Suffolk County Coastal Resilience

Memorandum

July 2024

Submitted to:
Suffolk County
Economic Development and Planning

Submitted by:
WSP USA Inc.

SUFFOLK COUNTY COASTAL RESILIENCE MEMORANDUM

Enhancing Coastal Resilience

Contents

EXECUTIVE SUMMARY

This memorandum presents a framework for coastal resilience in Suffolk County, which requires principles that address current and future flood risk and strategies that protect existing land uses and built and natural assets. The Suffolk County Coastal Resilience framework seeks to protect people, public health, and physical assets (both built and natural) while meeting County-wide goals and service objectives efficiently and effectively. The ultimate legacy of the memorandum will be the long-term benefits brought to the County's communities, charting a course for economic prosperity that is consistent with the social, environmental, and quality-of-life goals that make Suffolk County a great place to live, work, and play.

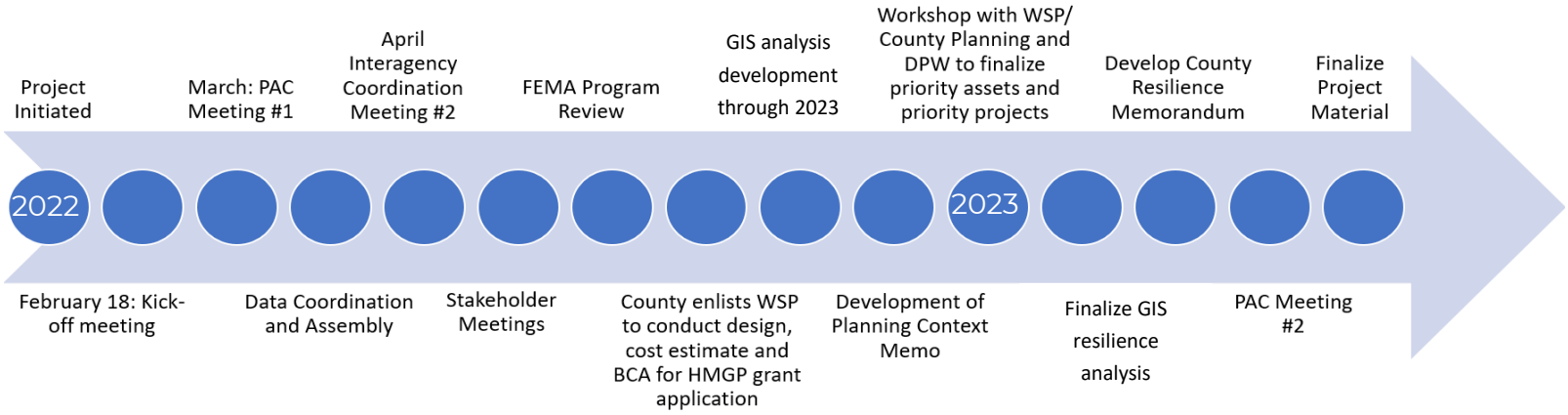
In 2012, Superstorm Sandy made landfall and caused significant damage to residential structures, businesses, and infrastructure across Suffolk County and its nearly 1,000-mile coastline. Since then, several studies and reports have been published that assess the County's vulnerabilities including the Suffolk County Hazard Mitigation Plan and Superstorm Sandy Review Task Force Report. The Suffolk County Coastal Resilience Memorandum builds off prior reports and studies to identify priority County assets that are vulnerable to coastal flooding, categorize relative risk, develop a prioritization framework, and identify strategies to improve resiliency for priority County assets.

The project team analyzed 24,000 county-owned sites, 2,200 of which were found to be at risk of coastal flooding. Out of these thousands of sites, prioritization scores were calculated based on the relative levels of risk. The team worked with county experts to identify 25 priority at-risk sites based on the prioritization scores, 10 of which were selected as highest-priority and three of which progressed through concept development and benefit cost analyses.

The memorandum provides project strategies, developed in partnership with stakeholders including the Department of Public Works and the Department of Parks and Recreation, to increase resilience at the identified priority Suffolk County assets. These project strategies reflect actions that the County can take and potential actions for municipalities, non-profits, and the State of New York. This type of cross-sector collective action will be critical to developing a resilient Suffolk County. The strategies included in this report provide a basis for developing additional resilience projects across the identified priority sites that are compatible with future grant applications and capital planning, programming, and funding.

PROJECT DEVELOPMENT

Over the course of the project, the Suffolk County Department of Economic Development & Planning worked with a group of stakeholders and conducted several public meetings. Project milestones are depicted in the timeline below:



REVIEW OF PAST INITIATIVES

As a basis for the memorandum, and to build upon the extensive resilience and hazard mitigation work already conducted by Suffolk County, the project team reviewed past work, including:

- 2022 Suffolk County Department of Fire, Rescue and Emergency Services Report
- 2020 Suffolk County All-Hazards Mitigation Plan
- 2020 Climate Smart Communities Certification Report
- 2019 Superstorm Sandy Review Task Force
- 2015 Suffolk County Climate Action Plan
- 2015 Suffolk County Comprehensive Master Plan 2035

A summary of the findings from each of these reports can be found in the Appendix. These documents, combined with institutional knowledge, stakeholder and public feedback, and new analysis, informed the assessment of future risk levels for each asset.

PROJECT OUTREACH, MEETINGS, AND COORDINATION

The project included two meetings with a Planning Advisory Committee (PAC), summaries from which can be found in the Appendix, and were comprised of key stakeholders including:

1. Babylon DEC
2. Citizens Campaign for the Environment
3. Cornell Cooperative
4. Defend H_2O
5. Fire Island National Seashore
6. First Coastal
7. Legislature District 1
8. Legislature District 2
9. Long Island Regional Planning Council
10. NAACP
11. New York State Department of Environmental Conservation
12. New York State Department of State

13. New York State Department of Transportation
14. Peconic Estuary Partnership
15. Peconic Land Trust
16. Presiding Officer, Suffolk County Legislature
17. Save the Great South Bay
18. Shinnecock Nation
19. SMPIL Consulting, Ltd., Native Plantings
20. South Shore Estuary Reserve
21. Suffolk County Department of Parks and Recreation
22. Suffolk County Department of Public Works
23. Suffolk County Village Officials Association
24. SUNY Stony Brook, SoMAS
25. Superstorm Sandy Task Force
26. The Nature Conservancy
27. Town of Babylon
28. Town of Brookhaven
29. Town of East Hampton
30. Town of Huntington
31. Town of Islip
32. Town of Riverhead
33. Town of Smithtown
34. Town of Southampton
35. Town of Southold
36. United States Army Corps of Engineers
37. United States Geological Survey, Long Island Program Office

In addition to the PAC meetings, the project included targeted interagency coordination meetings throughout the project with the Suffolk County Legislature, Suffolk County Department of Economic Development and Planning, Suffolk County Department of Parks and Recreation, and Suffolk County Department of Public Works. These meetings were held at critical project milestones to inform development of the priority assets list and development of the Hazard Mitigation Grant Program (HMGP) grant application for the wetland restoration projects at Scully Marsh, Islip Preserve and Cupsogue Beach Marsh.

METHODOLOGY & ANALYSIS

The memorandum is predicated on the need to improve the resilience of County-owned assets that are vulnerable to storm surge and sunny day flooding. The goal of the analysis was to identify priority County coastal assets to progress forward to concept design and funding allocation. To achieve this goal, the project team obtained a comprehensive list of 24,000 County-owned parcels representing parks, roads, and other assets. The parcel data analyzed included land use codes and descriptions, upon which the project team created filters to narrow down the list to assets most critical to the safety and quality-of-life of County residents, businesses, and visitors. Vacant parcels, residential land parcels, and other non-critical land uses such as golf courses were removed from consideration.

Additional GIS datasets relevant to a climate vulnerability assessment were then applied to further narrow the list down to priority assets. This analysis included storm surge, tidal flooding, and sea level rise data analyzed for County-owned assets using local and federal climate hazard datasets. This analysis identified the County-owned assets most vulnerable to coastal flooding and provided the basis for identifying and prioritizing at-risk assets.

Both current and future flood risk were analyzed under 15 scenarios from monthly tidal flooding to 1% annual chance storm events (100-year storm events) throughout the 21st century. Tidal flooding, or the inundation of normally dry land areas due to rising sea levels, also known as sunny-day flooding, was analyzed for 30-, 60-, and 90-day inundation intervals for three analysis time periods centered around 2025, 2055, and 2085 based on a New York State Energy Research & Development Authority (NYSERDA) study on marsh degradation. This data is comprised of Sea Level Affecting Marshes Model (SLAMM) projections for tidal flooding inundation as well as 10-year (10% annual chance) and 100-year (1% annual chance) storm inundation.[1] The combined risk of tidal flooding and storm surge throughout the county is depicted in Figure 1 and Figure 2. The sea level rise data used was the medium projection scenario from the New York Codes, Rules, and Regulations (NYCRR) Part 490 projections (see Table 1), which estimates that sea levels will rise by nearly three feet by 2100 in Long Island.[2] Proximity to the coastline and the presence of full or partial protective features were also factored into the prioritization rankings.

Table 1. NYCRR Part 490 sea level rise projections for the Long Island Region.

Time Interval	Low Projection	Low-Medium Projection	Medium Projection	High-Medium Projection	High Projection
2020s	2 inches	4 inches	6 inches	8 inches	10 inches
2050s	8 inches	11 inches	16 inches	21 inches	30 inches
2080s	13 inches	18 inches	29 inches	39 inches	58 inches
2100	15 inches	21 inches	34 inches	47 inches	72 inches

After undergoing this analysis, 2,200 at-risk parcels were identified as susceptible to coastal flooding out of the total original 24,000 County-owned parcels included in the dataset. The 2,200 County-owned parcels were sorted into the assets they represented, such as particular roadways, marshlands, county facility campuses, parks, bridges, public safety facilities and community service/utility facilities. These assets were then assigned risk categories based on climate hazard metric vulnerability.

The prioritized asset list was further refined based on several additional factors: criticality of the asset, replicability of potential solutions, and viability of integrating nature-based solutions. Assets were then prioritized based on input from the Department of Public Works and the Department of Parks and Recreation, including considerations of project readiness and value of the assets to the surrounding community.

This categorization narrowed the list of assets of concern down to a few hundred. Based on prioritization scores, community necessity, and discussions with the County and stakeholders, 25 priority assets were selected as high-risk. Ten of these assets were further selected as the most high-impact or high-priority.

[1] https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Research/Environmental/18-04-Integrating-SLAMM-Results-Marsh-Adaptation-Strategies.pdf
[2] https://www.dec.ny.gov/regulations/103877.html

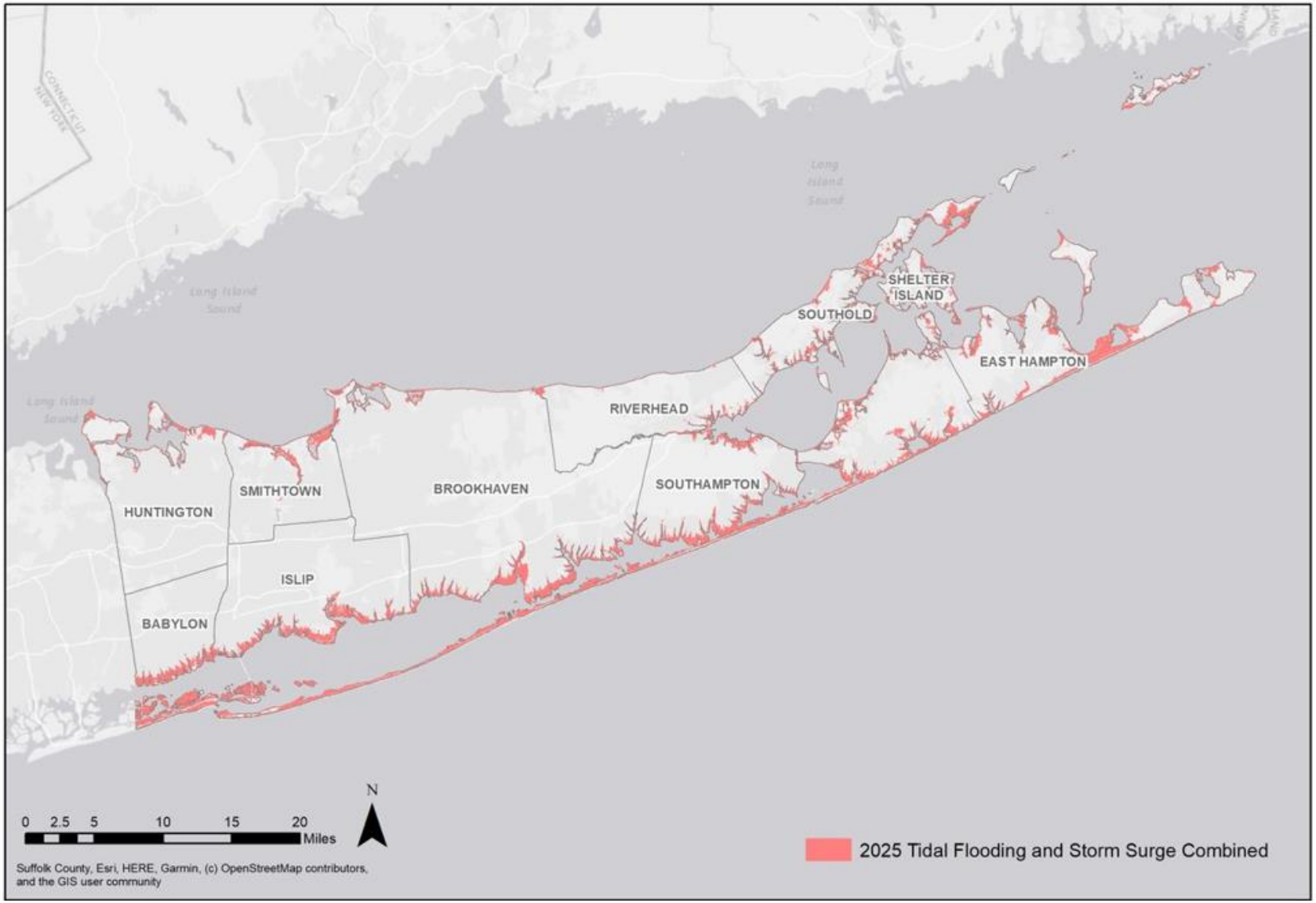


Figure 1. Map of tidal flooding and storm surge throughout the project area in 2025.

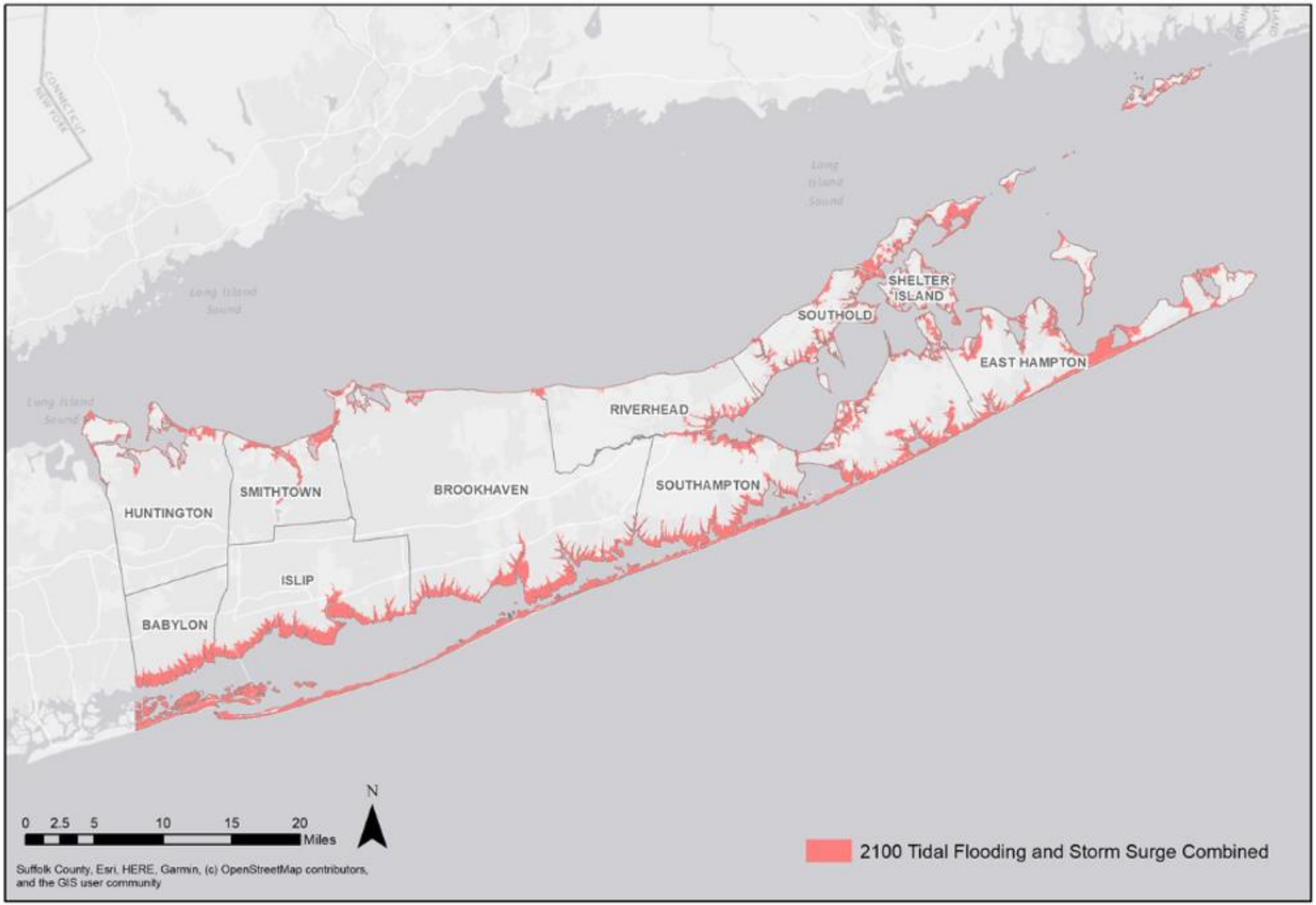


Figure 2. Map of tidal flooding and storm surge throughout the project area in 2100.

PRIORITY ASSETS AND STRATEGIES

Priorities are listed numerically for reference. Other than the distinction between the top 10 and additional 15 priority sites, the list is not presented in order of priority or vulnerability. Four classifications were included in the final prioritized list: assets, parks, roadways, and wetlands. Table 2 lists the priorities identified and Figure 5 shows the locations of the priorities. Specific risk levels of each priority can be found in the Appendix.

Table 2. List of priority sites identified. Numbers do not imply relative priority and are for location identification and tracking purposes only.

Priority Asset Ref Number	Priority Asset Name	Classification
1	Bergen Point Wastewater Treatment Plant – Gas & Electric	Asset
2	Bergen Point Wastewater Treatment Plant – Pumping	Asset
3	Cupsogue Beach County Park	Park
4	Cupsogue Beach Marsh	Wetland
5	County Road 46 – William Floyd Parkway	Roadway
6	County Road 48 – Middle Road/North Road	Roadway
7	County Road 60 – Noyack-Long Beach Road/Short Beach Road	Roadway
8	Scully Marsh	Wetland
9	Islip Preserve	Wetland
10	Shinnecock East, Southampton	Park
11	Corey Creek West	Wetland
12	Corey Creek East	Wetland
13	County Road 32 - Ponquogue Bridge	Roadway
14	County Road 63 – Lake Avenue	Roadway
15	County Road 65 – Middle Rd/Atlantic Ave/Weeks St/River Ave	Roadway
16	County Road 80 – Montauk Highway	Roadway
17	County Road 96 – Bergen Avenue	Roadway

18	Goldsmith's Inlet, Peconic	Park
19	Hubbard County Park West	Wetland
20	Mansion at Timber Point	Park
21	Indian Island, Riverhead	Park
22	Meschutt Beach, Hampton Bays	Park
23	Peconic River Shoreline and Wetland Restoration West	Wetland
24	Shinnecock Canal Powerhouse and Pumphouse	Asset
25	Suffolk County Police Dept. Marine Bureau	Asset

The four types of assets – wetlands, parks, assets, and roadways – each have different recommended strategies to improve resilience. These strategies are summarized in Table 3 and categorized by potential cost, responsible agencies, prospective grants, and more in Table 4. Grants are further explored in the Next Steps section of this report.

For wetlands like Cupsogue Beach Marsh, Islip Preserve, and Scully Marsh, restoration projects, once completed, will significantly reduce damage from flood events by attenuating wave action. Hazard Mitigation Grant Program (HMGP) applications have been submitted for all three of these sites. Without action, these sites will continue to deteriorate and provide little to no future benefit beyond 2050 for attenuating wave action during a storm event. However, with action, a healthy wetland will continue to thrive in perpetuity, adapting to sea level rise over time. These projects will also result in several other ecological benefits that accompany a fully functioning and restored marsh. These benefits include the establishment of healthy, diverse plant and wildlife habitat and natural mosquito control, reducing the need to apply pesticides in the marsh. These benefits are consistent with Suffolk County's long-term wetlands management plan.

For parks like Cupsogue Beach County Park and Shinnecock East Park in Southampton, nature-based solutions can be effective at building resilience to flooding. Groins perpendicular to the tidal flow can mitigate damage to parks, including infrastructure and access roads, and preserve beach areas by limiting erosion. Living shorelines have also proven to be effective at mitigating the impacts of erosion and preventing infrastructure loss.

For assets like the Bergen Point Wastewater Treatment Plant Pumping and Gas & Electric facilities, drainage improvements provide innovative solutions to protect vulnerable coastal sites. In order to most effectively develop specific plans for these solutions, detailed assessments should be conducted to ensure proper placement. Infrastructure improvements can provide vital protections to residents, businesses, and critical facilities, including things like stormwater pump stations, automated tide gates, and canal deepening and widening to alleviate flooding. These strategies were successfully implemented in the Federal Emergency Management Agency (FEMA) Eastern Shore Drive Drainage Improvement Project.[3] Located in a coastal community in Virginia Beach, Virginia with

[3] https://www.fema.gov/case-study/virginia-beach-virginia

several protected natural resources, this project implemented a variety of infrastructure, nature-based, and community outreach and education solutions to improve resilience against worsening chronic flooding, similar to the hazards faced in Suffolk County (see Figure 3).

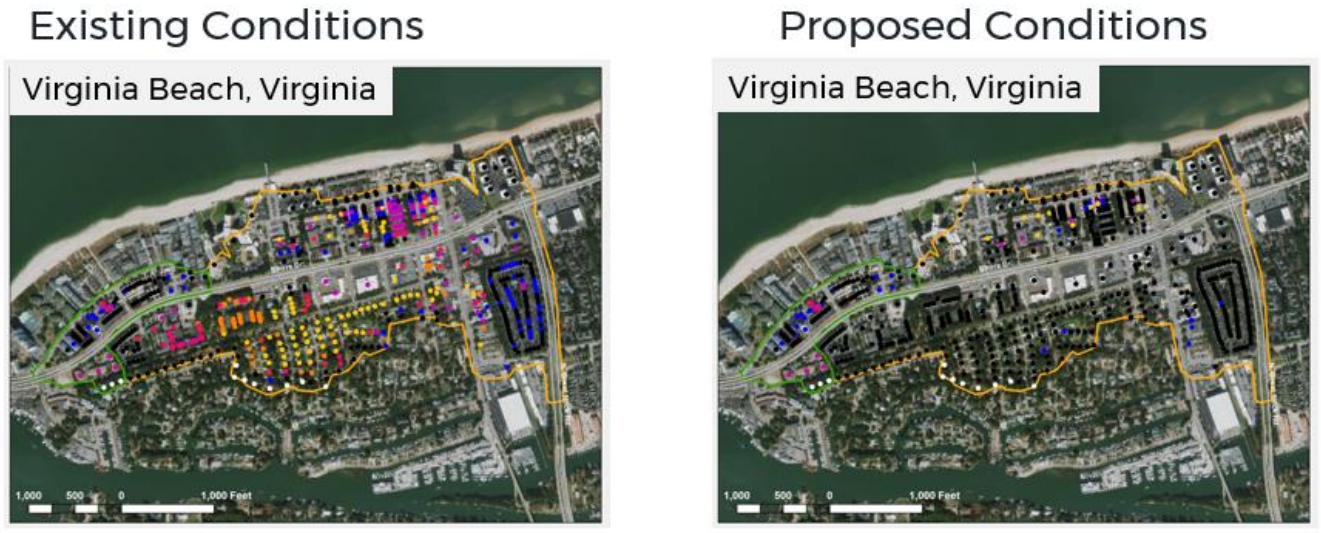


Figure 3. FEMA Virginia Eastern Shore Drive Drainage Improvement Project. For roadways like County Roads 46, 48, and 60, raising the roadways and implementing living shorelines can be very effective resilience strategies.

Nature-based solutions can have a significant impact, demonstrated in projects like the Tallahassee, Florida, living shoreline in Franklin County, which is being developed as part of the Franklin-98 project.[4] This project includes the establishment of nearshore reefs which will reduce wave energy and allow the creation of salt marshes to protect miles of shoreline and critical roadway segments. Another example of a relevant project is the Twin Lakes, FL subdivision Sea Level Rise Roadway and Drainage Pilot Project, which will construct a "pump and treat" stormwater drainage system and elevate roads.[5] This project includes drainage structures, a pollution treatment device, an elevated pump station with a backup emergency generator, pumps, piping, electrical controls, instrumentation, and injection well(s) for the final disposal of treated stormwater. For this project, the drainage infrastructure and pump station equipment designs require installation of three phases of electrical power to the right of way. Groundwater drainage systems can also be updated as sea levels rise. Gravity-based groundwater systems are designed to funnel stormwater in streets and lawns into stormwater drains which flow into nearby waterbodies through underground pipes. However, if the outflow of the pipe is no longer above sea level rise, ocean water can force its way up the underground pipes and cause flooding, leaving no additional drainage options for stormwater.

When thinking through prioritization for implementation, each type of asset should be evaluated separately given the differences in function, form, and impact of the four groups as well as the benefits of action, though there are

[4] https://www.arpc.org/franklin-98
[5] https://www.monroecounty-fl.gov/1282/Twin-Lakes

similar considerations that are applicable to all. For example, factors to take into consideration for prioritization could include, but are not limited to:

- timeline of climate impacts (when impacts are anticipated to be prevalent)
- benefit to cost ratio (BCR) of action
- implementability/ease of permitting
- constructability
- social benefits/environmental justice considerations
- measures of adjacent/benefitting population/service area
- alignment with other policy considerations or plans underway in the County

For wetland prioritization, an additional consideration could be acreage of impact; for roadway assets, measures could include capacity of the roadway, criticality of the roadway for evacuation routes and redundancy of the roadway network.

It is important to note that when entering the design phase and readying to expend capital dollars, a deeper and more comprehensive analysis should be conducted to determine the appropriate level of risk reduction based on multiple factors including criticality of the asset, life of the asset, associated lifecycle costs of possible impacts, and the intervention's potential for future adaptability to be adjusted for changing conditions. For critical assets, for example, this may include evaluating the comparative cost to designing to a higher sea level rise scenario (e.g., the high projection instead of the medium projection) and comparing the relative benefits of each design before selecting the one that is more cost effective (see Figure 4). The benefit of implementing such a framework is that it creates material to support project justification in a way that is not typical of common design practices.

