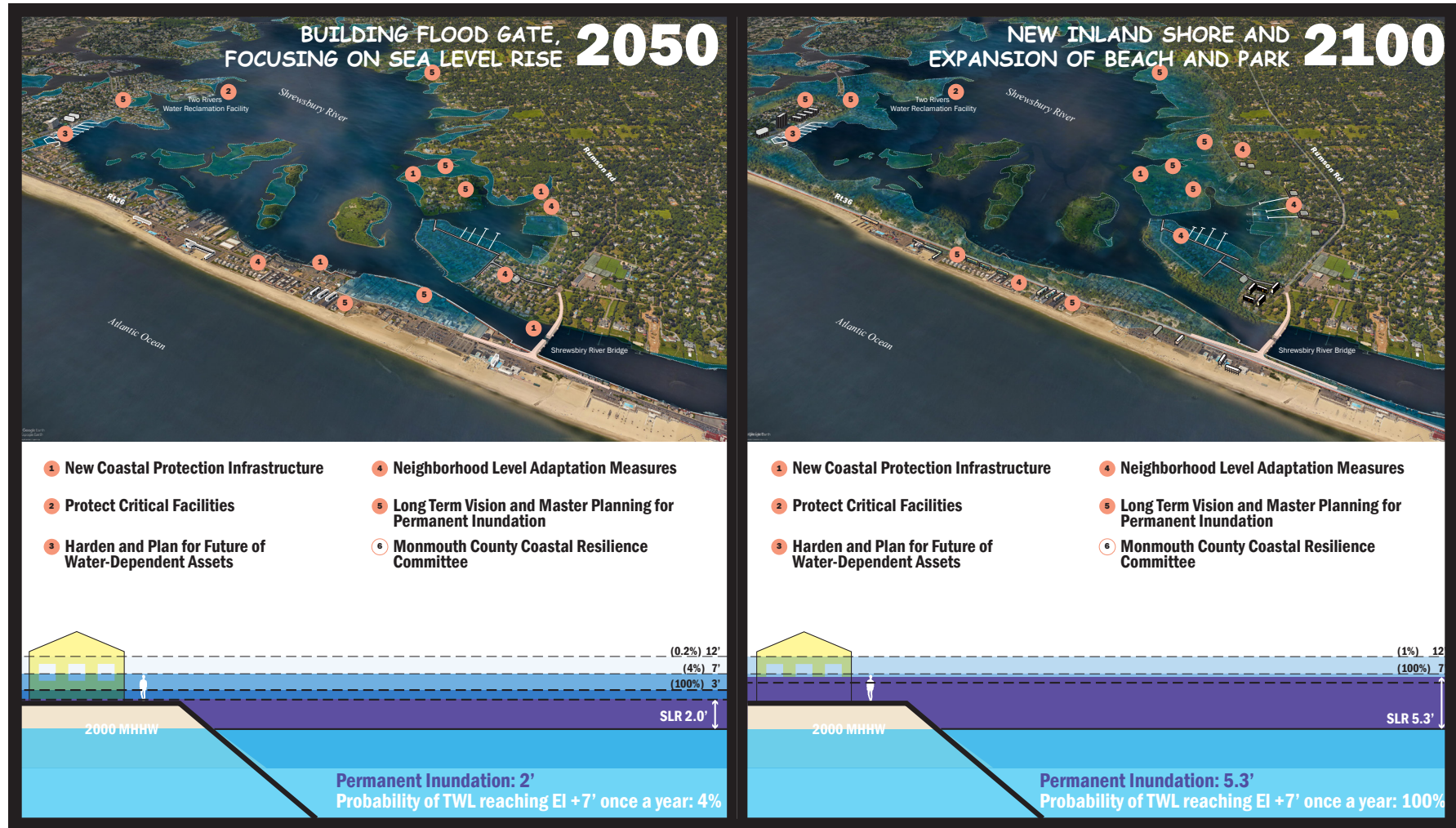


Figure 17. Conceptual Adaptation Scenario - Shrewsbury River, Sea Bright / Monmouth Beach

3.0. CONCLUSION

The Regional Action Plan provides a framework for incorporating regional resilience in the Two Rivers region's current and long-term planning processes. The six strategies present potential actions that promote resilience through adaptation, protection, and transition-based approaches. The strategies are intended to be modified or combined with the future realities of the region depending on realized risk or changes in governance.

While the Regional Action Plan provides a framework for the next 80 years, it is important to launch immediate next steps that begin to implement the six strategies and increase overall regional resilience. Table 14 lists the steps recommended by the planning team that can begin in 2020 for implementation of the Regional Action Plan.