Other factors such as the ability of the asset to maintain established performance standards over the life of the assets, and the potential to achieve multiple benefits may also impact decision making around the ultimate design approach. This is particularly important for the strategies associated with the asset and roadway categories when a stated standard can help guide ultimate design decisions (see Appendix D for FHWA's Adaptation Decision-making Assessment Process (ADAP)).

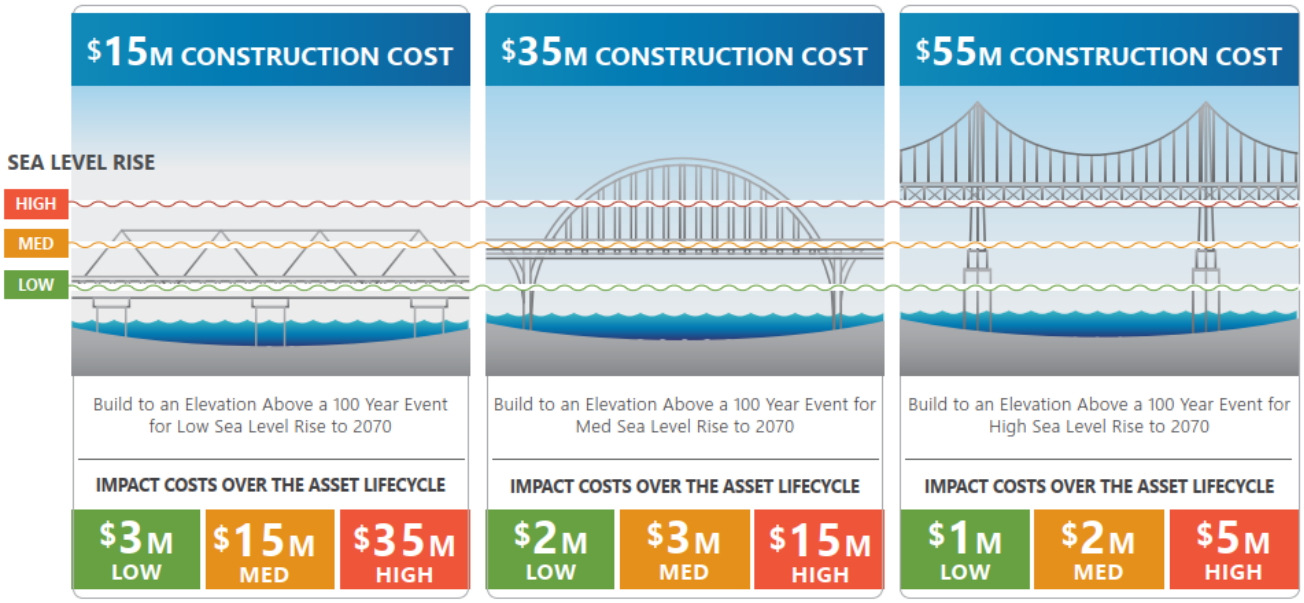


Figure 4. Decision-making conceptual framework based on FHWA's Adaptation Decision-making Assessment Process (ADAP). ADAP is a tool for planners and designers to account for climate-related hazards now and into the future in the design of civil works projects and to aid decision-makers in assessing and determining which project alternative(s) is most practical and effective.

Table 3. Top 10 priority site strategies. Numbers do not imply relative priority and are for location identification and tracking purposes only.

Priority Site Ref Number	Priority Site Name	Classification	Strategy
1	Bergen Point Wastewater Treatment Plant – Gas & Electric	Asset	Drainage improvements
2	Bergen Point Wastewater Treatment Plant – Pumping	Asset	Drainage improvements
3	Cupsogue Beach County Park	Park	Groins perpendicular to the tidal flow to mitigate infrastructure loss (lost roadway infrastructure and have access issues in season) and to preserve the beach by limiting erosion
4	Cupsogue Beach Marsh	Wetland	Wetland restoration
5	County Road 46 – William Floyd Parkway	Roadway	Roadway raising and living shoreline/ nature-based solutions
6	County Road 48 – Middle Road/North Road	Roadway	Roadway raising and living shoreline/ nature-based solutions
7	County Road 60 – Noyack-Long Beach Road/Short Beach Road	Roadway	Roadway raising and living shoreline/ nature-based solutions
8	Scully Marsh	Wetland	Wetland restoration
9	Islip Preserve	Wetland	Wetland restoration
10	Shinnecock East, Southampton	Park	Potential for living shoreline to mitigate beach erosion and infrastructure loss

Table 4. Top 10 priority site strategy matrix. Numbers do not imply relative priority and are for location identification and tracking purposes only.

Priority Site Ref	Priority Site Name	Class	Cost*	Timeline**	Responsible Agencies	Potential Grants	Potential Benefits	Communities Affected
1	Bergen Point Wastewater Treatment Plant – Gas & Electric	Asset	$$$	Long	SCDPW	HMGP; NCRF	Resilience, critical facility operation	West Babylon
2	Bergen Point Wastewater Treatment Plant – Pumping	Asset	$$$	Long	SCDPW	HMGP; NCRF	Resilience, critical facility operation	West Babylon
3	Cupsogue Beach County Park	Park	$$$	Long	SC Parks Department; SCDPW; DEP	BRIC; CAP	Public health, recreation, community, businesses	Westhampton Beach
4	Cupsogue Beach Marsh	Wetland	$	Medium	SC Parks Department; SCDPW; DEP	HMGP; STORM; CELCP	Public health, community, resilience, coastal protection	Westhampton Beach
5	County Road 46 – William Floyd Parkway	Roadway	$$	Long	SCDPW; NYSDOT	PROTECT; RAISE	Resilience, critical infrastructure, evacuation	Smith's Point
6	County Road 48 – Middle Road/North Road	Roadway	$$	Long	SCDPW; NYSDOT	PROTECT; RAISE	Resilience, critical infrastructure, evacuation	Southold/ Hashomomuck Pond

7	County Road 60 – Noyack-Long Beach Road/Short Beach Road	Roadway	$$	Long	SCDPW; NYSDOT	PROTECT; RAISE	Resilience, critical infrastructure, evacuation	Paynes Creek, Sag Harbor/The Big Narrows
8	Scully Marsh	Wetland	$	Medium	SC Parks Department; SCDPW; DEP	HMGP; STORM; CELCP	Public health, community, resilience, coastal protection	Islip
9	Islip Preserve	Wetland	$	Medium	SC Parks Department; SCDPW; DEP	HMGP; STORM; CELCP	Public health, community, resilience, coastal protection	Islip
10	Shinnecock East, Southampton	Park	$$	Long	SC Parks Department; SCDPW; DEP	BRIC; CAP	Public health, recreation, community, businesses	Southampton

* Cost: **$** = less than 5 million **$$** = 5-10 million **$$$** = more than 10 million

** Timeline: **Short** = 2-3 years **Medium** = 3-5 years **Long** = more than 5 years

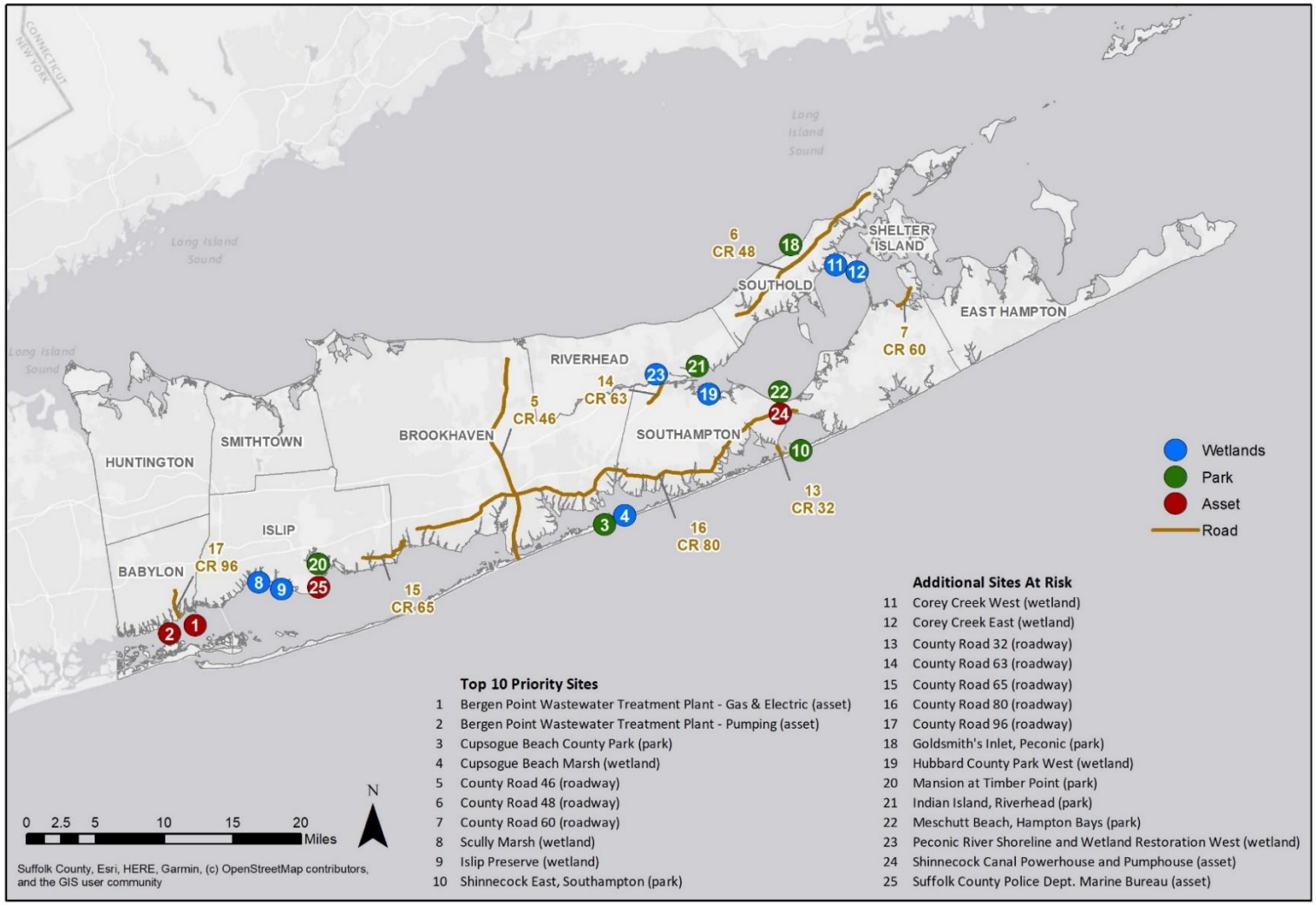


Figure 5. Map of the top 25 priority sites identified in the analysis. Numbers do not imply relative priority and are for location identification and tracking purposes only.

CONCEPTUAL DESIGN AND BENEFIT/COST ANALYSIS

Concept design and Benefit Cost Analyses (BCAs) were prepared for a Hazard Mitigation Grant Program (HMGP) grant application for the three wetlands in the top ten priority sites list: Scully Marsh, Islip Preserve, and Cupsogue Beach Marsh. The communities surrounding the project areas, medium- and high-density residential areas are susceptible to storm surge and coastal flooding as they face both the Atlantic Ocean and South Shore bays.

These project concepts were developed to protect residential areas, maintain natural systems, and invest in restoring natural systems on County property for optimal functionality while considering coastal flooding and sea level rise. A high Benefit Cost Ratio (BCR) was identified, 17.42, and an HMGP application was submitted for $4.5 million in federal grants to complement the County budget. This early action to enhance County resilience can provide a replicable model for future projects.

The proposed project, enhancing coastal resilience through integrated salt marsh management, aims to improve and restore the three identified wetlands by reducing flood damage through wave action attenuation. The BCA quantifies the project benefits to communities adjacent to the wetlands and identifies the deterioration and consequences of no action taken for improvements or restoration. Through the action of the project, the healthy wetlands will continue to thrive, adapting to sea level rise over time.

Hazard models provided spatial distribution of flood depths and wave heights for representative storm events, allowing for quantification of the benefits provided through implementation and the potential financial risk of not doing so. Table 5 shows the benefits, costs, and ratio for each of the three wetland sites. Further information on the methodology and findings from this analysis can be found in the grant application.

Table 5. Net present value of the projected project costs and benefits through the analysis period.

Project Asset	Benefits	Costs	Benefit Cost Ratio
Scully Marsh	$ 38,622,668	$ 1,723,772	22.41
Islip Preserve	$ 8,231,855	$ 1,814,744	4.54
Cupsogue Beach Marsh	$ 50,677,775	$ 2,060,750	24.59
Total	**$ 97,532,298**	**$ 5,599,266**	**17.42**

NEXT STEPS

The County applied for and has been awarded funding through the Hazard Mitigation Grant Program (HMGP) totaling $3,922,650 to implement Integrated Marsh Management (IMM) at the three top priority wetland sites:

Scully Marsh, Islip Preserve, and Cupsogue Beach Marsh. Phase I grant funding in the amount of $1,168,650 has been allocated by County resolution to initiate the next steps to prepare Environmental Assessments and progress into permit-ready engineering design plans for these three wetland restoration sites. The project construction Phase II award for the remaining $2,754,000 in grant funds will be made available to the County upon completion of the Phase 1 deliverables.

For future analyses and resilience-focused projects, Suffolk County should prioritize the improvement and development of robust spatial data, particularly for assets, critical facilities, and infrastructure. This data will provide functionality and interactivity to products resulting from future work and a higher level of accuracy and efficiency in the analyses.

The remaining priority assets that have not been submitted for grant applications should be progressed into conceptual design in order to be considered for applicable grant opportunities. Relevant grants for future work include the following:

- **Hazard Mitigation Grant Program (HMGP)**: develops hazard mitigation plans and rebuild in a way that reduces or mitigates future disaster losses in their communities. Projects that protect and/or mitigate risk to critical infrastructure, utilities, and/or repetitive loss structures will be prioritized for selection.
- **Building Resilient Infrastructure and Communities (BRIC)**: supports states, local communities, tribes, and territories in their hazard mitigation projects. Priority projects include those that benefit disadvantaged communities, use nature-based solutions, promote resilience to climate change, and adopt hazard resistant building codes.
- **Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM) Act**: intended to support states and eligible tribal governments to establish revolving loan funds to provide hazard mitigation assistance to local governments to reduce risks to disasters and natural hazards. The grants may finance green infrastructure, clean water, wastewater, infrastructure, disaster recovery, community, and small business development projects.
- **Coastal and Marine Habitat Restoration Grants**: provides funding for coastal habitat restoration; coastal habitat restoration planning, engineering, and design; and land conservation projects that support the goals and intent of the Coastal Zone Management Act, the Coastal and Estuarine Land Conservation Program (CELCP), and the Infrastructure Investment and Jobs Act, Public Law 117-58.
- **Coastal and Estuarine Land Conservation Program (CELCP)**: provides grants to states or local units of government to protect those coastal and estuarine areas with significant conservation, recreation, ecological, historical or aesthetic values, or those that are threatened by conversion from their natural state to other uses.
- **Climate Resilience Regional Challenge**: supports implementation of transformational resilience and adaptation strategies and associated actions for coastal communities anchored in previous planning efforts. Applicants must propose a suite of complementary adaptation actions that together build the resilience of multiple communities within a coastal region, including those that have been marginalized, underserved, or underrepresented.
- **National Coastal Resilience Fund**: intended to improve the resilience of coastal communities at risk of flooding and inundation by restoring or expanding natural ecosystems. Also includes funding for the National Oceanic and Atmospheric Administration (NOAA) Community-Based Restoration Project to improve the buffering shorelines from erosion, reducing flooding, and removing potentially hazardous structures.
- **Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation Program (PROTECT)**: provides funding to ensure surface transportation resilience to natural hazards including climate change, sea level rise, flooding, extreme weather events, and other natural disasters

through support of planning activities, resilience improvements, community resilience and evacuation routes, and at-risk coastal infrastructure. A benefit-cost analysis is required to apply.

- **Rebuilding American Infrastructure with Sustainability and Equity (RAISE)**: provides a unique opportunity for road, rail, transit, and port projects that promise to achieve national objectives. Previously known as the Better Utilizing Investments to Leverage Development (BUILD) and Transportation Investment Generating Economic Recovery (TIGER) Discretionary Grants, Congress has dedicated nearly $9.9 billion for 13 rounds of National Infrastructure Investments to fund projects that have a significant local or regional impact.
- **Capital Assistance Program (CAP) Section 204 – Beneficial Use of Dredged Material**: authorizes the implementation of projects for the protection, restoration, and creation of aquatic and ecologically related habitats, including wetlands, or to reduce storm damage to property, in connection with dredging for the construction or operations and maintenance of an existing authorized federal navigation project.
- **New York State Environmental Bond Act**: provides $4.2 billion in funding for New York's environment and communities – the Clean Water, Clean Air, and Green Jobs Environmental Bond Act passed legislative review in November 2022. It is the largest environmental bond act in state history focused on preserving, enhancing, and restoring New York's natural resources.
- **Dormitory Authority of the State of New York (DASNY) State and Municipal Facilities Capital (SAM) Grants**: provides $475 million in grant funding supporting community and economic development. There are a variety of economic development grant programs administered by DASNY, several programs which may be relevant to Suffolk County's resilience strategy:
    - The Community Resiliency, Economic Sustainability, and Technology Program (CREST)
    - New York Economic Development Capital Program (NYEDCP)
    - New York State Capital Assistance Program (NYS CAP)
- **Climate Smart Community Grants (part of the NYS Environmental Protection Fund)**: competitive 50/50 matching grant program for municipalities to implement projects focused on climate change adaptation and greenhouse gas mitigation. Project types also include certain planning and assessment projects that are part of a strategy to achieve Climate Smart Communities Certification. The adaptation part of the grants focuses on a variety of issues such as increasing emergency responsiveness and addressing extreme heat events. Other relevant projects would seek to increase natural resiliency to future flood risks (e.g., through living shorelines and nature-based landscape features) and relocate or retrofit critical infrastructure to reduce future flood risks.

APPENDIX A – FLOOD INUNDATION AT 25 AT-RISK SITES

FLOOD INUNDATION ANALYSIS – 2025, 2055, AND 2100

The following tables contain the results for flood inundation in the 2025, 2055, and 2100 time periods.

Table A-1. Flood inundation in 2025 for the top 10 priority sites. Numbers do not imply relative priority and are for location identification and tracking purposes only.

		Tidal Flooding - 2025			Storm Surge - 2025	
Top 10 Priority Sites		**Every 30 Days**	**Every 60 Days**	**Every 90 Days**	**10% Annual Chance**	**1% Annual Chance**
1	Bergen Point WWTP - Gas & Electric					X
2	Bergen Point WWTP - Pumping					X
3	Cupsogue Beach County Park	X	X	X	X	X
4	Cupsogue Beach Marsh	X	X	X	X	X
5	County Road 46 – William Floyd Parkway				X	X
6	County Road 48 – Middle Road/North Road				X	X
7	County Road 60 – Noyack-Long Beach Road/Short Beach Road					X
8	Scully Marsh	X	X	X	X	X
9	Islip Preserve	X	X	X	X	X
10	Shinnecock East, Southampton		X	X	X	X

Table A-2. Flood inundation in 2055 for the top 10 priority sites. Numbers do not imply relative priority and are for location identification and tracking purposes only.

		Tidal Flooding - 2055			Storm Surge - 2055	
Top 10 Priority Sites		**Every 30 Days**	**Every 60 Days**	**Every 90 Days**	**10% Annual Chance**	**1% Annual Chance**
1	Bergen Point WWTP - Gas & Electric					X
2	Bergen Point WWTP - Pumping					X
3	Cupsogue Beach County Park	X	X	X	X	X
4	Cupsogue Beach Marsh	X	X	X	X	X
5	County Road 46 – William Floyd Parkway				X	X
6	County Road 48 – Middle Road/North Road				X	X
7	County Road 60 – Noyack-Long Beach Road/Short Beach Road					X
8	Scully Marsh	X	X	X	X	X
9	Islip Preserve	X	X	X	X	X
10	Shinnecock East, Southampton	X	X	X	X	X

Table A-3. Flood inundation in 2100 for the top 10 priority sites. Numbers do not imply relative priority and are for location identification and tracking purposes only.

		Tidal Flooding - 2100			Storm Surge - 2100	
Top 10 Priority Sites		**Every 30 Days**	**Every 60 Days**	**Every 90 Days**	**10% Annual Chance**	**1% Annual Chance**
1	Bergen Point WWTP - Gas & Electric					X
2	Bergen Point WWTP - Pumping				X	X
3	Cupsogue Beach County Park	X	X	X	X	X
4	Cupsogue Beach Marsh	X	X	X	X	X
5	County Road 46 – William Floyd Parkway	X	X	X	X	X
6	County Road 48 – Middle Road/North Road	X	X	X	X	X
7	County Road 60 – Noyack-Long Beach Road/Short Beach Road		X	X	X	X
8	Scully Marsh	X	X	X	X	X
9	Islip Preserve	X	X	X	X	X
10	Shinnecock East, Southampton	X	X	X	X	X

Table A-4. Flood inundation in 2025 for the remainder of the 25 priority sites (11-25). Numbers do not imply relative priority and are for location identification and tracking purposes only.

		Tidal Flooding - 2025			Storm Surge - 2025	
Additional Priority Sites		**Every 30 Days**	**Every 60 Days**	**Every 90 Days**	**10% Annual Chance**	**1% Annual Chance**
11	Corey Creek West	X	X	X	X	X
12	Corey Creek East	X	X	X	X	X
13	County Road 32 - Ponquogue Bridge				X	X
14	County Road 63 – Lake Avenue				X	X
15	County Road 65 – Middle Rd/Atlantic Ave/Weeks St/River Ave				X	X
16	County Road 80 – Montauk Highway			X	X	X
17	County Road 96 – Bergen Avenue				X	X
18	Goldsmith's Inlet, Peconic	X	X	X	X	X
19	Hubbard County Park West	X	X	X	X	X
20	Mansion at Timber Point	X	X	X	X	X
21	Indian Island, Riverhead	X	X	X	X	X
22	Meschutt Beach, Hampton Bays		X	X	X	X
23	Peconic River Shoreline and Wetland Restoration West	X	X	X	X	X
24	Shinnecock Canal Powerhouse and Pumphouse				X	X
25	Suffolk County Police Dept. Marine Bureau				X	X

Table A-5. Flood inundation in 2055 for the remainder of the 25 priority sites (11-25). Numbers do not imply relative priority and are for location identification and tracking purposes only.

		Tidal Flooding - 2055			Storm Surge - 2055	
Additional Priority Sites		**Every 30 Days**	**Every 60 Days**	**Every 90 Days**	**10% Annual Chance**	**1% Annual Chance**
11	Corey Creek West	X	X	X	X	X
12	Corey Creek East	X	X	X	X	X
13	County Road 32 - Ponquogue Bridge	X	X	X	X	X
14	County Road 63 – Lake Avenue				X	X
15	County Road 65– Middle Rd/Atlantic Ave/Weeks St/River Ave	X	X	X	X	X
16	County Road 80 – Montauk Highway	X	X	X	X	X
17	County Road 96 – Bergen Avenue	X	X	X	X	X
18	Goldsmith's Inlet, Peconic	X	X	X	X	X
19	Hubbard County Park West	X	X	X	X	X
20	Mansion at Timber Point	X	X	X	X	X
21	Indian Island, Riverhead	X	X	X	X	X
22	Meschutt Beach, Hampton Bays		X	X	X	X
23	Peconic River Shoreline and Wetland Restoration West	X	X	X	X	X
24	Shinnecock Canal Powerhouse and Pumphouse				X	X
25	Suffolk County Police Dept. Marine Bureau	X	X	X	X	X

Table A-6. Flood inundation in 2100 for the remainder of the 25 priority sites (11-25). Numbers do not imply relative priority and are for location identification and tracking purposes only.

		Tidal Flooding - 2100			Storm Surge - 2100	
Additional Priority Sites		**Every 30 Days**	**Every 60 Days**	**Every 90 Days**	**10% Annual Chance**	**1% Annual Chance**
11	Corey Creek West	X	X	X	X	X
12	Corey Creek East	X	X	X	X	X
13	County Road 32- Ponquogue Bridge	X	X	X	X	X
14	County Road 63 – Lake Avenue	X	X	X	X	X
15	County Road 65– Middle Rd/Atlantic Ave/Weeks St/River Ave	X	X	X	X	X
16	County Road 80 – Montauk Highway	X	X	X	X	X
17	County Road 96 – Bergen Avenue	X	X	X	X	X
18	Goldsmith's Inlet, Peconic	X	X	X	X	X
19	Hubbard County Park West	X	X	X	X	X
20	Mansion at Timber Point	X	X	X	X	X
21	Indian Island, Riverhead	X	X	X	X	X
22	Meschutt Beach, Hampton Bays	X	X	X	X	X
23	Peconic River Shoreline and Wetland Restoration West	X	X	X	X	X
24	Shinnecock Canal Powerhouse and Pumphouse	X	X	X	X	X
25	Suffolk County Police Dept. Marine Bureau	X	X	X	X	X

2055 FLOOD INUNDATION INDIVIDUAL PRIORITY SITE MAPS

The following figures show the site conditions for 2055 for each of the priority sites. Roadways with multiple points of flood inundation have multiple site maps. Numbers do not imply relative priority and are for location identification and tracking purposes only.

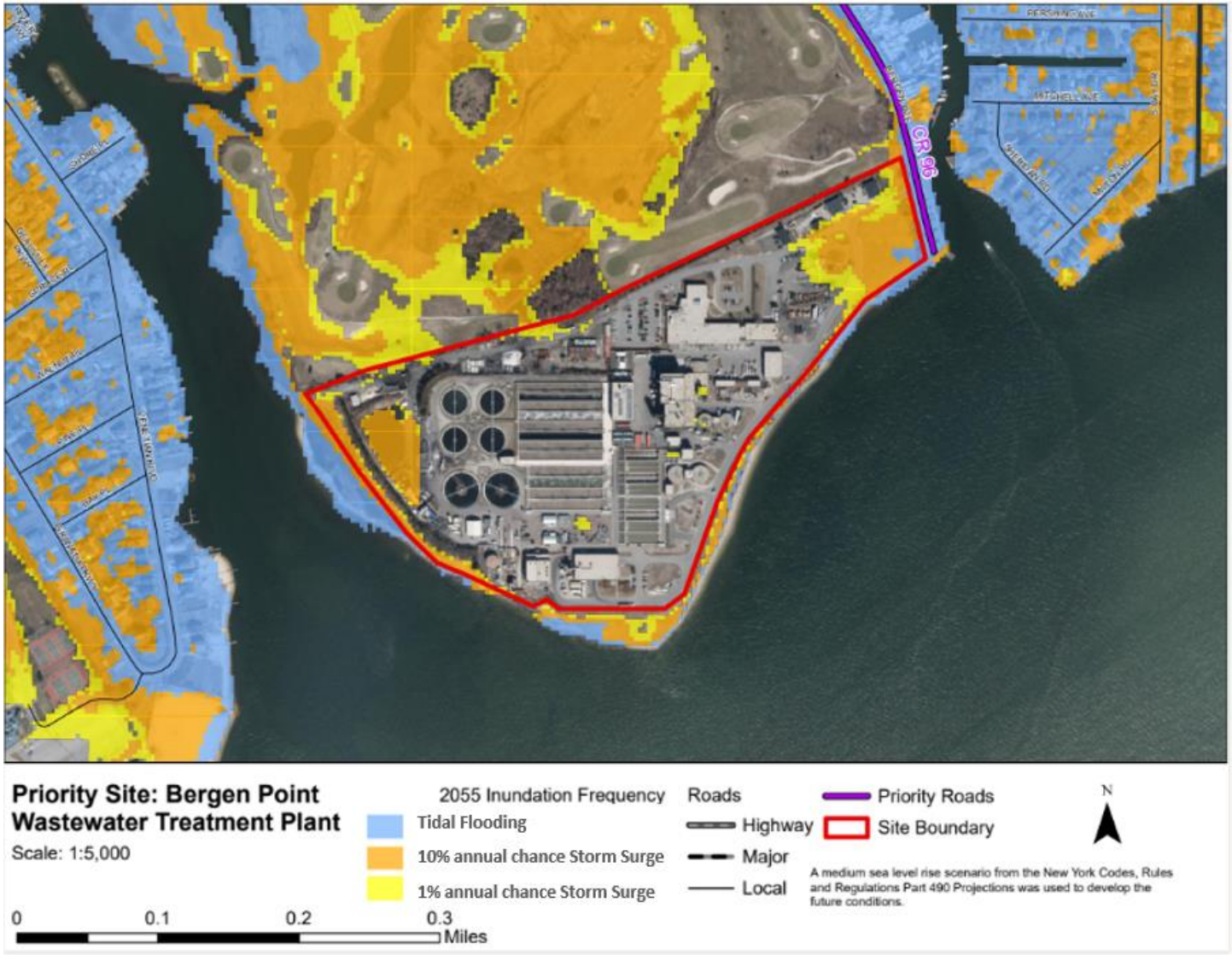


Figure A-1. Priority site map #1 & #2: Bergen Point, West Babylon.