Table 13. Next Steps and Recommendations

	Recommendation	Start Date	Potential Implementers	Time to Completion	Other stakeholders
1	A team of county leaders and select municipal and non-profit and academic leaders determine the roles and responsibilities of the Monmouth County Coastal Resilience Committee	January 2020	Monmouth County Planning, Two River Council of Mayors	1 year	Current stakeholder members
2	Coordination with wastewater and sewage treatment plants to understand risk and development plans	Spring 2020	Municipal officials, Two Rivers Council of Mayors	Ongoing	Sewer/wastewater customers beyond the Two Rivers region
3	Presentation of regional strategies for consideration in USACE project planning and feasibility studies	2020	County, NJDEP Coastal Engineering	Ongoing	USACE, Baykeeper, American Littoral Society, waterfront residents and building owners
4	Consideration of regional strategies for residential, commercial, and open space development (enforceable by planning boards and municipality/county plans)	2020	County, municipal leaders	Ongoing	Waterfront property and asset owners
5	Adaptation of progressive home-raising measures for each municipality	2020	Municipal leaders and zoning boards	Ongoing	Individual residential property owners
6	Coordination with regional transportation entities to understand long-term risk	2020	Monmouth County Office of Emergency Management, Monmouth County Planning	Ongoing	NJ Department of Transportation, Monmouth County Engineering, New Jersey Transit, municipal leaders

List of Figures

Figure 1. Two Rivers Region.....	4
Figure 2. Flood Levels and Permanent Inundation: 2030.....	12
Figure 3. Total Water Level.....	13
Figure 4. Flood Levels and Permanent Inundation: 2050.....	14
Figure 5. Flood Levels and Permanent Inundation: 2100.....	16
Figure 6. Suggested storm-surge barrier along the part of the river	30
Figure 7. Protecting Middletown.....	38
Figure 8. Monmouth Cove Marina, 2020.....	43
Figure 9. Protecting Monmouth Cove Marina, 2030.....	44
Figure 10. Raising homes and targeted roadways.....	50
Figure 11. Long-term Route 36 Commercial Corridor Sustainable Development Plan	56
Figure 12. Conceptual scenario - 2050.....	64
Figure 13. Conceptual scenario - 2050.....	66
Figure 14. Conceptual scenario - 2100.....	68
Figure 15. Conceptual Adaptation Scenario - Bayshore Waterfront.....	71
Figure 16. Conceptual Adaptation Scenario - Downtown Highland.....	73
Figure 17. Conceptual Adaptation Scenario - Shrewsbury River, Sea Bright / Monmouth Beach.....	75

List of Tables

Table 1.No Action Risk Assessment–Summary of Monetized Impacts.....	15
Table 2.New Coastal Protection Infrastructure Strategy: Planning and Development Initiatives.....	36
Table 3.New Coastal Protection Infrastructure Strategy: Potential Funding Sources	37
Table 4.Protect Critical Facilities Strategy: Planning and Development Initiatives	42
Table 5.Protect Critical Facilities Strategy: Potential Funding Sources.....	42
Table 6.Water-dependent Asset Strategy: Potential Funding Sources.....	47
Table 7. Water-dependent Asset Strategy: Applicable Planning and Development Initiatives.....	48
Table 8.Neighborhood-level Adaptation Measures Strategy: Planning and Development Initiatives.....	52
Table 9.Neighborhood-level Adaptation Measures Strategy: Potential Funding Sources.....	52
Table 10.Long-term Vision and Master Planning for Permanent Inundation Strategy: Planning and Development Initiatives.....	57
Table 11.Long-term Vision and Master Planning for Permanent Inundation Strategy: Potential Funding Sources.....	58
Table 12.Strategy Components and Planning and Development Initiatives.....	62
Table 13.Next Steps and Recommendations.....	76

List of Appendices (Available Electronically Online)

Appendix A:	Community Goals
Appendix B:	Enhanced Conceptual Scenario Visualizations
Appendix C:	Full Methodology for Water Levels
Appendix D:	Methodology for Baseline Risk Assessment
Appendix E:	NJ FRAMES No Action Risk Assessment 2019 Update
	E.1. August 2018 Assessment of Planning Event Frequencies
	E.2. August 2018 Population Projection

<https://www.nj.gov/dep/bcrp/njframes.html>

Acronyms and Abbreviations

ANJEC	Association of New Jersey Environmental Commissions
Bayshore	Sandy Hook Bayshore
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
MHHW	Mean Higher High Water
NAVD88	North American Vertical Datum of 1988
NJDEP	New Jersey Department of Environmental Protection
NJ FRAMES	New Jersey Fostering Regional Adaptation through Municipal Economic Scenarios
NOAA	National Oceanic and Atmospheric Administration
NWS	Naval Weapons Station
Regional Action Plan	Two Rivers Regional Resilience Adaptation Action Plan
USACE	U.S. Army Corps of Army Engineers
USD	U.S. Dollar
USDOT	U.S. Department of Transportation