Figure A-2. Priority site map #3: Cupsogue Beach County Park, Westhampton Beach.

Figure A-3. Priority site map #4: Cupsogue Beach Marsh, Westhampton Beach.

Figure A-4. Priority site map #5a: County Road 46 and Smith Point Bridge – leading to Smith's Point.

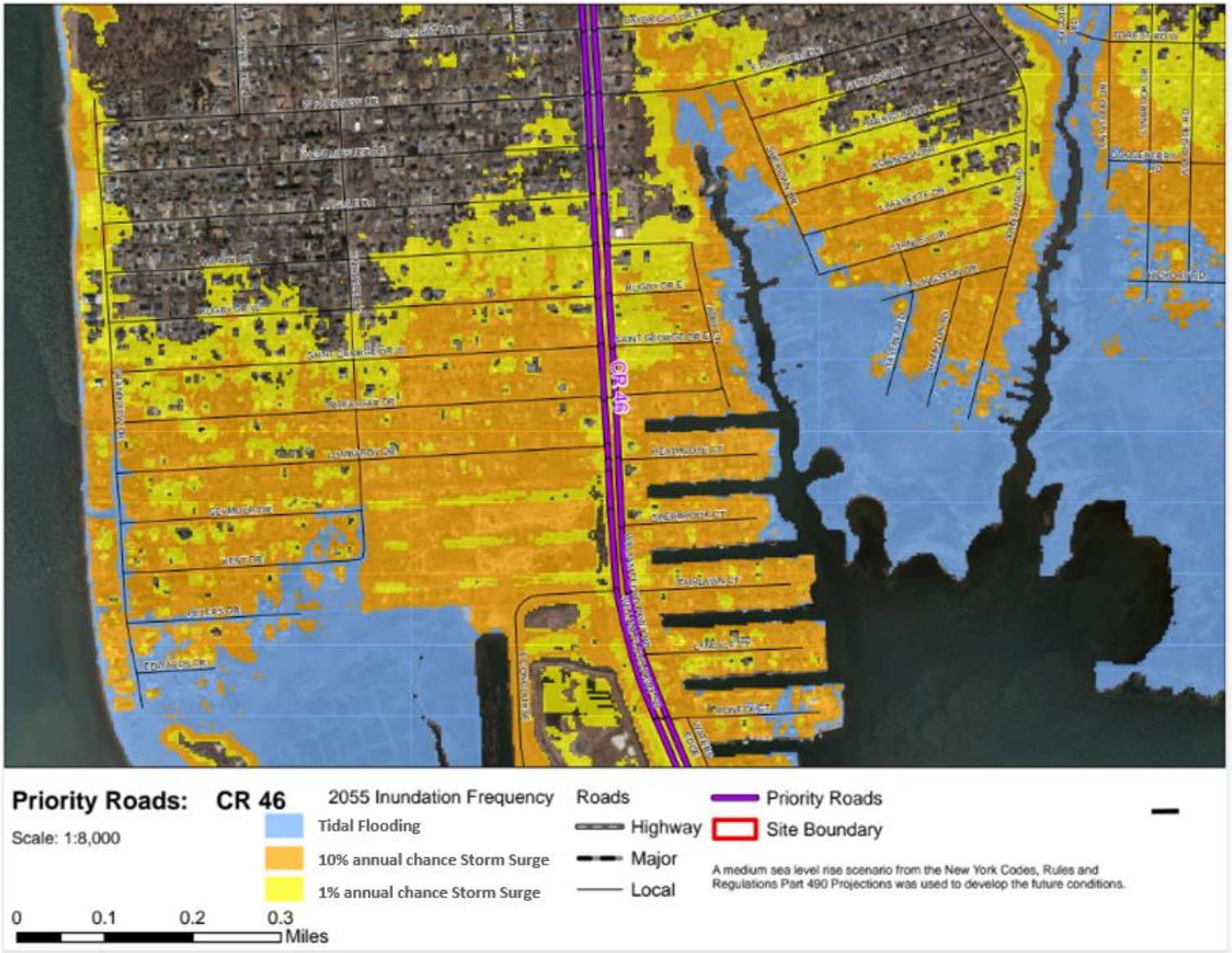


Figure A-5. Priority site map #5b: County Road 46 and Smith Point Bridge – William Floyd Parkway.

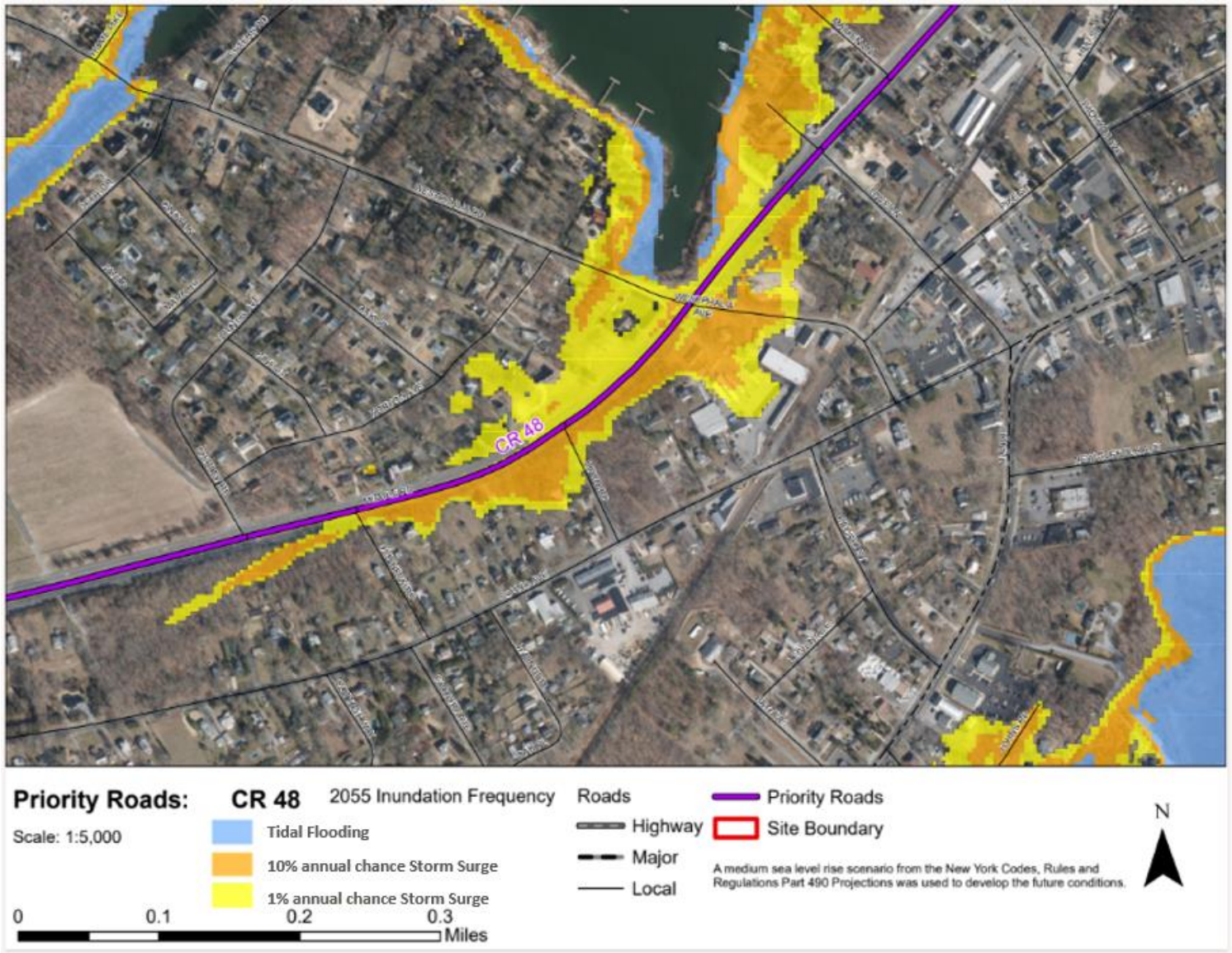


Figure A-6. Priority site map #6a: County Road 48 Middle Road – North Road, Southold.

Figure A-7. Priority site map #6b: County Road 48 North Road – Hashomomuck Pond, Southold.

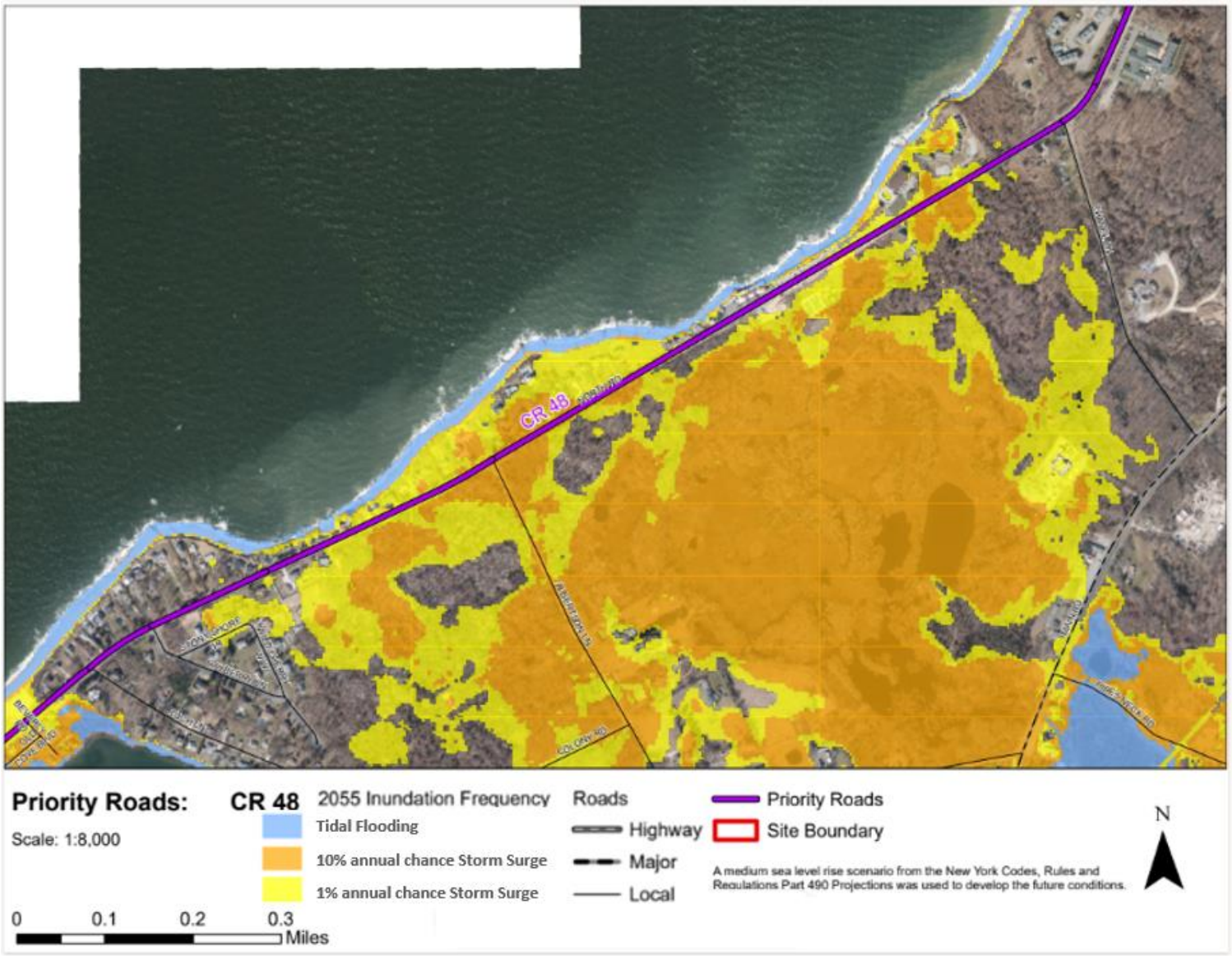


Figure A-8. Priority site map #6c: County Road 48 North Road – Hashomomuck Pond, Southold.

Figure A-9. Priority site map #7a: County Road 60 Noyack-Long Beach Road – Paynes Creek, Sag Harbor.

Figure A-10. Priority site map #7b: County Road 60 Noyack-Long Beach Road – The Big Narrows.

Figure A-11. Priority site map #7c: County Road 60 Harbor Drive – Noyack, Sag Harbor.

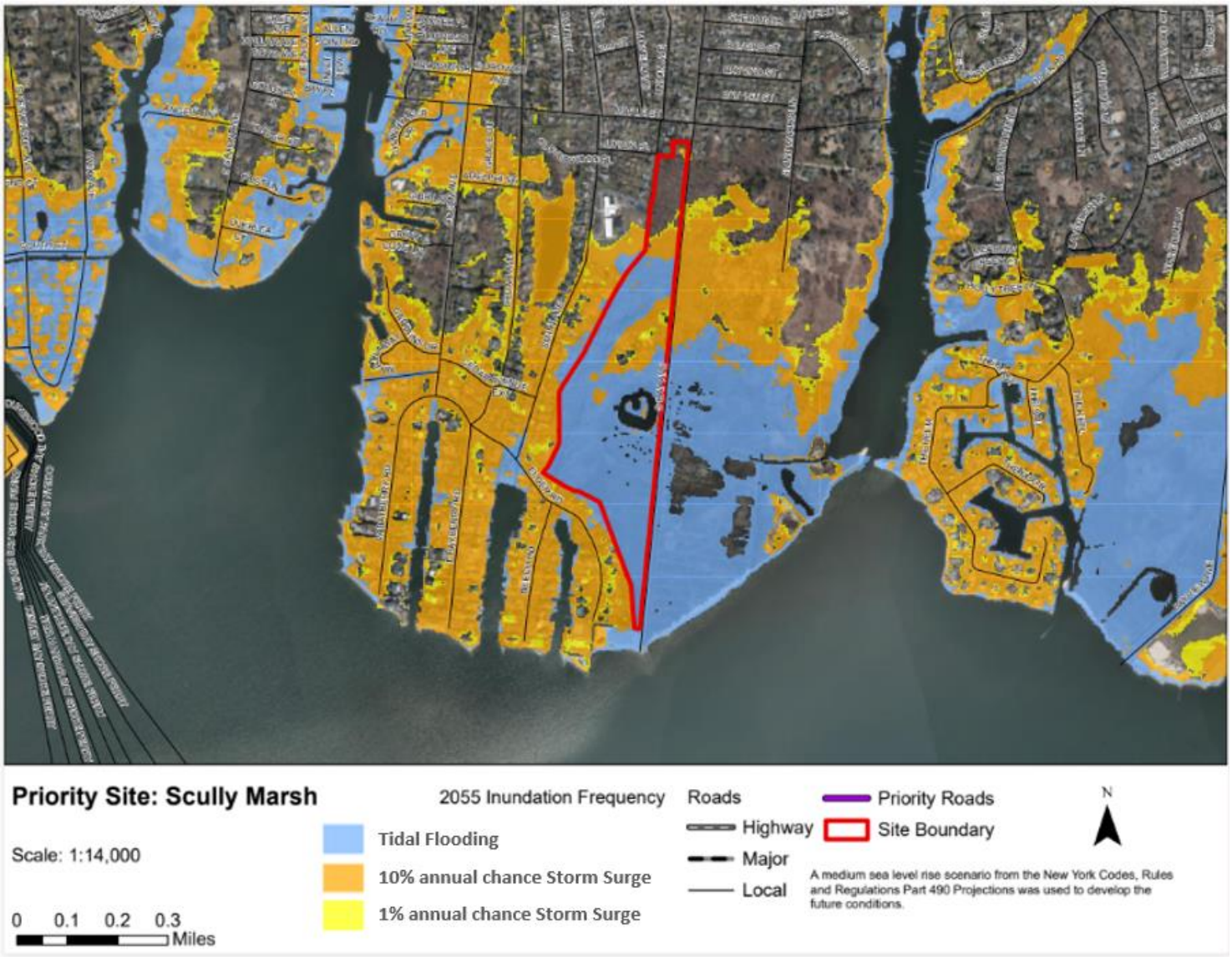


Figure A-12. Priority site map #8: Scully Marsh, Islip.

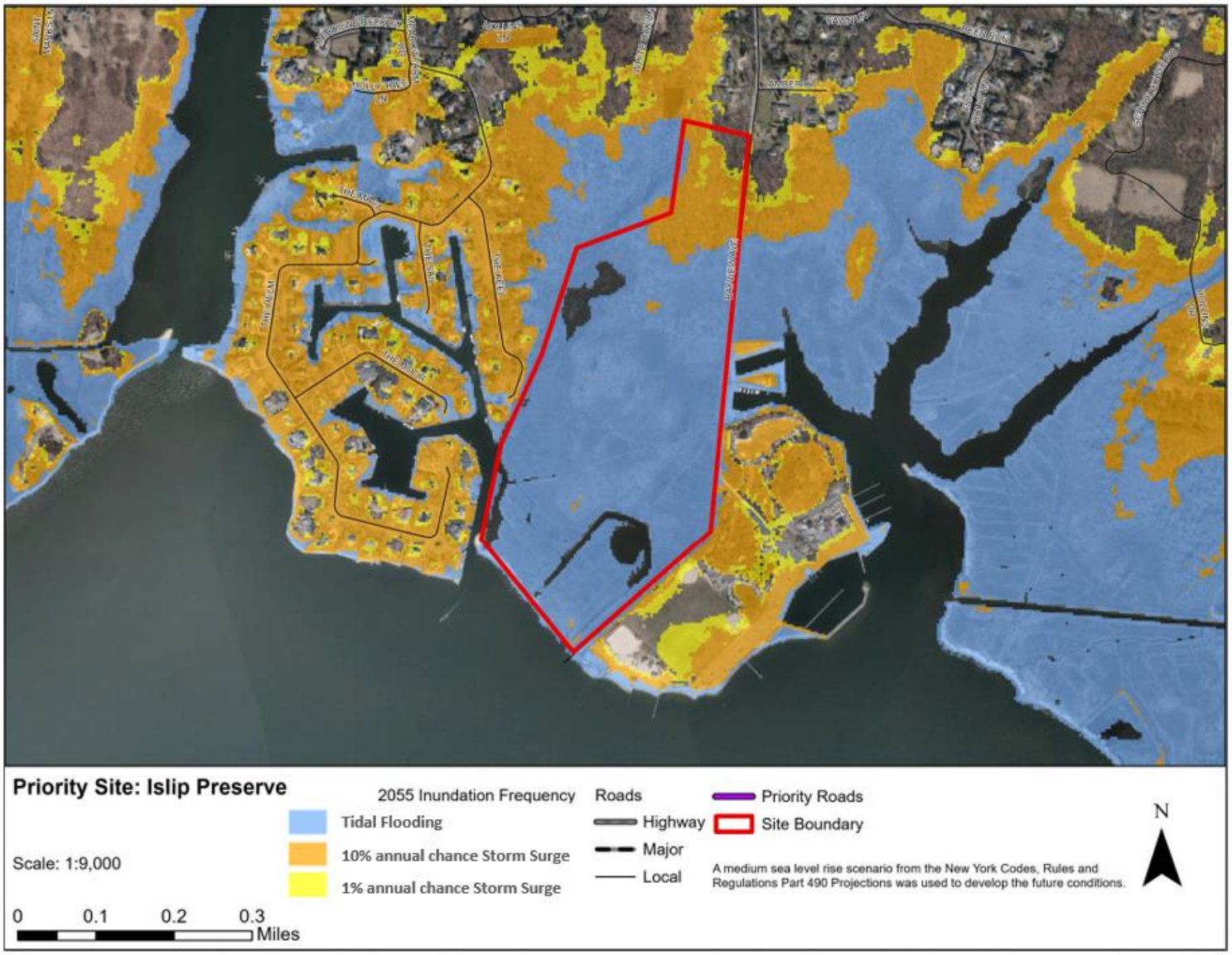


Figure A-13. Priority site map #9: Islip Preserve, Islip.

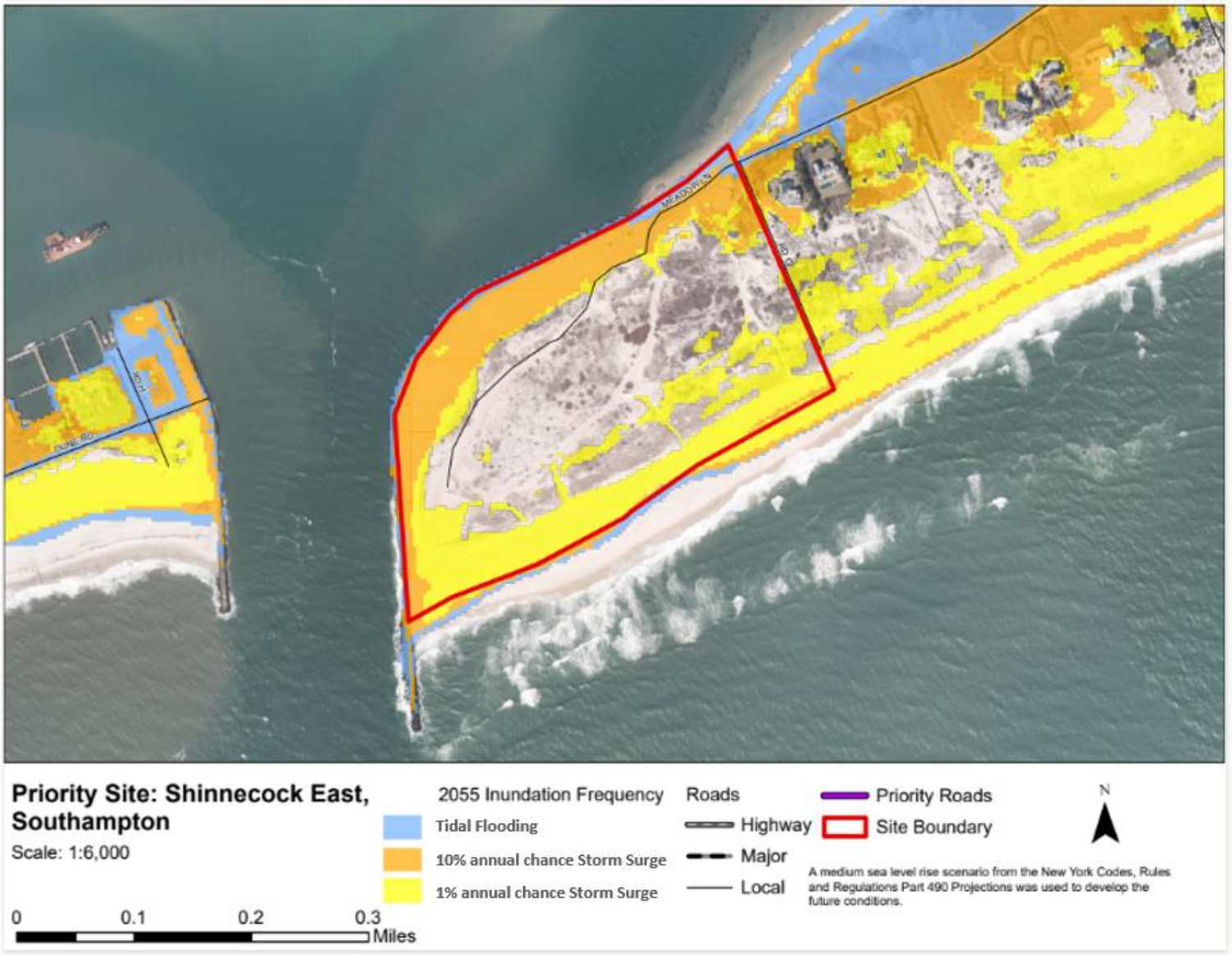


Figure A-14. Priority site map #10: Shinnecock East County Park – adjacent to Shinnecock Inlet, Southampton.

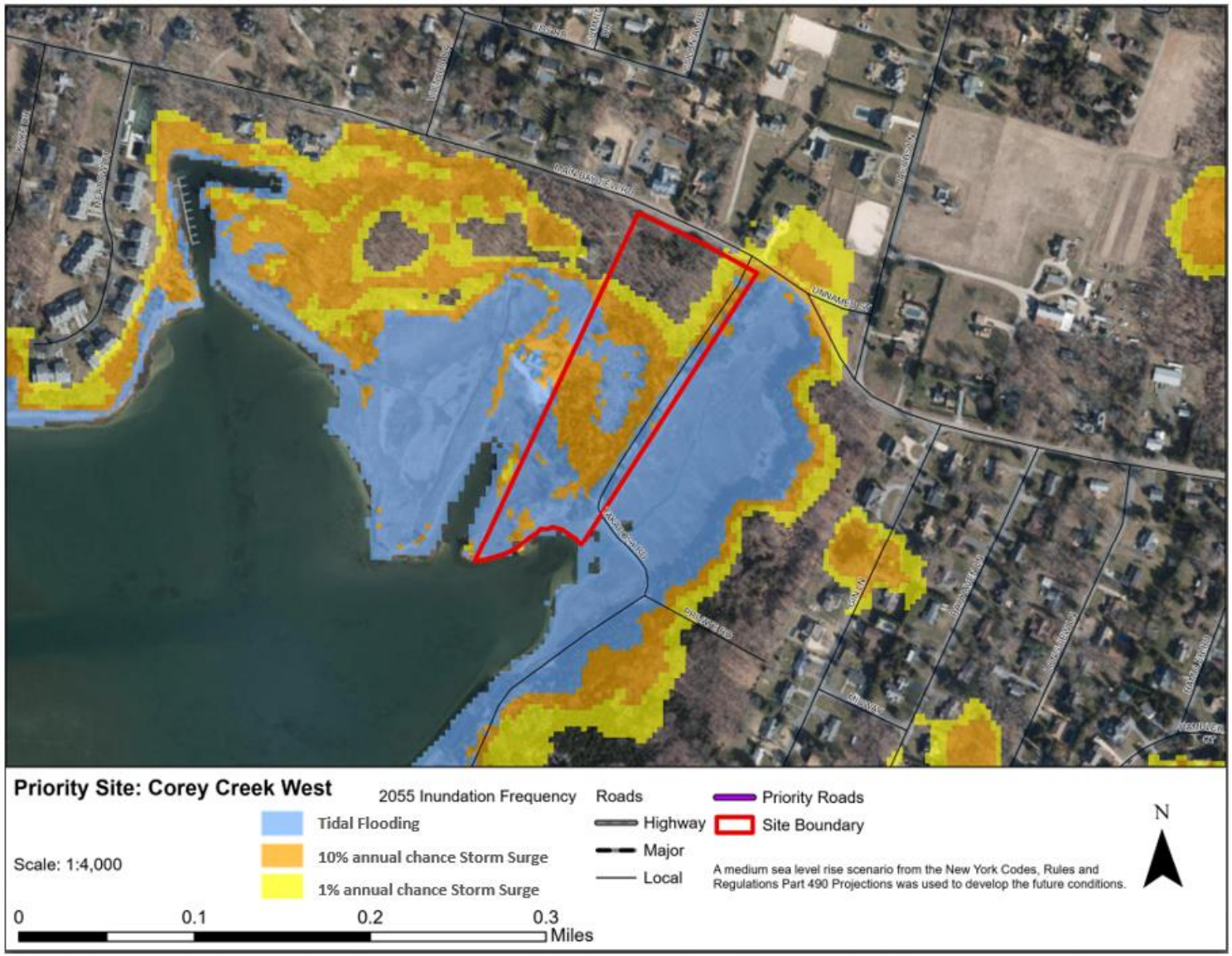


Figure A-15. Priority site map #11: Corey Creek West, Southold.

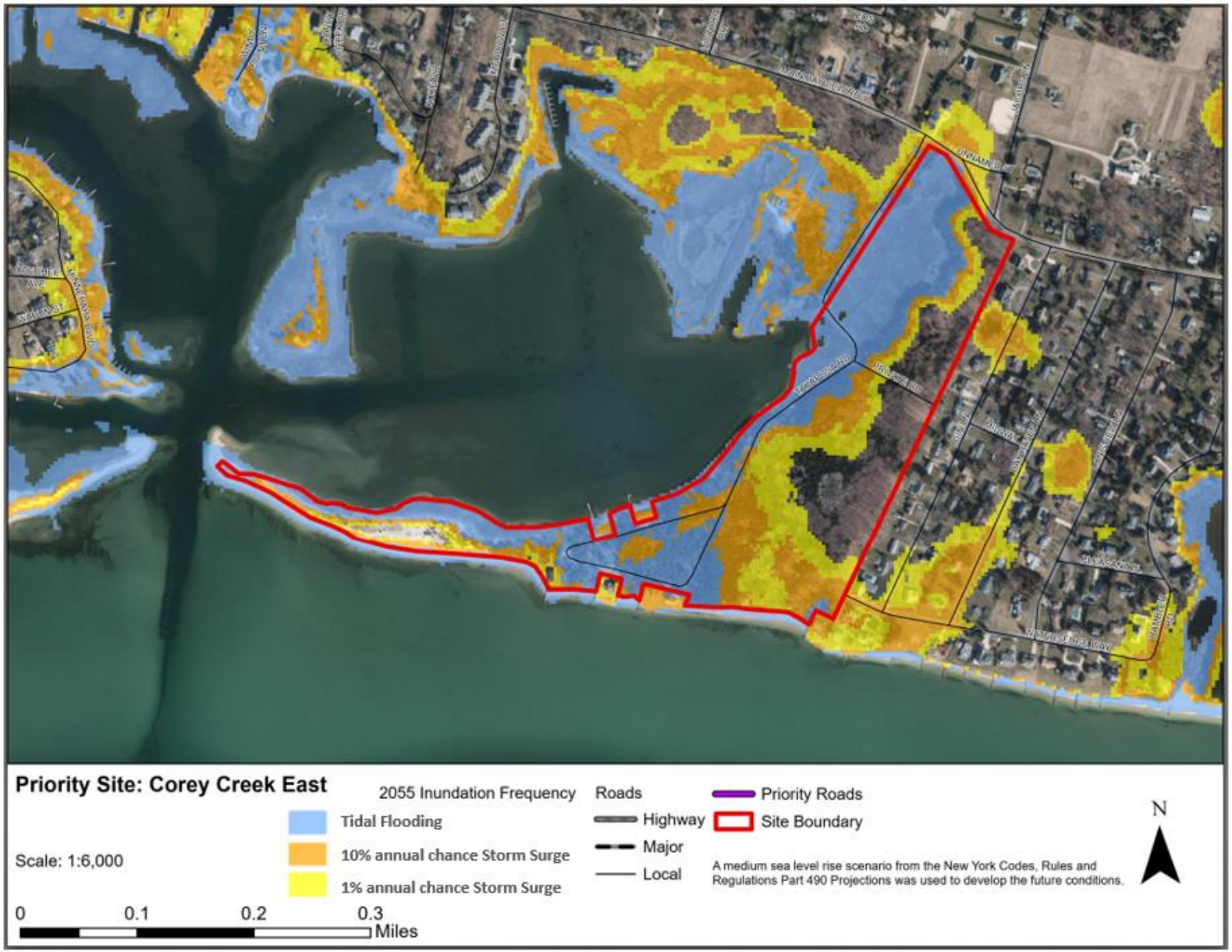


Figure A-16. Priority site map #12: Corey Creek East, Southold.

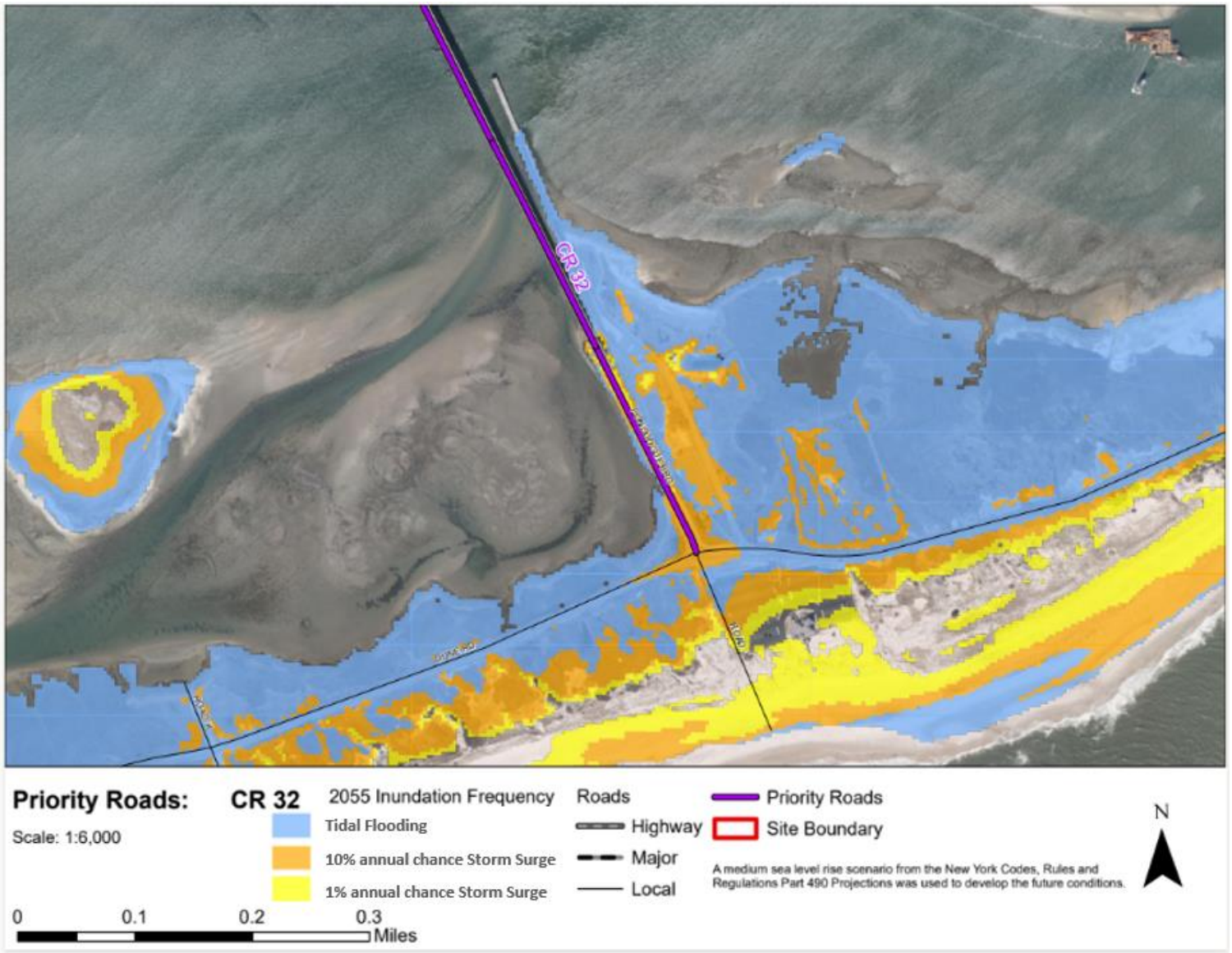


Figure A-17. Priority site map #13a: County Road 32 – leading to Dune Road, Hampton Bays.

Figure A-18. Priority site map #13b: County Road 32 – from Mainland, Hampton Bays.

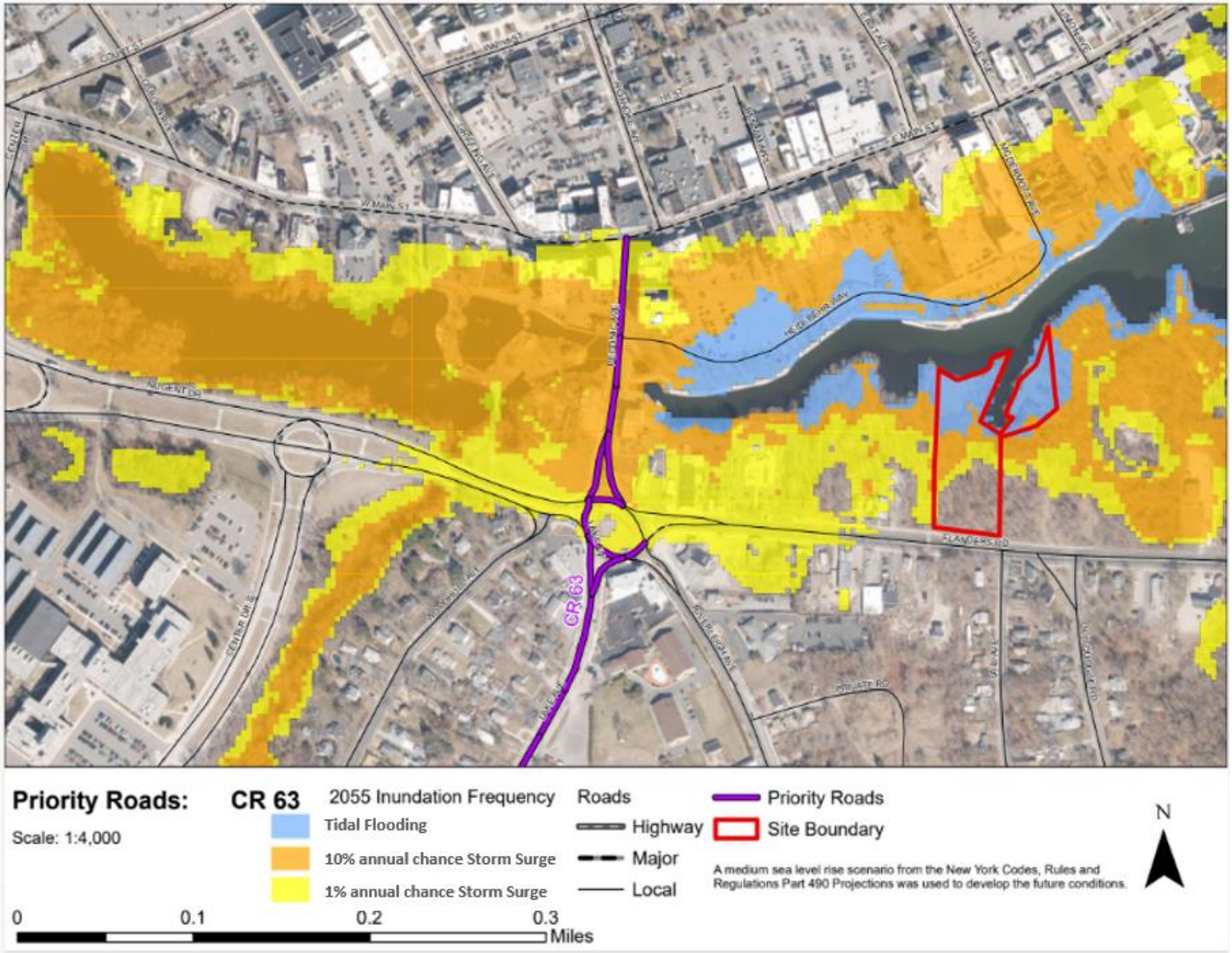


Figure A-19. Priority site map #14: County Road 63 – traffic circle at Flanders Road, Riverhead.

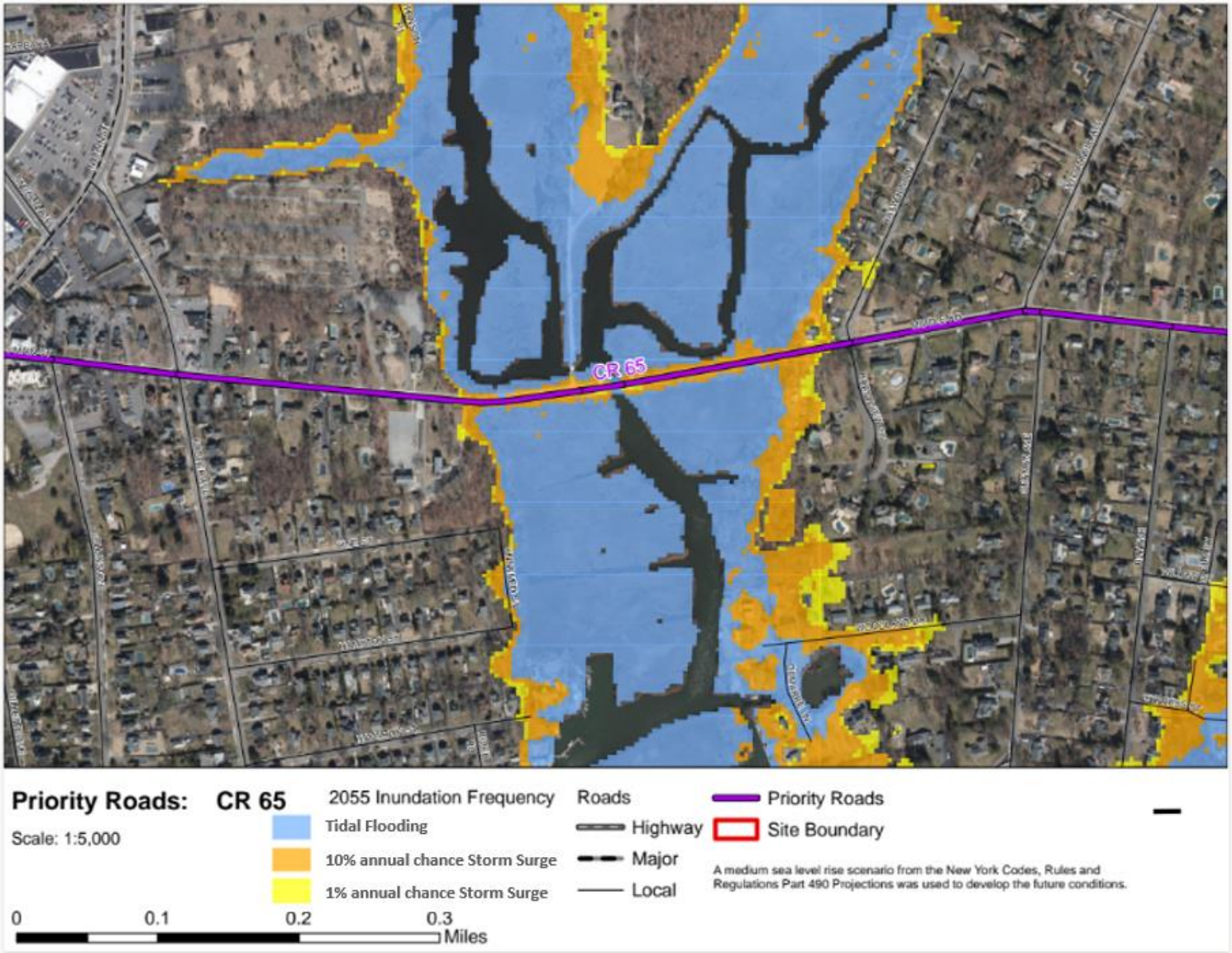


Figure A-20. Priority site map #15a: County Road 65 Middle Road – Meadow Croft, Bayport.

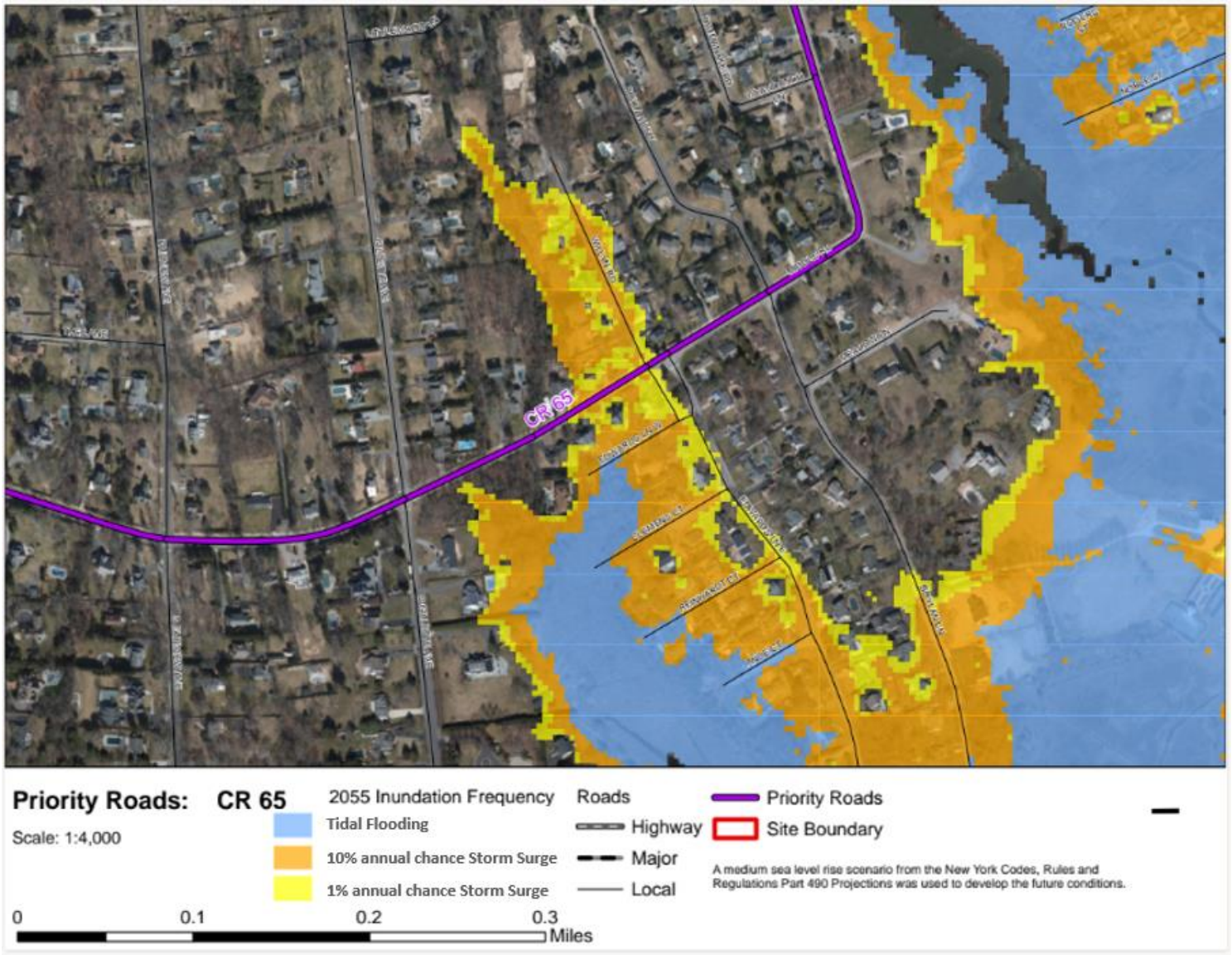


Figure A-21. Priority site map #15b: County Road 65 Middle Road – Stillman Creek, Blue Point.

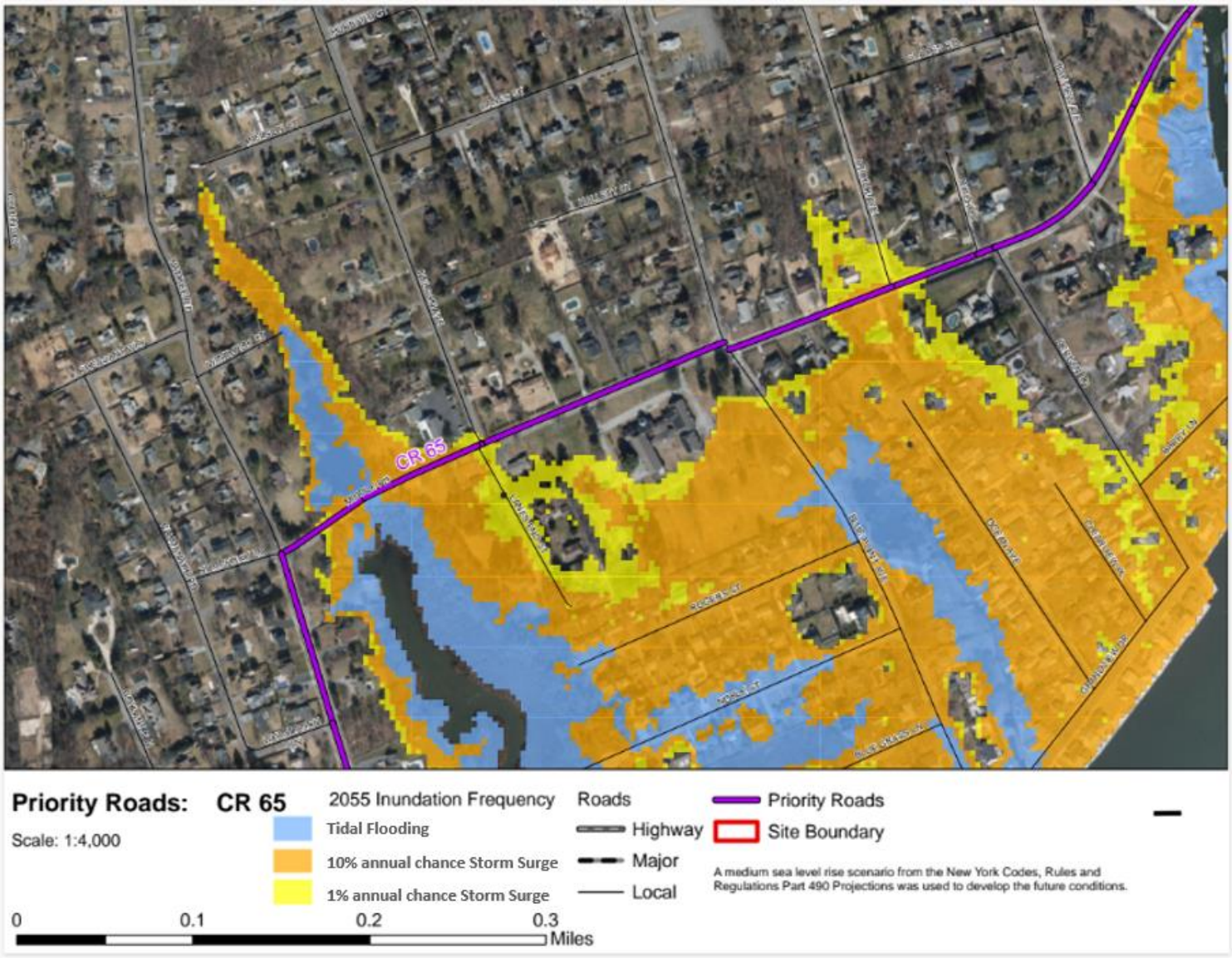


Figure A-22. Priority site map #15c: County Road 65 Middle Road – Stillman Creek, Blue Point.

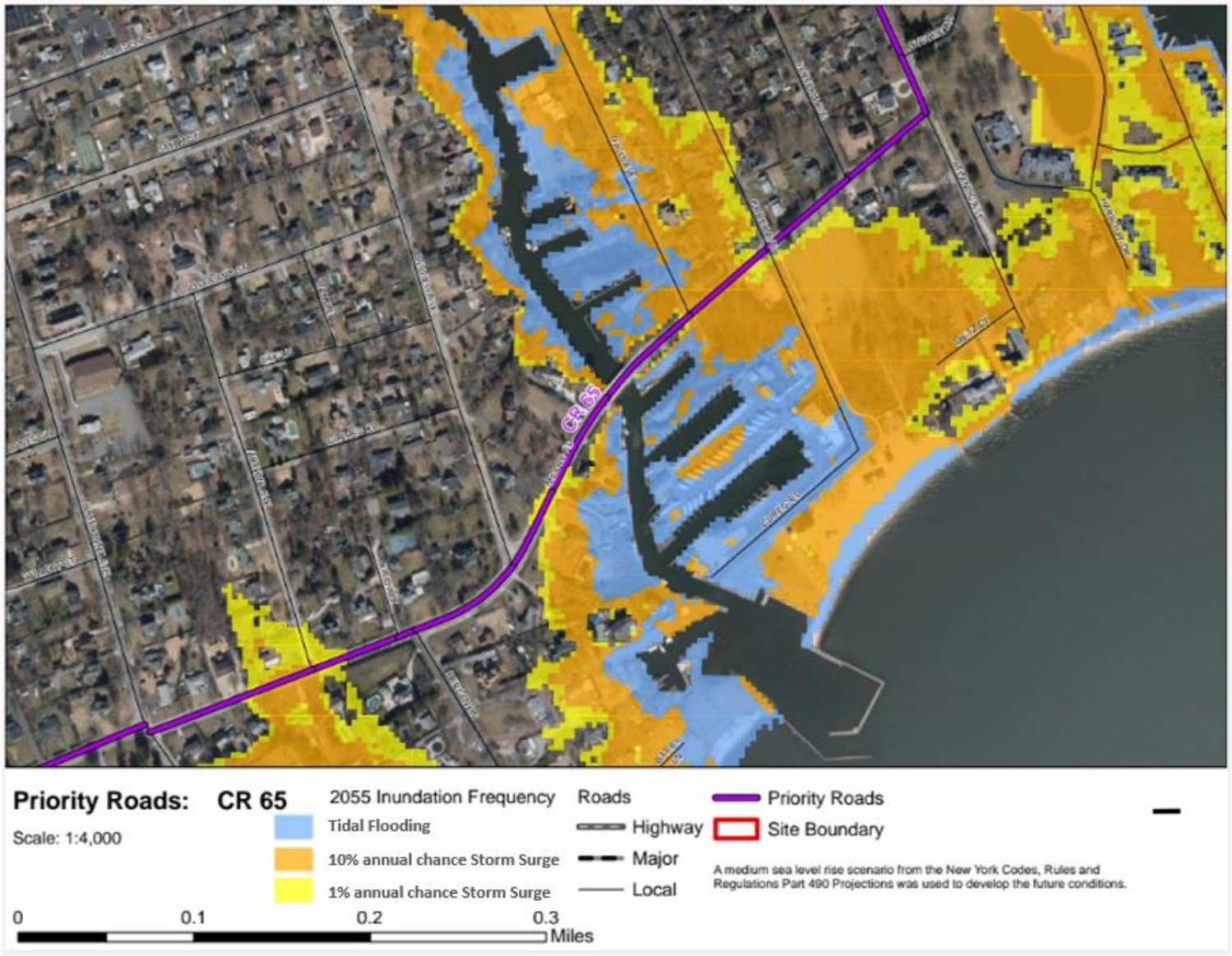


Figure A-23. Priority site map #15d: County Road 65 Middle Road – Blue Point Marina, Blue Point.

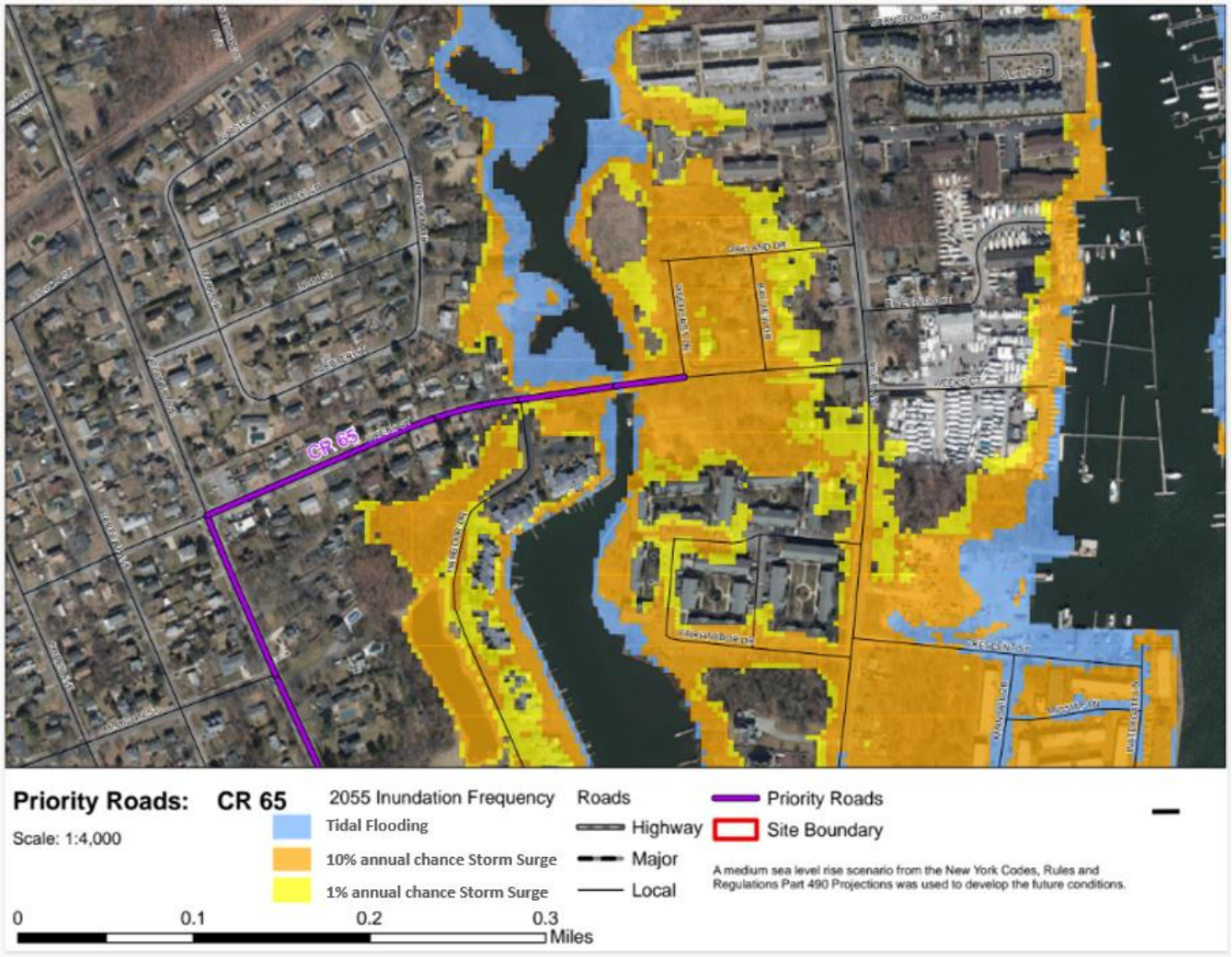


Figure A-24. Priority site map #15e: County Road 65 Atlantic Avenue and Weeks Street – Tuthills Creek, Blue Point/Patchogue.

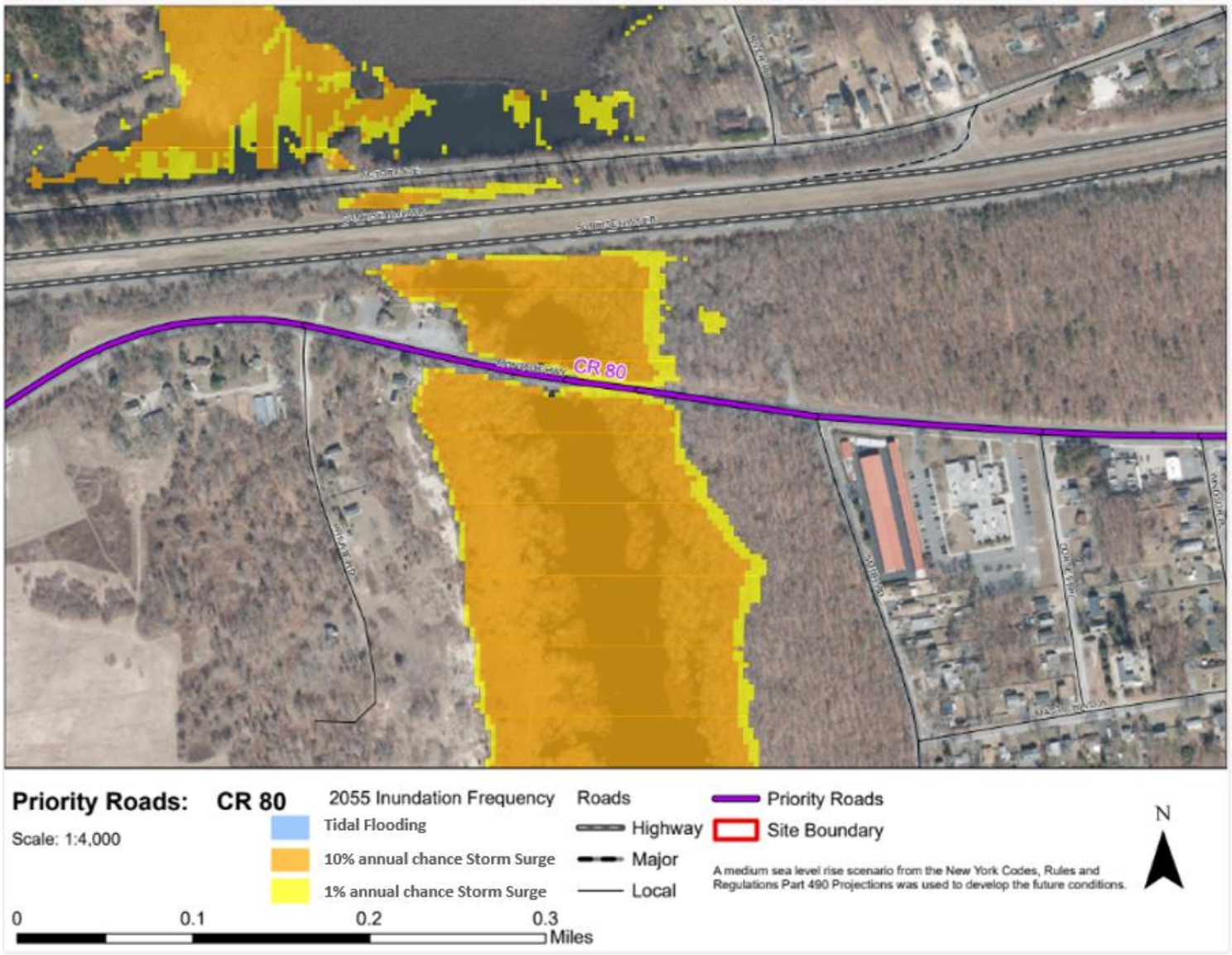


Figure A-25. Priority site map #16a: County Road 80 Montauk Highway – Wertheim National Wildlife Refuge, Shirley.

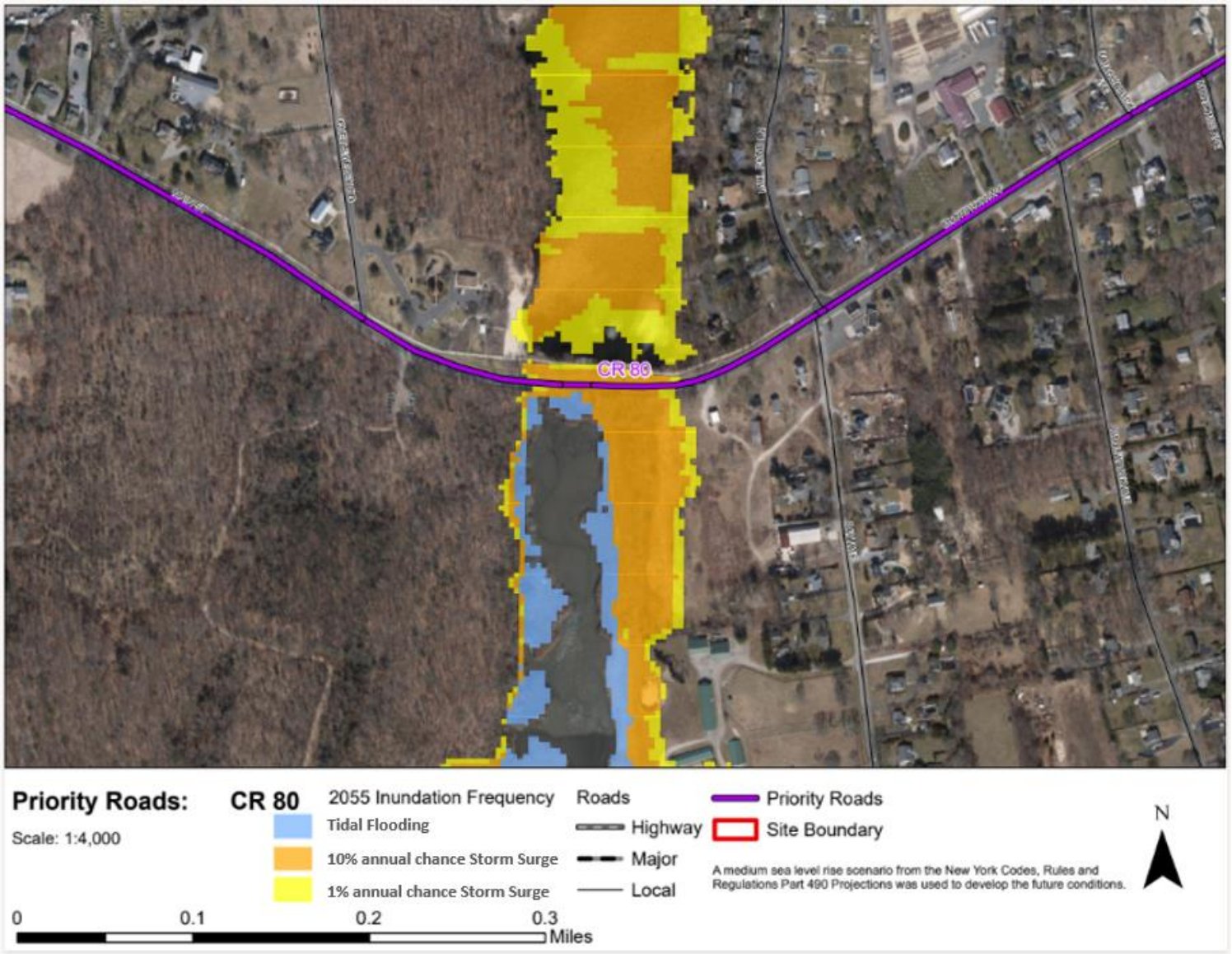


Figure A-26. Priority site map #16b: County Road 80 Montauk Highway – Mill Pond, East Moriches.

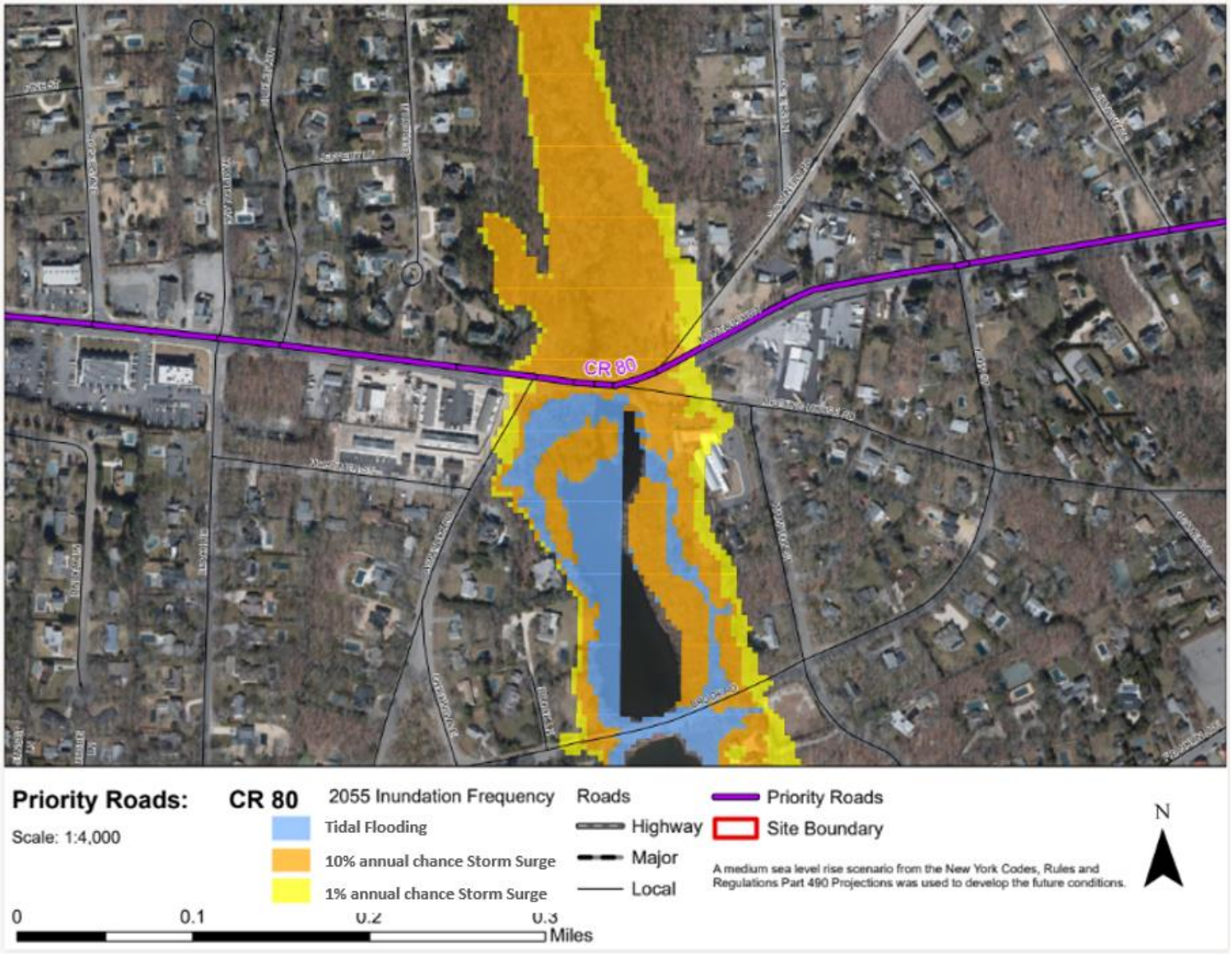


Figure A-27. Priority site map #16c: County Road 80 Montauk Highway – Aspatuck River, Westhampton Beach.

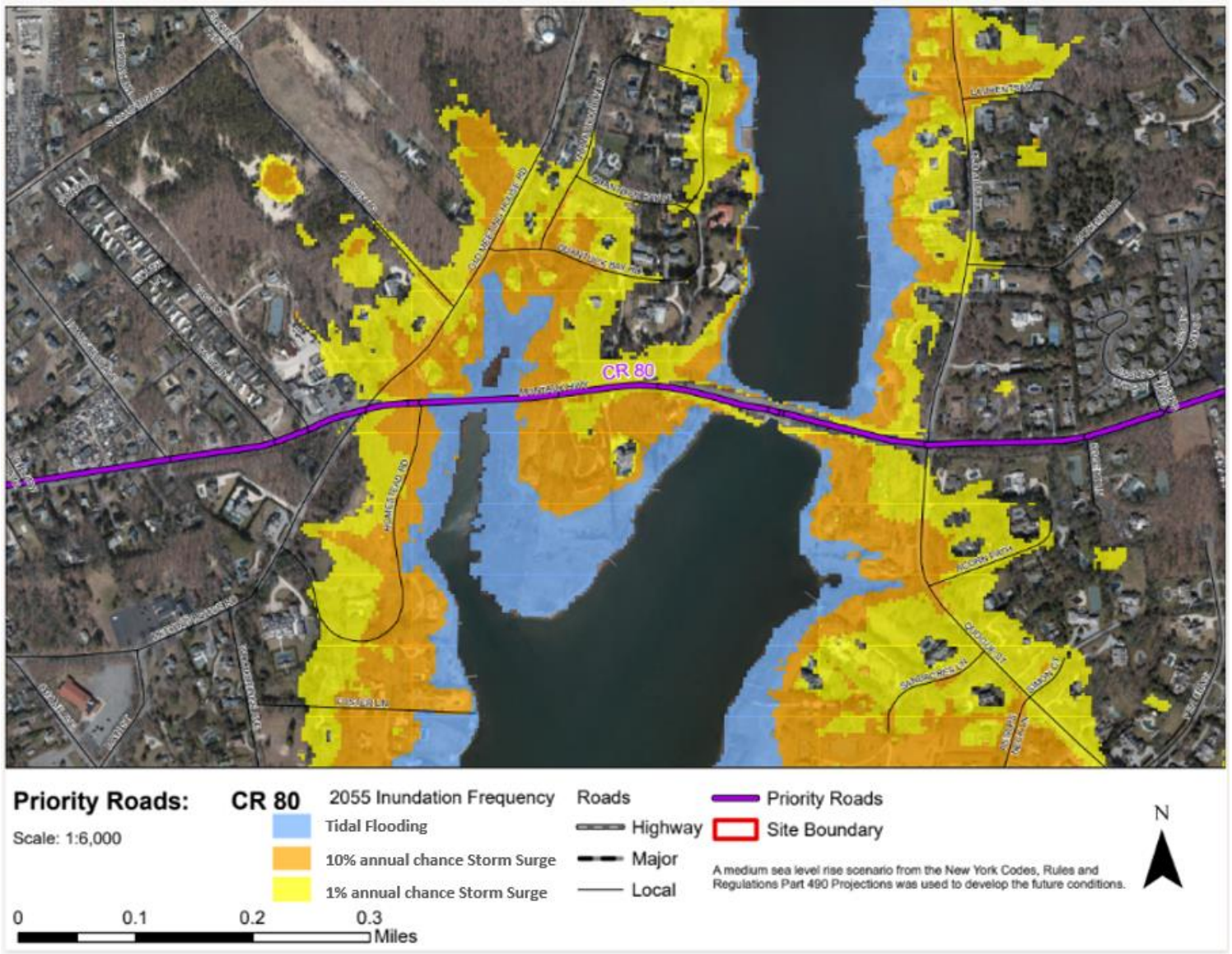


Figure A-28. Priority site map #16d: County Road 80 Montauk Highway – Quogue.

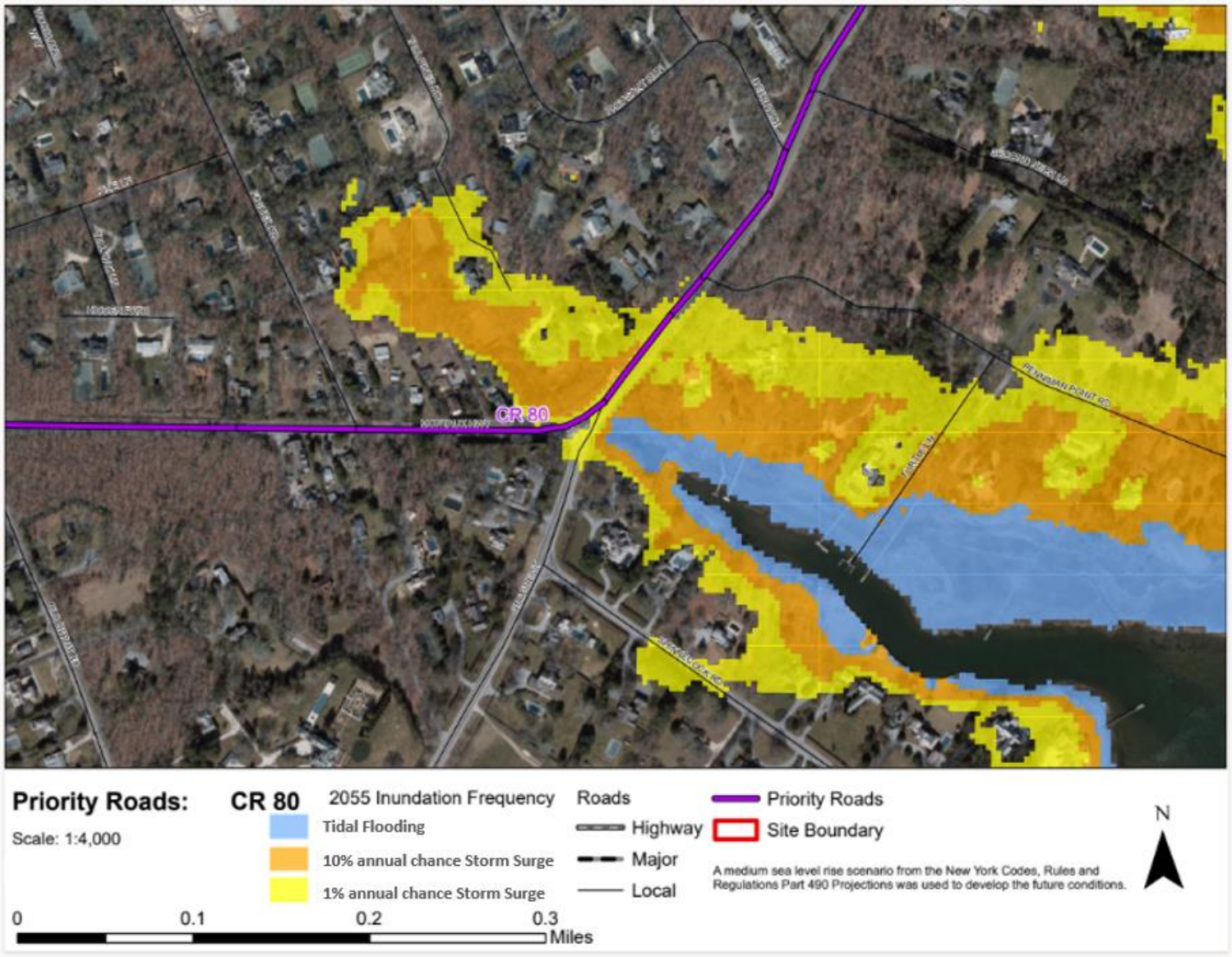


Figure A-29. Priority site map #16e: County Road 80 Montauk Highway – Penniman Creek, East Quogue.

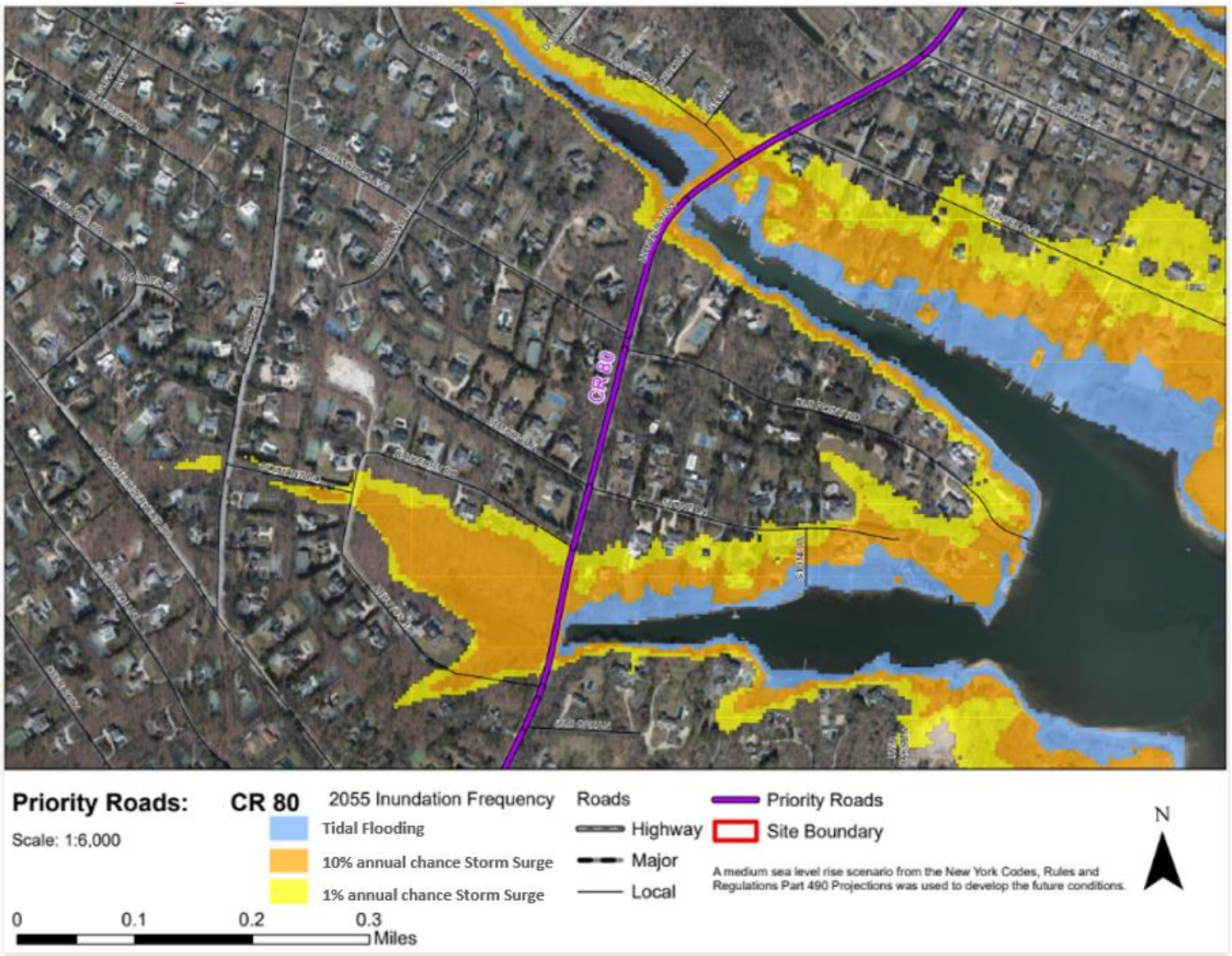


Figure A-30. Priority site map #16f: County Road 80 Montauk Highway – Stone Creek and Phillips Creek, East Quogue.

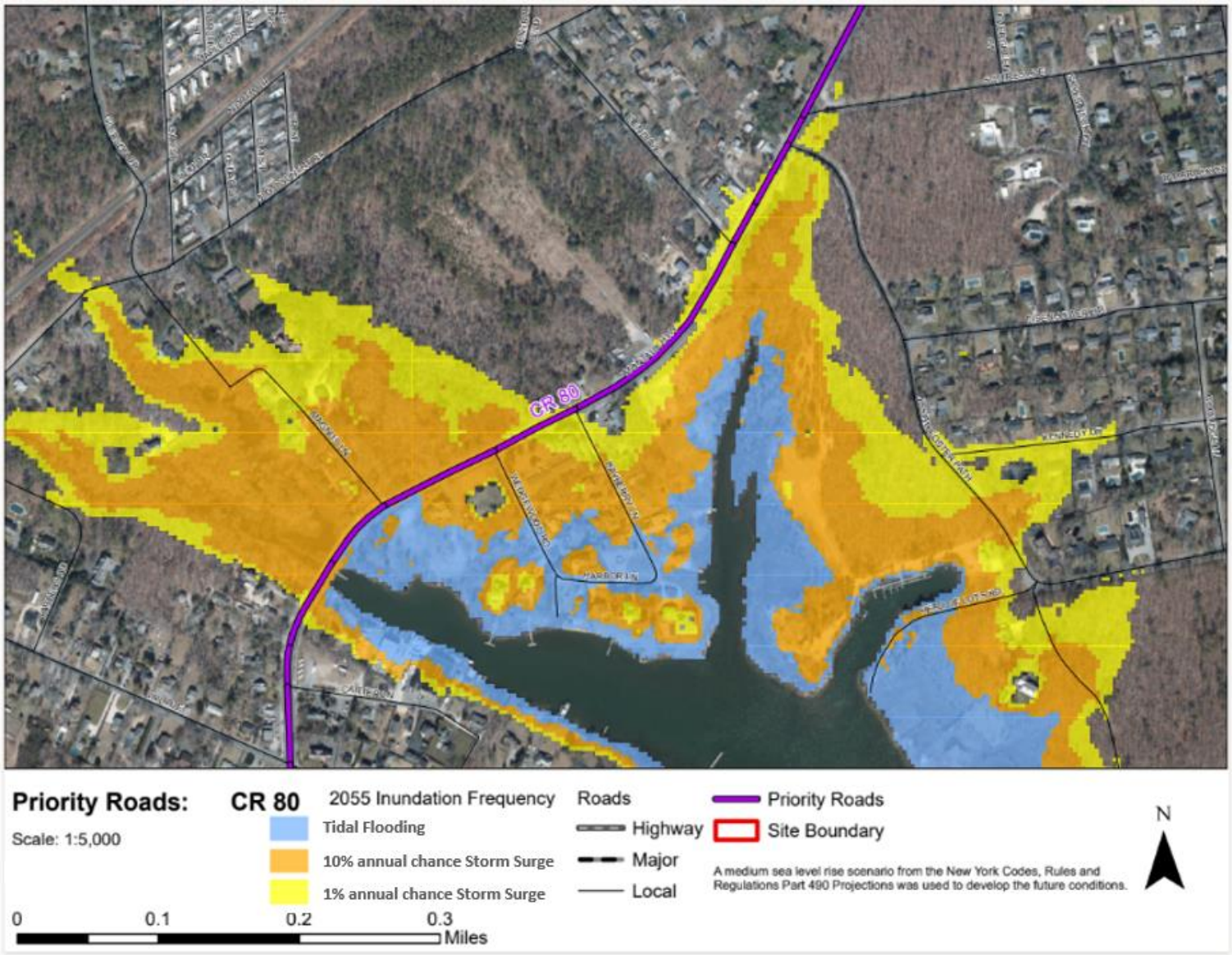


Figure A-31. Priority site map #16g: County Road 80 Montauk Highway – Weesuck Creek, East Quogue.

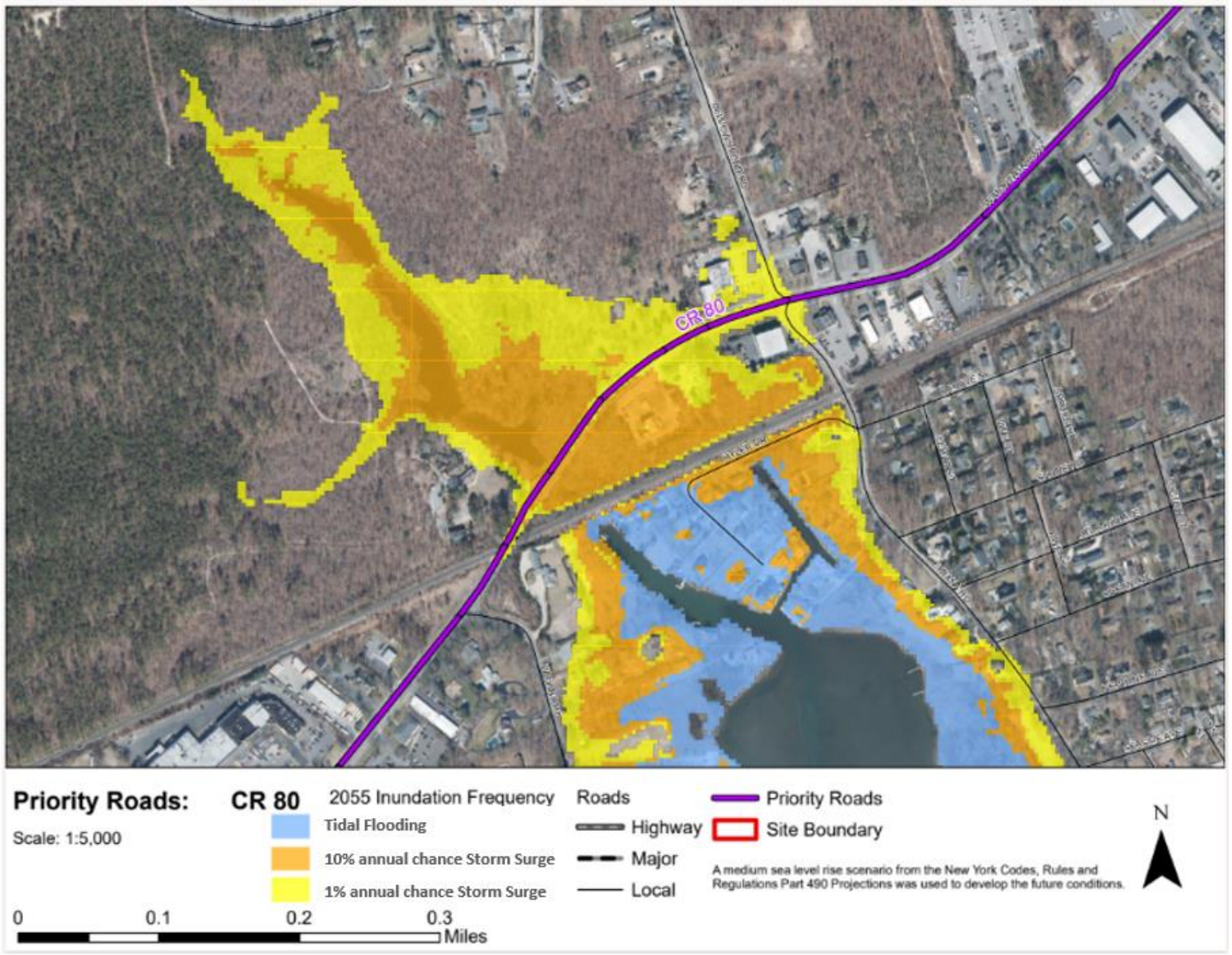


Figure A-32. Priority site map #16h: County Road 80 Montauk Highway – Tiana Bay, Hampton Bays.

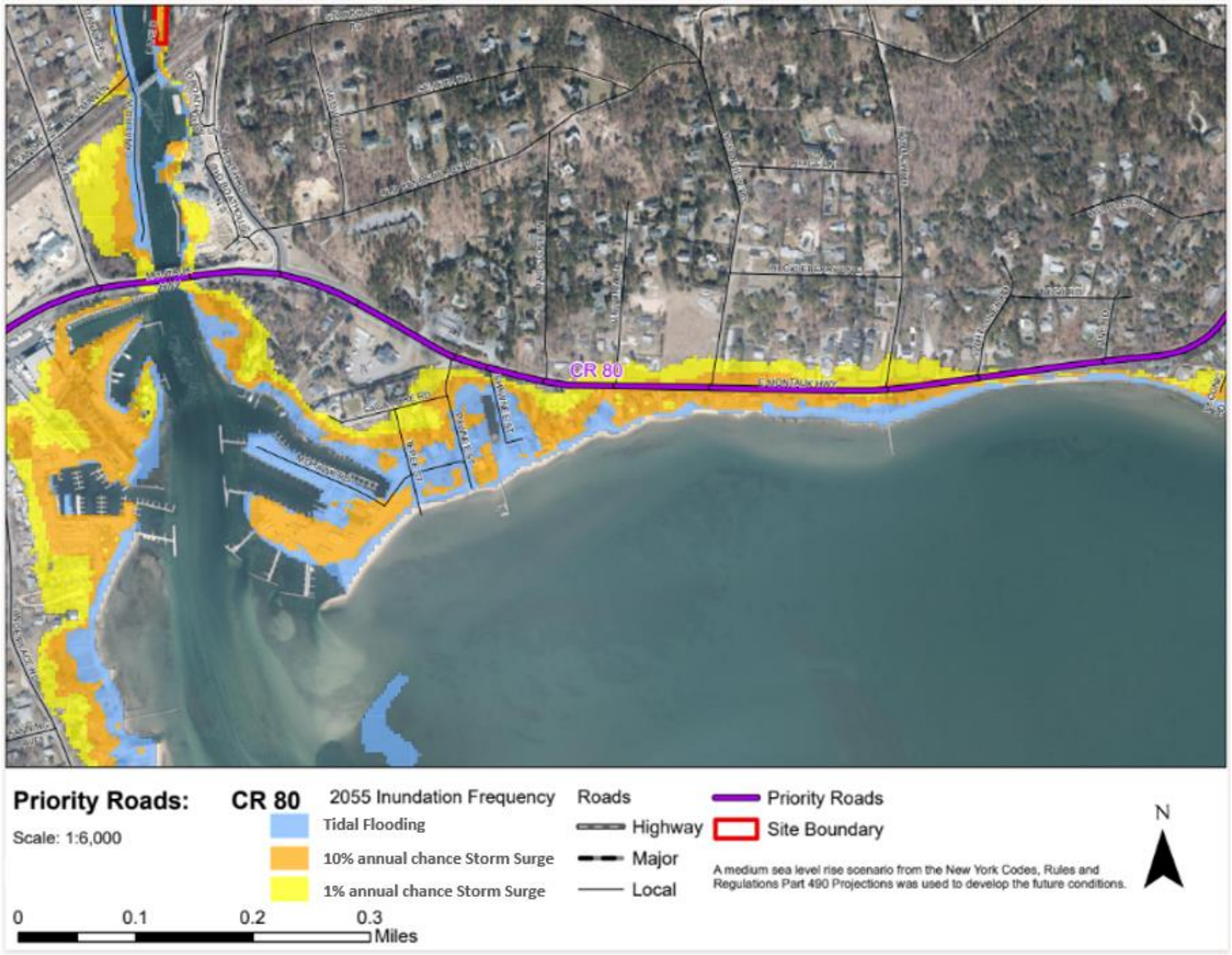


Figure A-33. Priority site map #16i: County Road 80 Montauk Highway – Shagwong Marina, Hampton Bays.

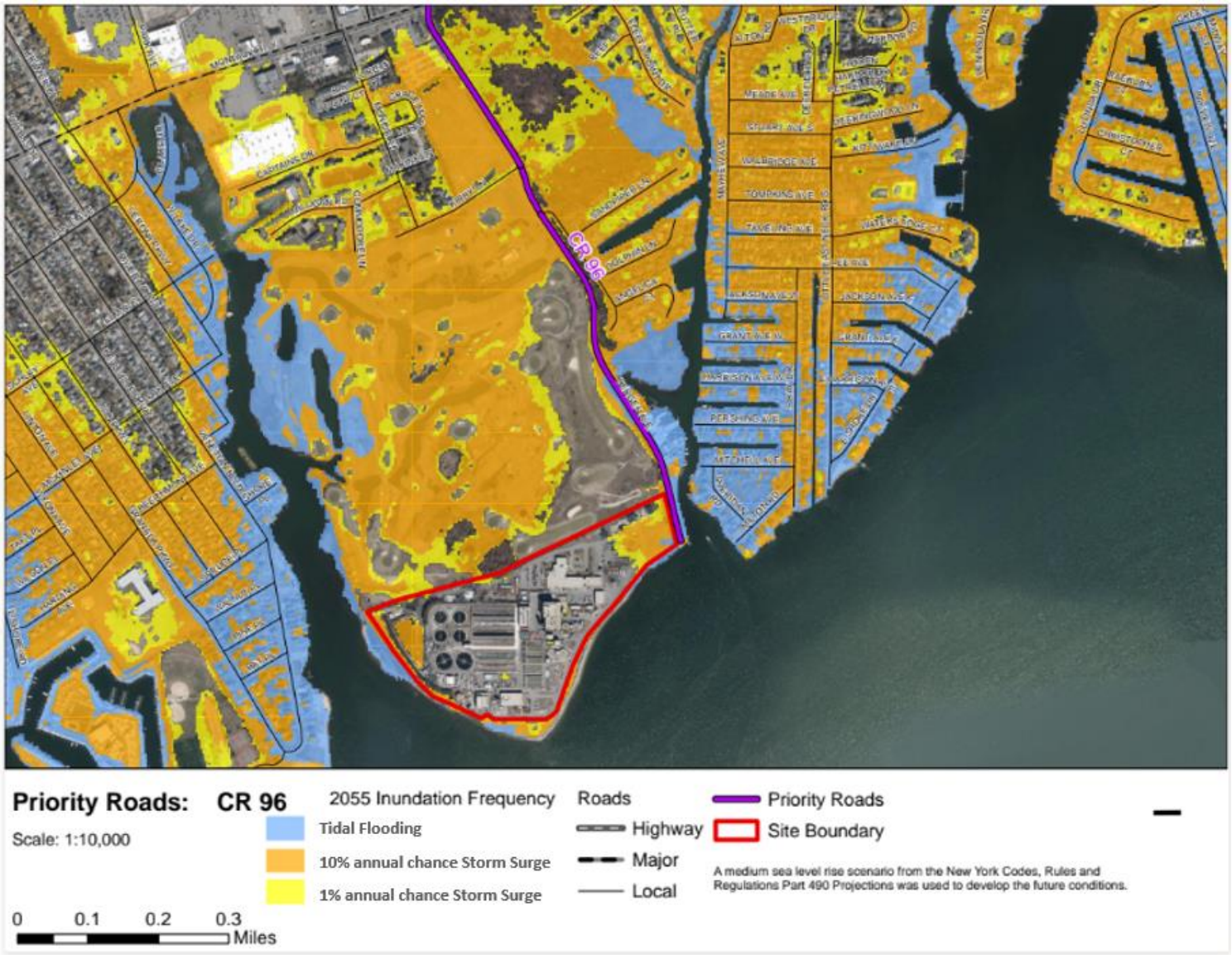


Figure A-34. Priority site map #17: County Road 96 Bergen Road – access to Bergen Point, West Babylon.

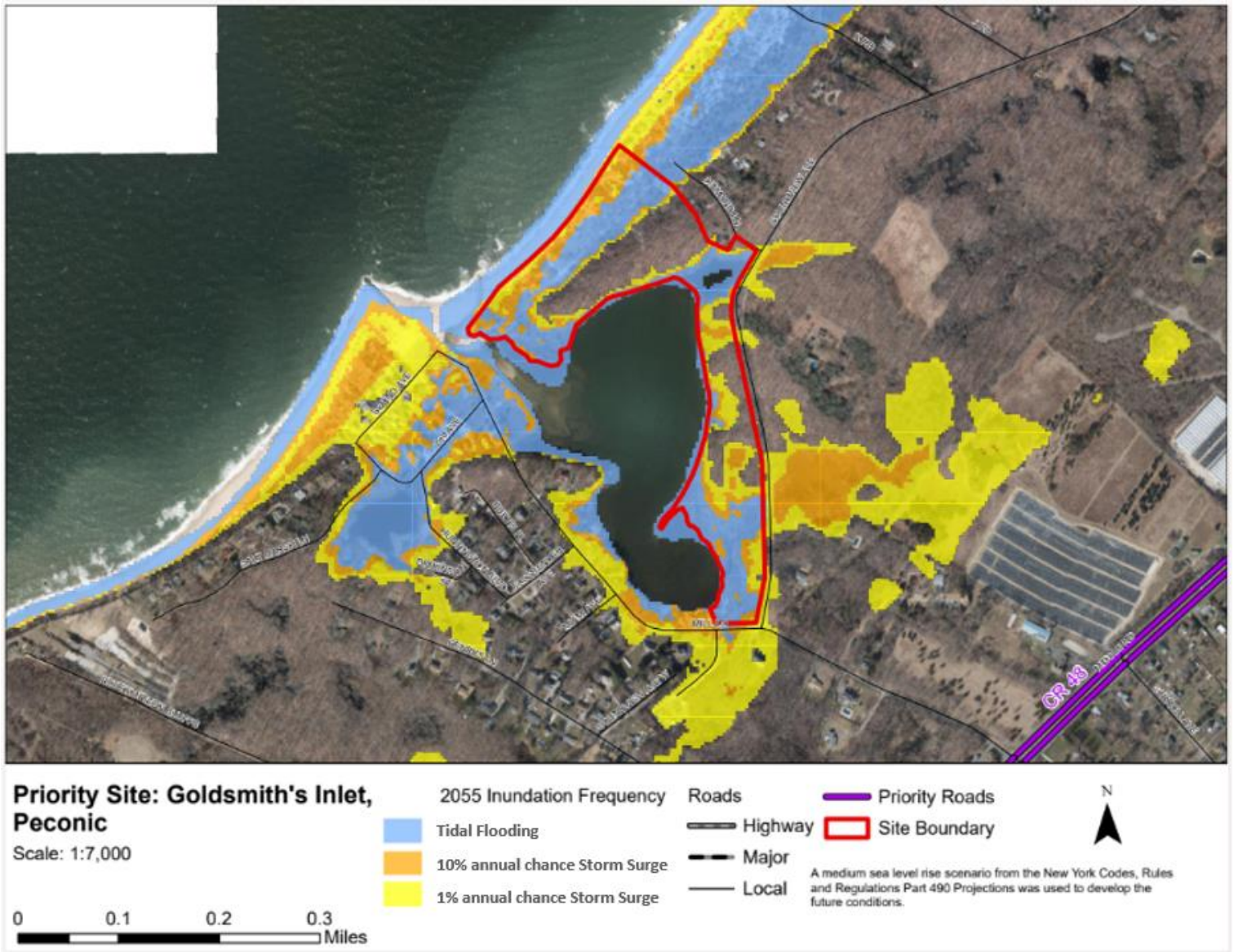


Figure A-35. Priority site map #18: Goldsmith's Inlet – property adjacent to Soundview Avenue and Mill Road, Southold.

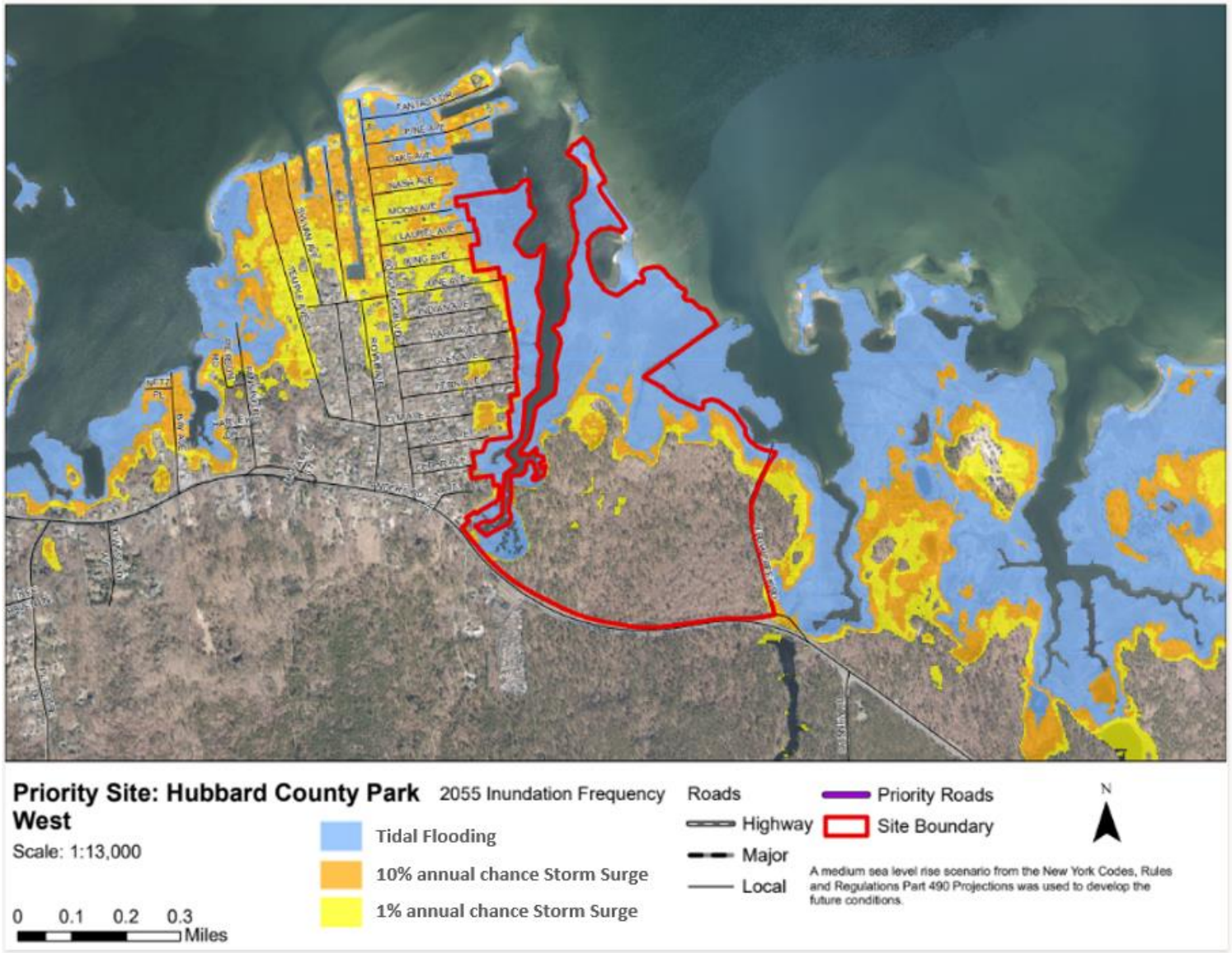


Figure A-36. Priority site map #19: Hubbard County Park West, Southampton.

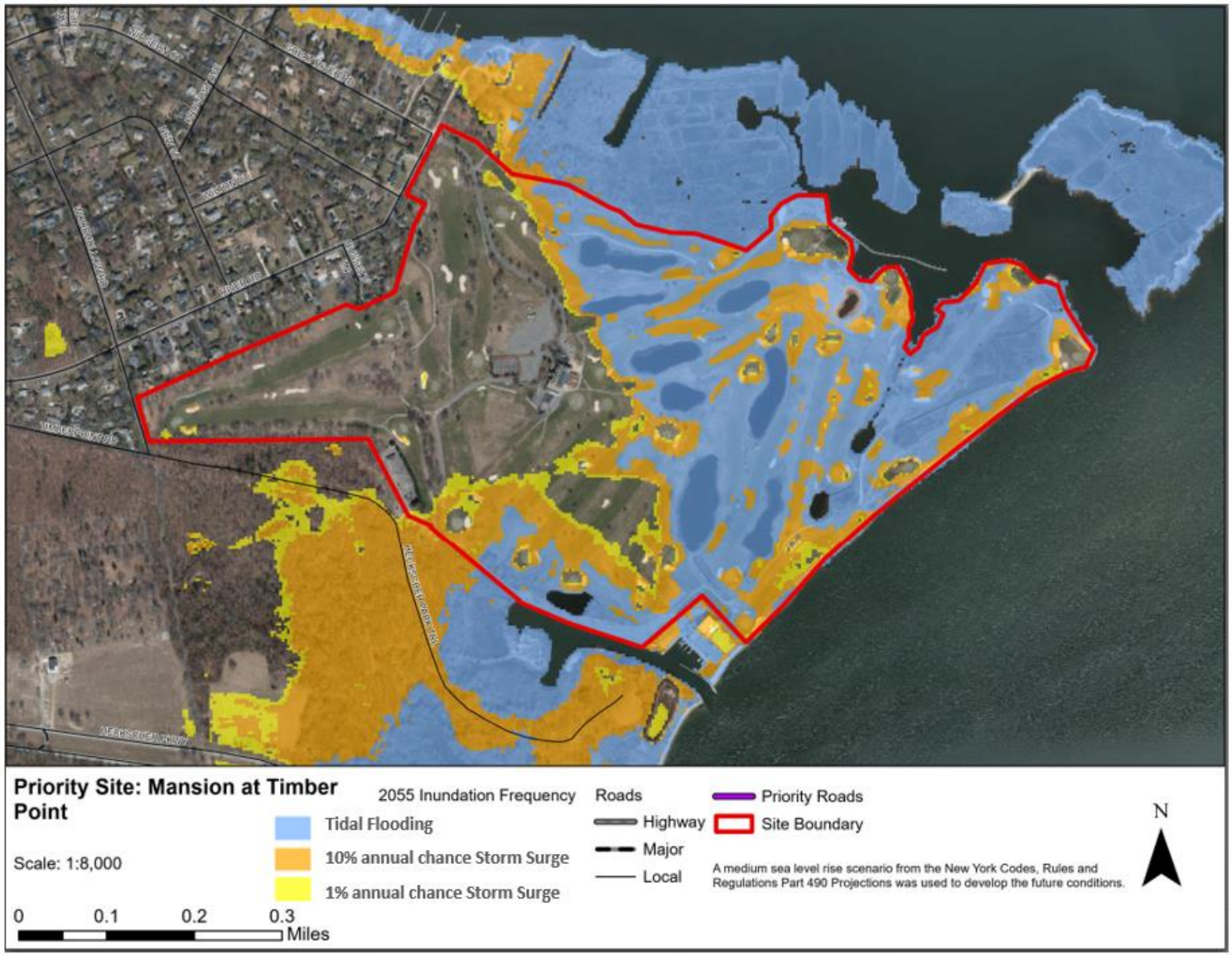


Figure A-37. Priority site map #20: Mansion at Timber Point, Great River.

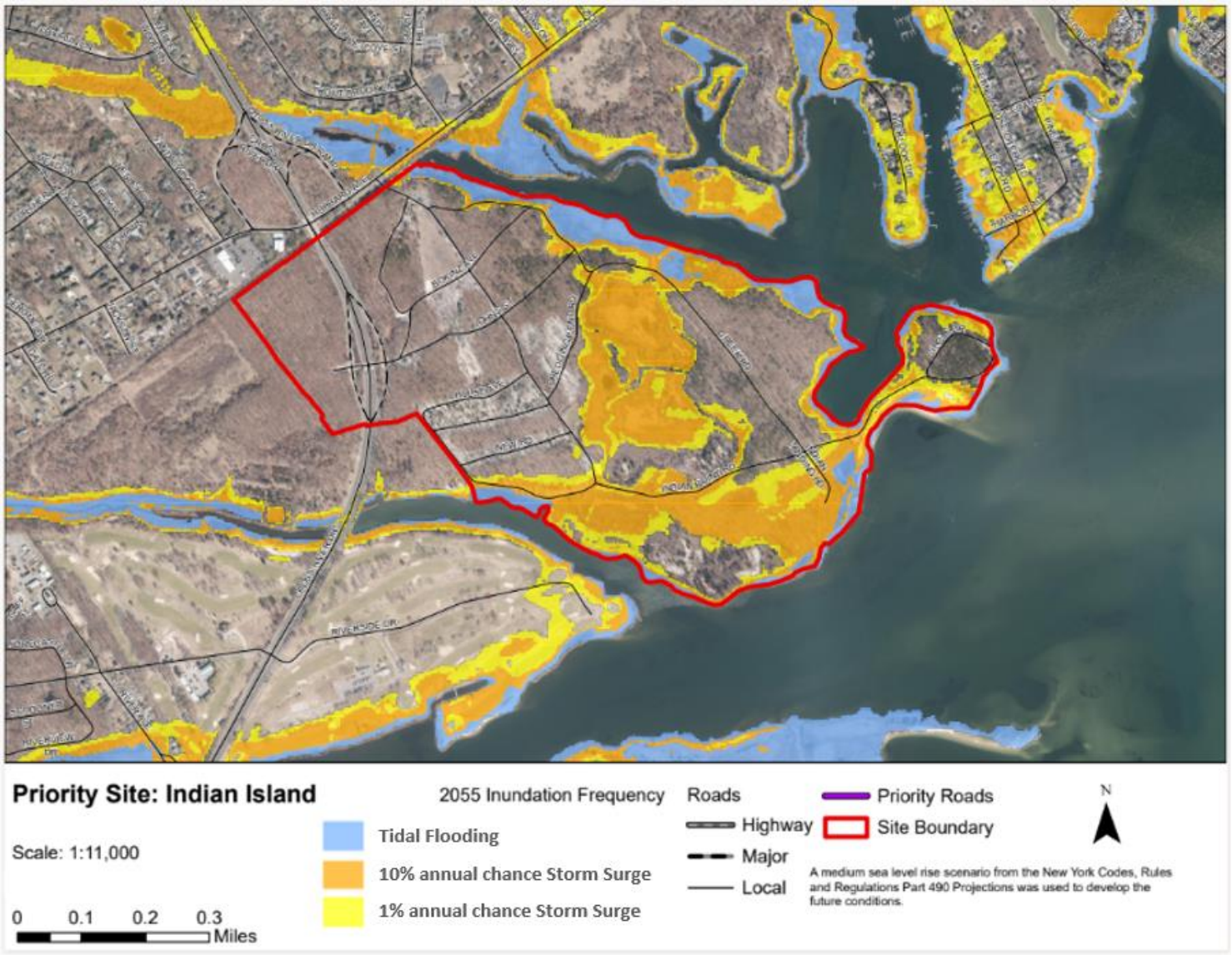


Figure A-38. Priority site map #21: Indian Island, Riverhead.

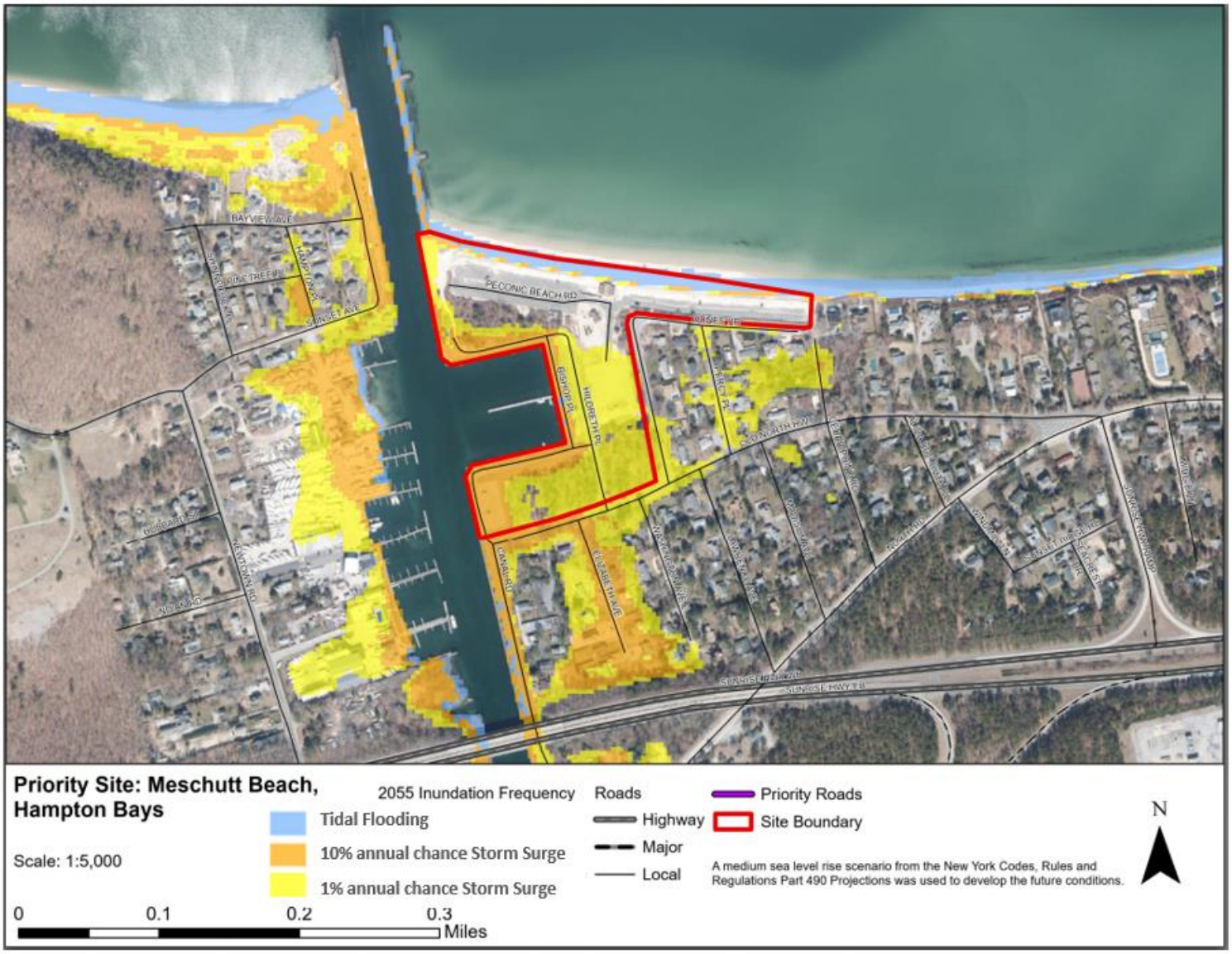


Figure A-39. Priority site map #22: Meschutt Beach, Hampton Bays.

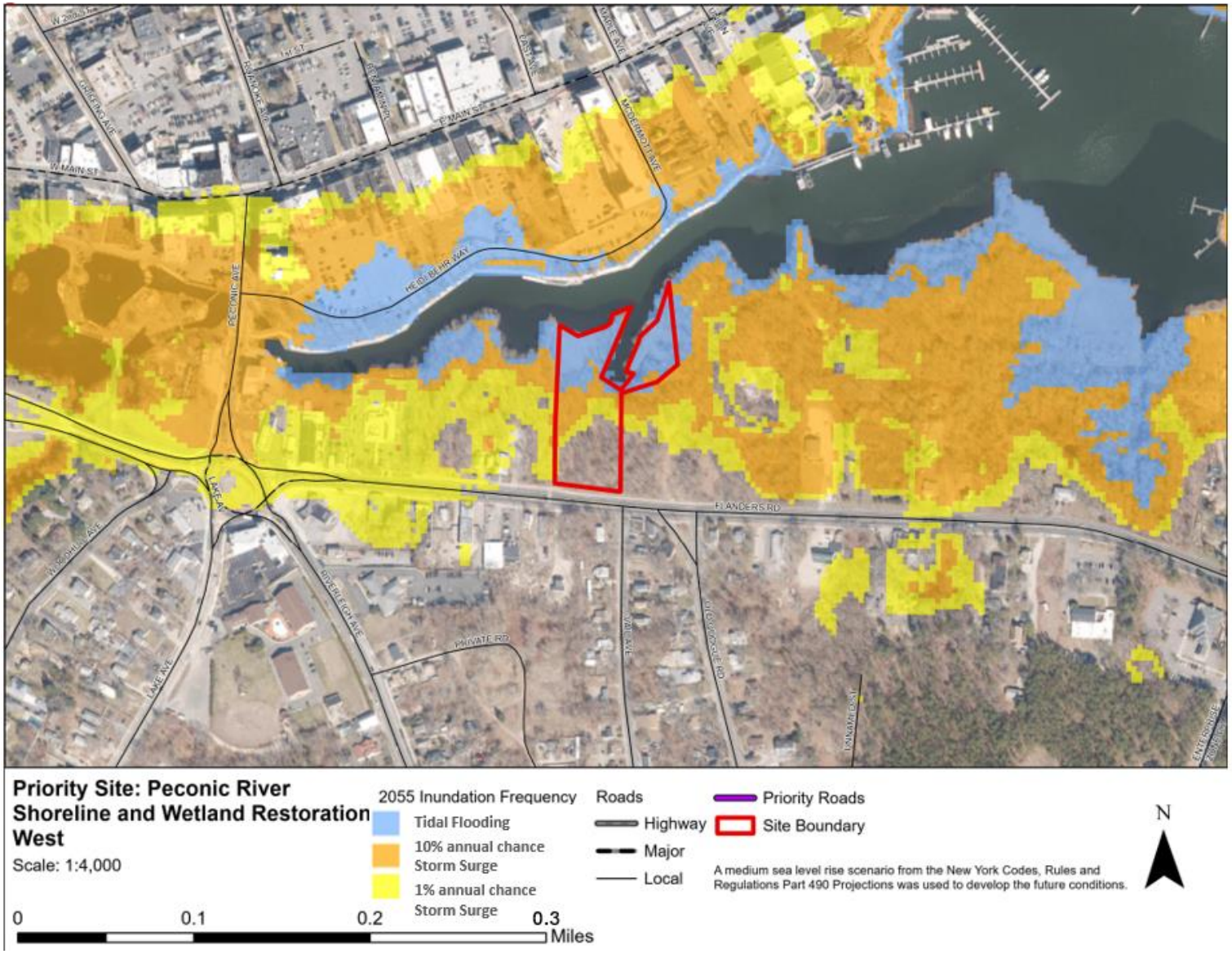


Figure A-40. Priority site map #23: Peconic River Shoreline – property adjacent to Flanders Road (NY-24), Hampton Bays.

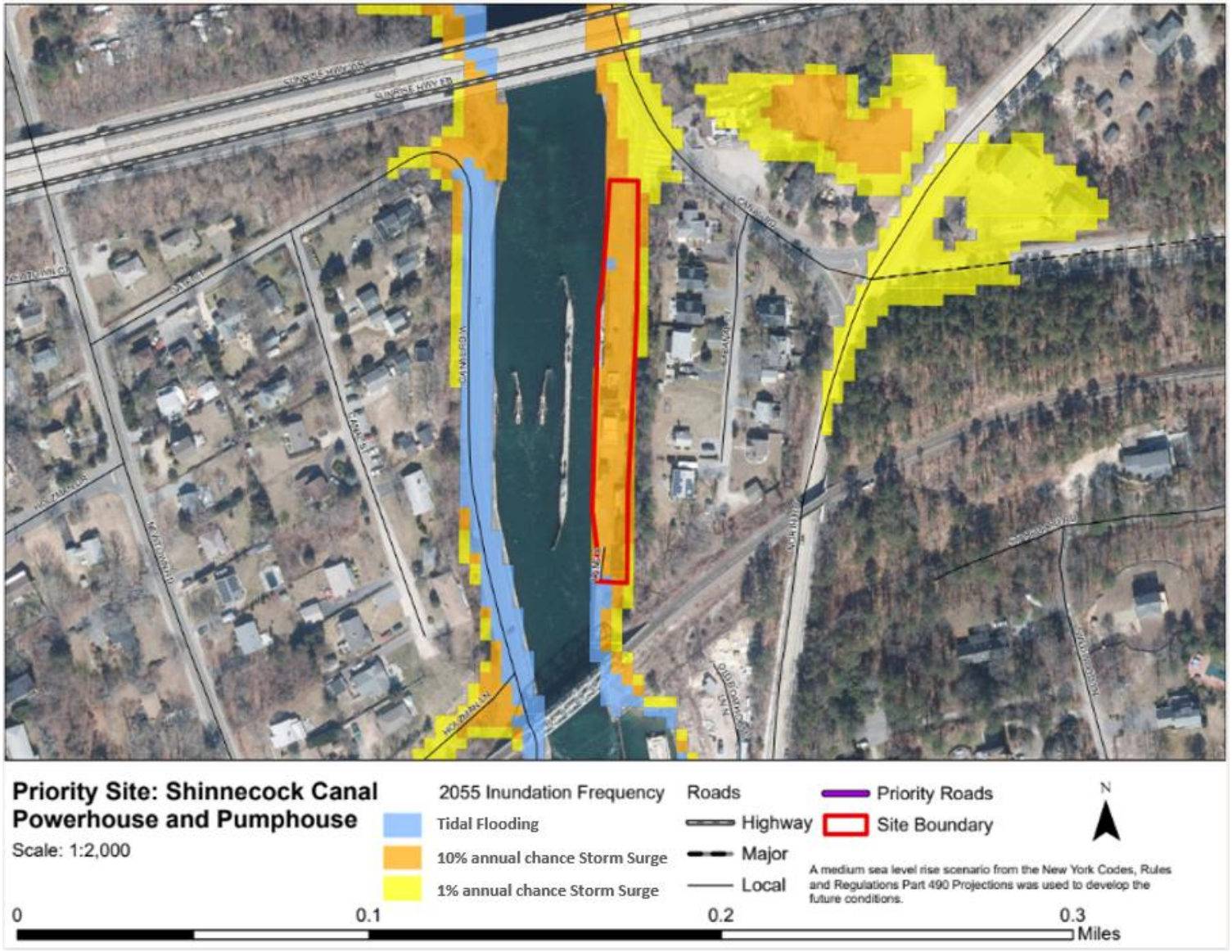


Figure A-41. Priority site map #24: Shinnecock Canal Powerhouse and Pumphouse, Hampton Bays.

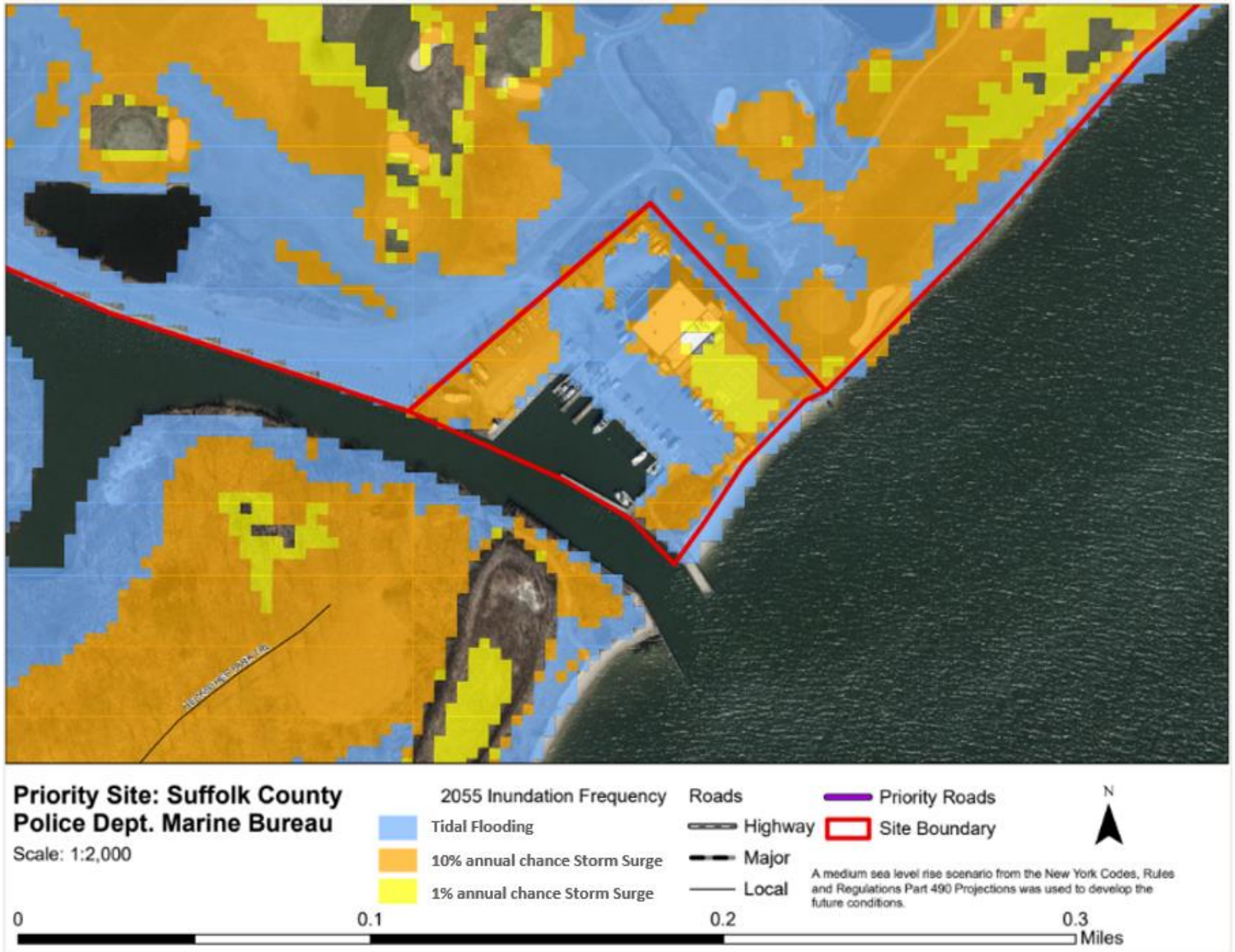


Figure A-42. Priority site map #25: Suffolk County Police Department Marine Bureau – Timber Point, Great River.

APPENDIX B – RELEVANT SUFFOLK COUNTY RESILIENCE REPORTS, STUDIES, & DOCUMENTS

Table B-1. Overview and findings from reports, studies, and documents relating to resilience and climate hazards in Suffolk County.

Report/Study	Year Published and Sponsor	Overview and Findings
Suffolk County All-Hazards Mitigation Plan[1]	2020, Town of Southampton	› This 2020 update was created in accordance with The Disaster Mitigation Act of 2000, where it has reassessed risk and updated strategies to manage and mitigate those risks. › Suffolk County participated in a mitigation workshop in June of 2020 and was provided FEMA publications to use as a resource for all possible activities and mitigation measures to address hazards. Regarding the mitigation strategy, fourteen criteria were used to prioritize each proposed mitigation action. › Various projects have been proposed which have been identified as high priority and will address flooding and costal erosion hazards such a multiple bulkhead replacement projects as well as bulkhead and roadway elevation. Bulkhead and roadway reconstruction were also recommended to address hazards such as hurricanes, severe storms, nor'easters, flooding and coastal erosion. Other actions recommended for addressing flooding include automated flood gates, repair appropriate spillways and dams. › During storm events, culverts are unable to accommodate excess water flow which causes flooding to the surrounding areas. Recommended actions include reconstruction, replacement or cleaning culverts throughout Suffolk County which will allow water to flow freely and will assist to eliminate flooding.
Superstorm Sandy Review Task Force[2]	2019, Suffolk County Legislature	› Superstorm Sandy was one of Suffolk County's worst experiences which has led to investments of Federal and State dollars through The New York State's Governor's Office of Storm Recovery (GOSR) for infrastructure improvements such as home elevation and additional natural protection due to property buyouts. › The Superstorm Sandy Review Task Force identifies that there are improvements to be made to be better prepared for the next storm or disaster such as improving governmental processes, enhancing man-made infrastructure, and bolstering natural protections. › The Task Force recognizes two strategies for managing coastal storm risks from a 2014 National Research Councill report. The first strategy looks to reduce the probability of flooding or wave impact through hard structures such as seawalls, levees, flood walls, and storm surge barriers, as well as natural mitigation strategies such as beach nourishment, dune building and restoration or expansion of natural areas. The second strategy looks to reduce the number of people or structures in areas at risk or to make them less vulnerable to storms which includes elevating or flood proofing, relocation, and land use planning. › According to the Task Force, Suffolk County and local municipalities should formulate zoning and land use policies that limit development in sensitive coastal areas. Other actions proposed include develop plans and programs to allow for retreat to occur at a large scale in Suffolk County, relocation, flood proofing, elevation, wind-bracing and anchoring, and living shorelines. › The Task Force recognizes that bulkheads, riprap revetments, seawalls, jetties and groins can have adverse impact on ecology while natural and hybrid approaches can be more cost-effective, therefore, prefers living shorelines to hardened shorelines.

Report/Study	Year Published and Sponsor	Overview and Findings
Suffolk County Comprehensive Master Plan 2035[3]	2015, Suffolk County Department of Economic Development and Planning	› The Suffolk County Comprehensive Master Plan 2035 is captured by three themes: Revitalize, Rebuild and Reclaim, i.e., Revitalize the economy, rebuild our downtowns and infrastructure, and reclaim the quality of our groundwater, surface water and terrestrial resources. › The existing pattern of low-density residential development with scattered single-use commercial areas can no longer be sustained by the network of transportation, water and wastewater infrastructure and cannot easily accommodate any additional residential growth or economic development. Also, is not resilient to large-scale disruption such as that caused by superstorm Sandy. › The Suffolk County Comprehensive Master Plan 2035 identifies six key objectives which include: build a 21st century transit network to provide more transportation choices to improve mobility, access, and safety; provide equitable, affordable, and fair housing; enhance economic competitiveness and capacity to build an innovation economy; support vibrant communities; streamline government, coordinate policies, and leverage investment; protect the environment and enhance our human capital. › The Suffolk County Comprehensive Master Plan 2035 recommends the following actions and implementation strategies as a result of Superstorm Sandy to promote resilience: create and/or expand sewer districts for existing communities identified as priority areas and upgrade current wastewater infrastructure to improve coastal resiliency, water quality, and/or targeted economic development supported by local communities; identify locations for wastewater upgrades to protect water quality and promote resurgence of coastal wetlands; facilitate the development of stormwater management projects (rain gardens, permeable pavement, etc.) for enhanced coastal resiliency; improve resiliency of Suffolk County's transportation systems and limit expenditures in high hazard areas (e.g., within the 100-year floodplain); to the greatest extent possible, leave shorelines in a natural state, where appropriate and feasible; pursue New York State and Federal funding for resiliency; provide funding for the implementation of green infrastructure (i.e., bioswales, permeable pavers, wetland restoration); and wastewater treatment upgrades in unsewered, flood prone areas.
Climate Smart Communities Certification Report[4]	2020, Climate Smart Communities	› The Climate Smart Communities Certification Report identifies Suffolk County as a Silver Certified Climate Smart Community. Suffolk County was certified on May 28, 2020, with 349 points earned from 54 completed actions. The certification will expire on September 30, 2025. › Suffolk County Earned 16 Points on the Community Climate Action Plan, a bronze and silver priority where it sets a target of 20 percent reduction in community wide emissions below the 2005 baseline by 2020. › The Suffolk County Comprehensive Master Plan 2035 earned 21 points and identified as a bronze and silver priority where the plan was developed with an emphasis on sustainability, resiliency, and innovation in planning for Suffolk Counties future. › Alternative-fuel Infrastructure earned 12 points, a bronze and silver priority for the Clean Energy Communities Program where the County has 4 CNGV fueling stations installed in 2011 and are open to the public. › Climate Vulnerability Assessment earned 4 points, a bronze priority, and silver priority for the Superstorm Sandy Review Task Force. The Climate Adaptation Plan, a bronze priority and silver priority, earned 8 points for the Superstorm Sandy Review Task Force for reviewing past and current conditions and drafting strategies for the future.
Suffolk County Climate Action Plan[5]	2015, New York Climate Smart Communities	› The Climate Action Plan is organized into four sections: Municipal Facilities and Operations; Suffolk County Community College Facilities and Operations; Community-wide Policies and Initiatives; and Climate Change Adaptation and Resiliency. Section four, Climate Change Planning and Adaptation, provides an overview of the County's plans to adapt to the effects of climate change including rising seas, more intense rainfall, higher temperatures, and more frequent droughts.

Report/Study	Year Published and Sponsor	Overview and Findings
		› The Action Plan acknowledged possible effects of climate change based on a report from the New York State Energy Research and Development Authority called ClimAID. ClimAID projects that there will be lowered groundwater, increased water temperatures, lost agricultural productivity from temperature stresses, summer drought, invasive species, increased flooding affecting ecosystems, communities, and infrastructure. In addition, it identifies sea level rise, leading to permanent inundation of low-lying areas, increased beach erosion, reduction of coastal wetland area and species, and flood events that are more frequent and more destructive. › The adaptation strategies fall into three categories: Protection, Accommodation and Retreat. The first category, Protection, recommends maintenance of local and regional ecosystems, habitat restoration, coastal buffers, wetland mitigation, urban reforestation, and expanded green infrastructure. Natural (soft) solutions are preferred to constructed (hard) solutions. The next section, Accommodation, recommends strategies that do not prevent flooding or inundation, but allow structures to survive. Examples include elevation of structures and stormwater system improvements. The last section, Retreat recommends strategies that do not prevent flooding or inundation but offer options for the loss of use or property value. Examples include buyouts, acquisitions, transfer of development rights, purchase of development rights, rolling easements, and conservation easements. › Other strategies under consideration include: retrofitting, acquisition and/or relocation of structures located in flood-prone areas to protect structures from future damage, especially those known to be identified as 'repetitive loss' properties and raise historic structures; develop and/or enhance the current stormwater management; track repetitive loss properties and develop potential strategies for transitioning properties to non-residential/public use; in preparing for a storm or emergency event, restrict access to highly vulnerable and/or dangerous areas to decrease evacuation times and reduce unnecessary risks; develop a pilot program to upgrade wastewater infrastructure in flood prone coastal areas; restore bulkheading and reconstruct jetties throughout Suffolk County; install sewage pump stations as well as making improvements to existing stations; provide infrastructure protection and erosion control; enhance existing beach nourishment plans; and develop engineered beaches where appropriate.
Suffolk County Department of Fire, Rescue and Emergency Services Report	2022, Suffolk County Department of Fire, Rescue and Emergency Services (FRES)	› The Sandy Damage Suffolk County Facilities list identifies damages at specific facilities and their repair costs. › Most of the damage seen related to Superstorm Sandy is roof damage. Reported repair costs by the insured range from $20,000-$155,000. The JSH ACV estimate ranged from $14,000-$90,000 › Water and flood damage is also seen due to Superstorm Sandy. Reported repair costs by the insured range from $4,000– $125,000. The JSH ACV estimate ranged from $3,2000- $245,000. › The total repair cost of all damage across Suffolk County facilities reported and updated by the insured as of 06/27/2013 is $2,403,313.80. The JSH ACV estimate for total repair cost is $1,435,043.55 › When inspecting each facility, buildings that were very poorly maintained were noted as well as damages related to Tropical Storm Irene

APPENDIX C – PAC MEETINGS

PAC MEETING #1

DATE	02 March 2022
TIME	11:00 AM – 1:00 PM
VENUE	398 Great River Rd, Great River, NY 11739 (Timber Point Country Club)
SUBJECT	PAC Meeting #1: "Discovery"

ATTENDEES

Project Team Attendance			
WSP	**VHB**	**Wilson**	**Suffolk County**
Aryeh Lemberger	Louis Bekofsky	Krause Wilson	Dorian Dale
Adriana Herrera	James Rigert		Sarah Lansdale
Michael Flood	Kim Rondinella		

PAC Attendance			
Name	**Affiliation**	**Email**	**Phone**
Robyn Silvestri	Save the Great South Bay	robyn@savethegreatsouthbay.org	631-848-0210
Tom Iwanejko	Suffolk County Department of Public Works	tom.iwanejko@suffolkcountyny.gov	631-852-4267
Alison Branco	The Nature Conservancy	alison.branco@tnc.org	917-612-5389
Lorne Brousseau	LLE Suffolk	LB66@cornell.edu	631-871-1250
Al Krupski	Suffolk County Legislature	al.krupski@suffolkcountyny.gov	631-852-3200
Elizabeth Cole	Long Island Regional Planning Council	ecole@lirpc.org	516-571-7613
Robert Calarco	NYS Department of Environmental Conservation	Robert.calarco@DEC.NY.gov	631-444-0256
Irene Donohue	Suffolk County Legislature	irene.donohue@suffolkcountyny.gov	631-852-8400
Colleen Badolato	Suffolk County Department of Economic Development and Planning	colleen.badolato@suffolkcountyny.gov	631-853-5204
Janice Scherer	Town of Southampton	jscherer@southamptontownny.gov	631-702-1801
Bridget Fleming	Suffolk County Legislature 2nd District	bridget.fleming@suffolkcountyny.gov	631-852-8400
Lindsay Kurnath	National Park Service Fire Island National Seashore	lindsey-kurnath@nps.gov	631-687-4750
Elisa Picca	Suffolk County	elisa.picca@suffolkcountyny.gov	
Michael Monaghan	Suffolk County Department of Public Works	monaghanm@suffolkcountyny.gov	516-458-5925
Pat Beckley	Suffolk County Fire, Rescue, and Emergency Services	Patrick.beckley@suffolkcountyny.gov	631-655-6134
Jeremy Campbell	NYS Department of State – South Shore Estuary Reserve	Jeremy.campbell@dos.ny.gov	518-949-0315
Aram Terchunian	First Coastal	aram@firstcoastal.com	516-982-0743

PAC Attendance			
Maureen Murphy	Citizens Campaign	mmurphy@citizenscampaign.org	-
Adrienne Esposito	Citizens Campaign	aesposito@citizenscampaign.org	631-384-1378
Marshall Brown	Long Island Conservancy	marshall@longislandconservancy.com	212-380-8148
Brian Zitani	Town of Babylon	bzitani@townofbabylon.com	631-422-7640
Danielle Tommaso	U.S. Army Corps of Engineers	Danielle.m.tommaso@usace.army.mil	917-790-8527
Jennifer A. Juengst	Town of Smithtown	jjuengst@smithtownny.gov	631-360-7570
Kevin McAllister	Defend H2o	Mac.waterwarrior@icloud.com	631-599-9324
Chris Schubert	USGS	schubert@usgs.gov	631-736-0783
Alan Duckworth	Town of Brookhaven	Aduckworth@brookhavenny.gov	-
James Fonda	NYS Department of Transportation	James.fonda@dot.ny.gov	631-952-2762
Jade Blennau	Peconic Estuary Partnership	Jade.blennau@suffolkcountyny.gov	631-852-2967
David Calone	Jove Equity Partners	dcalone@jovepartners.com	917-684-1052

A press conference on the Suffolk County Coastal Resiliency Study was held on March 2, 2022. Following the press conference, a kick-off "discovery" meeting was held with the Project Advisory Committee (PAC). The following notes highlight key items discussed during the meetings.

Press Conference

A press conference was held at Timber Point Park to highlight key aspects of the Suffolk County Coastal Resiliency project. Speakers included: County Executive Steve Bellone; Legislators Bridget Fleming, Kevin J. McCaffrey, and Al Krupski; The Nature Conservancy's Alison Bronco; and Executive Director for Citizens Campaign for the Environment, Adrienne Esposito.

PAC Meeting Notes

1.1.1.1 Opening Speaker: Legislator Bridget Fleming

This project was originally conceptualized in 2019 with $200,000 allotted from the County's capital budget. The Legislature's vision for this project included establishing funding for an RFP and developing specifications to help drive the vision for coastal resiliency.

With this substantial investment, the County has the opportunity to take bold and thoughtful action to mitigate climate change impacts with a focus on nature-based solutions. Nature-based solutions were a focus of identifying resiliency measures (e.g., offshore reefs, living shorelines, etc.)

1.1.1.2 *Agenda (see attached presentation)*

1. Project introductions
2. PAC members & project team introductions
3. Project goals & products
4. Project timeline
5. Discovery working session
6. Next steps & action items
7. Open discussion and Q&A

1.1.1.3 *Project Introductions*

- Following Legislator Bridget Fleming's opening remarks, Dorian Dale, Suffolk County project manager, provided project introductions and outlined the purpose of the study.
    - The primary driver for the Suffolk County Coastal Resiliency Study is to identify feasible adaptation and mitigation projects that will have the greatest impact on people, infrastructure, and the environment.
    - Many of the County's key assets that need attention or investment are both costly and time consuming. For example, the road elevation project in Captee costs over $1 million per ¼ mile to raise the road two inches.
    - The County will look at global examples of resilience strategies that have proven to work and will apply them to the County.
    - A preliminary list of adaptation and mitigation measures were presented and are included in the attached presentation.
- Legislator Al Krupski noted that Land Preservation should be added to the list of adaptation measures and mitigation measures to be looked at as part of this project

1.1.1.4 *PAC members & project team introductions*

- Following Dorian Dale's project introduction and project outline, Aryeh Lemberger, consultant team project manager, introduced the PAC members and project team.
- Throughout the project, the PAC will be asked to provide input on the priority assets, handbook development, recommendations for resiliency measures, funding sources, and capital financing plan.

1.1.1.5 *Project Goals & Products*

- Project deliverables were discussed including the web-based GIS tool which will be used to help identify priority at-risk county assets.
- The GIS tool will be an interactive, editable, and customizable.

- The GIS tool will provide users the ability to select a County property or asset and display a summary of its potential risks, including anticipated flooding and whether the cause is due to tidal inundation, groundwater inundation, and/or storm events so proper mitigations can be identified.
- The GIS tool will help identify an initial 'long-list' of top 25 Priority Assets. From the priority assets, the project team will develop concept-level designs and costs estimates for up to 10 realistic and implementable projects.
- FEMA benefit/cost analysis (BCA) that incorporates changing conditions associated with climate change will be developed for the 10 projects so that the BCA information can be further utilized in subsequent grant applications.
- A handbook will be developed. It will provide the County with a blueprint for how to anticipate and respond to risks anticipated for the future based on a uniform set of guiding principles. The handbook will also contain an evaluation matrix to help identify coastal resiliency risks and methodologies for resilience design that can be further applied to county and non-county properties in the future.
- The GIS tool and handbook will provide important points that help to prioritize a list of projects for incorporation into a long-term capital financing plan. The capital financing plan will contain long-, mid- and near-term priorities and information about available non-county funding sources.

1.1.1.6 Project Timeline

- An overview of the anticipated PAC meeting dates and other meetings were discussed. The project schedule can be found in the attached presentation.
- There will be a total of four (4) PAC meetings scheduled to present strategies and concepts, identify project goals and the vision for the development of the handbook, and provide input relating to project recommendations, evaluation processes, and capital financing planning.
- The schedule has overlapping timelines between tasks which will help integrate discussions and findings.

1.1.1.7 Discovery Working Session

- At this point in the presentation, the project team engaged with PAC members around three (3) topic area stations organized to gather input/feedback:
    1. Resiliency Measures Topic Area Station
        - This station was set up to facilitate dialogue on resiliency measures that are most important to PAC members.
        - An easel with a board was provided for PAC members to write down their priorities. The following input was provided by PAC members:
            - Sand Bypass
            - Storm preparation - River/pond systems should have flood control gates to lower water levels before storms
                - Could also remove impoundments to restore habitat and allow water to fill and slow storm floods
            - Oyster reefs

- Land preservation/acquisition – create recharge for public safety
- Tidal gates/flood gates – doubles as energy generation
- Land elevation and soil creation

- Through a questionnaire provided by the project team, the PAC was able to identify their top 5 resiliency measures viewed as favorable solutions. Based on the responses, the following reflects the measures considered top priorities of PAC members:

Priorities	Quantity of Votes	Priorities Cont.	Quantity of Votes
Wetland restoration	9	Retreat	3
Living shorelines	8	Catch basins	2
Hardening critical infrastructure	5	Offshore reefs	2
Road elevation	5	Backup generation	1
Beach replenishment	4	Flood gates	1
Nitrogen loading reduction	4	Open space acquisition/recharge	1
Stormwater systems	4	Oyster reefs	1
Bioswales/rain gardens	3	Pervious road/surfaces	1

2. Priorities Topic Area Station

- This station focused on obtaining input from PAC members relating to priority resiliency measures/coastal assets, as well as any guiding principles of interest.
- The following PAC input was received at the Priorities Station:
  - Priority Assets
    - Sea level rise results in equivalent groundwater table rise which leads to:
      - Failure of septic systems
      - Failure to stormwater systems (recharge basins and leaching basins)
      - Soil instability (landslides and subsidence)
    - Road-stream crossings
      - Need to upsize culverts or create bridges
    - Public and private sunny day flooding

        - Anything within the 10-year floodplain
        - Coastal communities
        - Coastal infrastructure
        - Ecosystem services
        - Sewage treatment plants
        - Commercial fishing industry
            - Landings and docks
        - County parklands and Town infrastructure nearby
    - Guiding Principles
        - Long-term and sustainable – no more band-aid solutions
        - Limit shoreline hardening to only the locations where it is most essential
        - Protect natural shorelines
        - Use nature (i.e., wetlands) to protect people
        - "Do no harm"
        - Beneficial re-use
        - Multi-functional (solutions that solve more than one problem)
        - Systems philosophy
        - Regenerative and value-adding
        - Not just money
            - Need to consider people and equity
        - Effective, permittable, and affordable
        - Communicate with each other and our communities

3. Identification & Mapping of Coastal Assets Focus Area Station

    - This station provided PAC members the opportunity to identify priority County-owned coastal assets that should be protected. Three maps were provided for PAC members to mark up, identify points of concern or prioritization and add notes.
    - The following PAC input was received at the Identification & Mapping of Coastal Assets Station:
        - County Holdings (Map 1):
            - Focus on priority areas along southern shore and forks with some focus on the north shore.
            - Areas of concern include:
                - Protect lifeline roads below the floodplain
                - Health care access

        - Power generation facilities
        - Dredging concerns
        - Locations of sewage treatment plant outfalls that contribute to wetland loss
        - Inlet restoration
    - County assets of concern:
        - Suffolk DPW
        - Suffolk County Marine Environmental Learning Center
        - Smith Point County Park
        - Suffolk Police Marine Bureau
    - Other assets of concern:
        - Cornell Cooperative Riverhead
        - Bergen Point Golf Course
        - Port Jefferson Wastewater Treatment Plant
        - West Sayville Golf Course
        - Gilgo Inlet
        - Islip Shellfish Culture Facility
- County Holdings and Sea Level Rise (Map 2):
    - Priority areas focus on protection of natural features, addressing existing transportation systems, and mitigating erosion and degradation.
    - Areas of concern include:
        - Wetland restoration
        - Shelter Island ferry systems
        - Pesticide reduction
        - Reservoir shrinkage
        - Bluff retreat
        - Land protection
        - Road flooding
        - Retreat management
        - Seagrass protection
        - Stormwater runoff reduction
    - County assets of concern:
        - Suffolk County Wetlands Stewardship Strategy locations

- Other assets of concern:
    - Accabonac harbor
    - Shelter Island ferry
    - Shinnecock Nation
    - Dune Road
    - Shoreham bluffs
    - Belle Terre Coastal Park
    - Meadowcroft Estate
    - Fire Island National Seashore

- County Holdings and Flood Hazard Areas (Map 3):
    - Priority areas along southern shore and forks with no notes on the north shore.
    - Comments on this map were similar to those in the sea level rise map, with more emphasis on specific assets of concern.
    - County assets of concern:
        - Orient Point County Park
        - County roads vulnerable to flooding
        - Goldsmith's Inlet Park and jetty
        - Suffolk County Marine Environmental Learning Center
        - Indian Island County Park
        - Cupsogue Beach County Park
    - Other assets of concern:
        - Tiana Shores Association
        - Brown's River

1.1.1.8 Next Steps & Action Items

- Following the breakout session, Aryeh Lemberger discussed what the project team will be doing between PAC Meeting #1 and the next PAC meeting and what the PAC members can expect in PAC Meeting #2:
    - The project team will be advancing the Reconnaissance tasks including preparing the GIS mapping tool.
    - The next meeting will be during development of the evaluation criteria and evaluation matrix, and at the beginning of the development of site-specific recommendations.

1.1.1.9 Open Discussion and Q&A

- Legislator Bridget Fleming asked if the project team and County is conscious and aware of the urgency to obtain federal and state funds (by deadlines). The project team responded by noting that the project team and County will be looking at opportunities and deadlines, but some things are to be determined (such as

cost-effective project recommendations) as time goes on. Many funding programs are recurring, but some are also time sensitive so it will be an evolving and important matter. Additional funding was also noted by Dorian, which can come from other organizations (i.e. US Army Corp of Engineers - USACE).

- Adrienne Esposito noted that Infrastructure grant money from the NYS Environmental Facilities Corporation will be going away.
- Legislator Bridget Fleming noted that the County should prioritize a few projects early on so the County can take advantage of available/additional funds.
- $60 million was allocated to green infrastructure from FIMP.
- 14 nature-based infrastructure projects are already in effect and have obtained grant money. It is unlikely that this money will still be available.

PAC MEETING #2

DATE	12 December 2023
TIME	2:00 PM – 4:00 PM
VENUE	Microsoft Teams – Virtual Meeting
SUBJECT	Final PAC Meeting

ATTENDEES

Project Team Attendance	
WSP	**Suffolk County**
Michael Flood	Dorian Dale
Aryeh Lemberger	Sarah Lansdale
Angie Garcia Arevalo	Elisa Picca
Sienna Templeman	

PAC Attendance			
Name	**Affiliation**	**Email**	**Phone**
Al Krupski	Suffolk County Legislature	al.krupski@suffolkcountyny.gov	631-852-3200
Alan Duckworth	Town of Brookhaven	aduckworth@brookhavenny.gov	-
Ann Welker	-	-	516-380-2944
Aram Terchunian	First Coastal	aram@firstcoastal.com	516-982-0743
Brian J Schneider	USGS	bschneider@usgs.gov	-

PAC Attendance			
Brian Zitani	Town of Babylon	bzitani@townofbabylon.com	631-422-7640
Bridget Fleming	Suffolk County Legislature 2nd District	bridget.fleming@suffolkcountyny.gov	631-852-8400
Catherine Stark	Suffolk County	catherine.stark@suffolkcountyny.gov	-
Danielle Tommaso	U.S. Army Corps of Engineers	danielle.m.tommaso@usace.army.mil	917-790-8527
David Calone	Jove Equity Partners	dcalone@jovepartners.com	917-684-1052
Gwynn Schroeder	Suffolk County	gwynn.schroeder@suffolkcountyny.gov	-
Jade T. Blennau	Peconic Estuary Partnership	jade.blennau@suffolkcountyny.gov	631-852-2967
Jennifer McGivern	Suffolk County	jennifer.mcgivern@suffolkcountyny.gov	-
Josh Halsey	Peconic Land Trust	joshhalsey@peconiclandtrust.org	-
Karen Baumert	-	-	-
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Sally Kellogg	New York Department of State	sally.kellogg@dos.ny.gov	-
Tom Iwanejko	Suffolk County Department of Public Works	tom.iwanejko@suffolkcountyny.gov	631-852-4267
Vanessa Lockel	Cornell Cooperative Extension	-	-
Unknown Participant	-	-	603-809-2204

PAC Meeting Notes

A virtual meeting regarding the Suffolk County Coastal Resiliency Study was held on December 12, 2023 with the Project Advisory Committee (PAC). The following notes highlight key items discussed during the meeting.

This project was originally conceptualized in 2019 with $200,000 allotted from the County's capital budget. The Legislature's vision for this project included establishing funding for an RFP and developing specifications to help drive the vision for coastal resiliency. With this substantial investment, the County has the opportunity to take bold and thoughtful action to mitigate climate change impacts with a focus on nature-based solutions.

1.1.1.10 Agenda

1. Introductions & Background
2. Project Timeline
3. Project Progress Update
4. Project GIS Data Review
5. HMGP Application
6. Next Steps
7. Action Items

1.1.1.11 Meeting Minutes

1. Introductions & Background
    - Project team was introduced
        - Previous PAC meeting occurred in February 2022 – significant progress has been made since then
        - $1.5 million is included in additional funding per year in 2024, 25, and 26 to implement coastal resilience and wetland restoration projects, so more movement is to be expected moving forward
2. Project Timeline
    - The following major milestones were outlined:
        - 2022:
            - Project initiation and kick-off
            - First PAC meeting
            - Data coordination and assembly
            - Interagency coordination meeting
            - Stakeholder meetings
            - FEMA program review
            - Design, cost estimate, and BCA for HMGP grant application
            - Concept design, cost estimate, and FEMA BCA delivered
        - 2023:
            - Development of Planning context memo
            - DPW workshop to finalize priority assets and projects
            - Finalize resilience planning
3. Project Progress Update
    - Project process was discussed:

- Analysis
  - Developed a robust science-backed planning tool to identify projects now and in the future
  - Analyzed 24,000 county-owned sites; 2,200 deemed at-risk of flooding
- Prioritization
  - Worked with county experts to:
    a. Identify 25 priority at-risk sites
    b. Select 10 priority sites
- Implementation
  - Developing project concepts (3 complete to-date)
  - Developing benefit cost analyses (3 complete to-date)

4. Project GIS Data Review
   - Sea level rise scenarios were outlined from NOAA 2017 data
   - Flood risk maps were presented (available in slide deck)
   - Analysis of 2,200 at-risk sites:
     - County-owned sites susceptible to coastal flood risk representing buildings, parks, bridges, roads, and infrastructure
     - Current and future flood risk under 15 scenarios from monthly tidal flooding to 1% annual chance storm event over the next 50 years
       - Tidal flooding – every 30, 60, or 90 days (2025, 2055, 2100)
       - Coastal storm surge flooding – 10% annual chance (10-year) and 1% annual chance (100-year) (2025, 2055, 2100)
   - Prioritization
     - Coastal flood risks – frequency and extent
     - Criticality of asset
     - Replicability
     - Viability of integrating nature-based solutions
   - Top 10 and additional 15 priorities were discussed (available in slide deck)
     - It was noted that the word 'priority' on the map is confusing – it seems as though 1 is higher priority than 2 and so on. Recommendation was made to clarify this as priorities are either top 10 or top 25 but are not listed in any specific order otherwise
     - County road (CR) 48 – Legislator Fleming noted that this is an opportunity for collaboration between federal, county, and local level approaches
       - Legislator Krupski noted that DPW has already made advances in resilience of CR 48
   - Resilience investment considerations were discussed:
     - Move beyond design criteria
     - Consider future conditions and uncertainties
     - Define risks over the project lifecycle
     - Complete a comprehensive review
   - Examples of replicable projects were discussed:
     - Roadway raising & stormwater improvements – Lindenhurst roadway elevation project, $3 million dollars per ½ mile
       - This could be applied to all of the county roads listed in the priorities
       - Brian Zitani, the project manager, provided further background on this project:
         a. Funded fully by the town
         b. Road was elevated to the maximum extent possible for a 10-year flood

c. 32 check valves were installed in the first phase
d. Redundancy check for single lines was conducted and completed this summer
e. Breaking ground on phase two to complete the section will happen in 2024
f. Land-use controls to control potential pollutant discharge into the bay was not implemented for this project, but the project team is looking into it

- Rising sea levels and groundwater systems were discussed:
  a. Gravity-based systems
     i. Outfalls into water bodies for tidal conditions
     ii. Built to observed groundwater levels
  b. Design
     i. Stormwater in streets and lawns gets funneled into a slightly sunken drain
     ii. The water then travels downward through a pipe
     iii. The water flows into the canal or river whose water level sits a few inches below the storm drain outfall
  c. Future concerns
     i. Blocked outfalls
     ii. Higher groundwater conditions
     iii. Flow path for tidal conditions
  d. Failures with sea level rise
     i. With ocean water blocking the pipe, any additional stormwater has no place to drain
     ii. Ocean water forces its way up the storm drain, flooding into streets and lawns
     iii. As sea levels rise due to climate change, the ocean water in canals and rivers will sit higher than drains' outfalls
  e. Legislator Krupski noted that stormwater must be treated to all extent possible as it otherwise encourages the mass loading of everything that closes down shellfish beds and impairs water quality, which will be noted in the report

- Drainage improvements – Virginia Beach, Virginia
  - Stormwater treatment and design in addition to tide gates reduced the influx of water
  - This was funded by a FEMA BRIC grant
  - This could be applied to Bergen Point Wastewater Treatment Plant
    a. Legislator Fleming's questions on this:
       i. Q: What are the risks associated with Bergen Point? Is there a danger of wastewater combining with groundwater? Is there a danger of saltwater intrusion?
          1. Generally, wastewater treatment plants are high-risk assets since the community effects can be quite substantial
          2. Evacuations are required in failures or discharge of wastewater treatment plants
       ii. Q: Is it possible to avoid tidal gates and look at gas and electric as a separate concern? For example, implement recharging or raising the facilities instead of something as intense as a tidal gate? What is the price tag for this?
          1. Yes, there are many possible solutions that range in pricing as well
          2. More detailed assessments of the facilities are recommended to determine potential solutions and come up with a phased approach
          3. There are opportunities for funding from other sources as well for significant capital expenditures which could be determined with an additional detailed assessment

iii. From a realistic perspective, Legislator Fleming recommends offering policymakers an opportunity to make a difference at a lower cost and not focusing on the technical aspects of the science as much (but still presenting a scientific-based approach)
1. County road 96 has also been added to the priority list (which is the roadway that leads to Bergen Point)

- Roadway raising and living shoreline – Tallahassee, Florida
  - Franklin 98 project – green & gray infrastructure offshore environment
  - Provides benefits at the shoreline, habitat restoration, biological benefits, and eliminates erosion at the shoreline that has been a pressing local concern
    a. Implemented by the regional planning agency although it is state owned infrastructure, so the process was very collaborative and more widely supported
  - This could be applied to all of the county roadways in the priority list
    a. Legislator Krupski is curious about the projections for sea level rise elevation levels that could be applied for each of the projects
      i. Each road is context-sensitive based on the causes and effects and consequences to determine the appropriate levels of investment to elevate roadways
      ii. Phased approaches can be implemented as well, it is not always done all at once
- Wetland restoration projects
  - Tom Iwanejko discussed the county-wide wetland restoration projects
    a. Coastal resilience after Superstorm Sandy is a major concern as many wetlands and county park lands were inundated with water with some areas destroyed
    b. These projects can be applicable to replicate for additional wetland priorities
    c. Indian Island living shoreline has been implemented and was effective
    d. Wetland restoration projects implemented in the county have shown clear ecological benefits
    e. Top priorities:
      i. Scully Marsh (~40 acres)
      ii. Islip Preserve (~60 acres)
      iii. Cupsogue Marsh (~133 acres)
    f. In the case of another storm event similar to Sandy, the shorelines reduce the wave impact and block some of the flooding
    g. Legislator Krupski is curious as to what sea level rise projections are used
      i. WSP used the NYCRR part 490 project medium scenario (1.33 feet) – this data is also available in detail within the BCA applications
      ii. Funding is underway for three of these projects but the money is not in place yet
        1. Funding will be dual-phase – phase 1 is design permitting and phase 2 is the funding for the actual work
    h. Smith Point South project that was originally proposed (Smith Point North has already been restored) was removed as there is already an Army Corps project slated for that location
    i. Legislator Krupski also noted that the town is preserving a parcel in between Corey Creek West and East, which should be included in the restoration as there is a considerable amount of dredging on the parcel
  - Phillip Brown from the Shinnecock Nation has completed wetland restoration projects as well

5. HMGP Application
   - Goals:

- Protect residential areas and maintain natural systems
- Consider rising sea levels and storm surge
- Invest in restoring natural systems on county property to function optimally

- Opportunities:
  - High benefit cost ratio (17.42)
    - This has been accepted by FEMA as well
  - $4.5 million federal grant submitted to complement county budget
    - Legislator Fleming would like to know what the match commitment is – Dorian noted that it is 10% that does not eat into the $4.5 million budget because it is provided through in-kind match
  - Early action to enhance county resilience and provide a replicable model for future projects
  - Grant applications have been submitted to FEMA
- Benefit cost analysis (BCA) summary:
  - Aims to improve and restore three coastal marshes in Suffolk County
  - BCA quantifies the project benefits to communities adjacent to the wetlands
  - It is assumed that without the project (with 'no action'), the three sites will continue to deteriorate and provide little to no future wave action attenuation benefits beyond 2050
  - With the project (with 'action'), a healthy wetland will continue to thrive in perpetuity, adapting to sea level rise over time
  - Additional project benefits:
    - Establishment of a healthy, diverse plant and wildlife habitat
    - Natural mosquito control, which reduces the need to apply pesticides in the marsh
  - Legislator Fleming wonders, in regards to the sea level rise adaptation over time, about marsh migration over time – is less space protected by the wetland as it migrates into developed areas?
    - This was not considered in the analysis – benefit areas were established by coastal engineers and modeling was conducted to determine wave attenuation within the areas of study being 100% restored versus degradation over time
    - Tom Iwanejko noted that the wetlands will be made more resilient to trap more sediment so they can keep up with sea level rise more effectively – some level of human intervention and manipulation is required and can be different for each location, but expected annual maintenance for each site was included in the BCA
  - Loss estimation was a key input for BCA – maps and results were discussed for 10-, 50-, and 100-year return periods for 'action' and 'no action' scenarios (available in slide deck)
    - Using information from the county, specific buildings and characteristics were identified based on their susceptibility to the hazard scenarios produced in the modeling effort
    - Legislator Krupski is wondering if low- medium- and high-density housing is defined
      a. The building use data provided by the county included definitions and categorizations
      b. Clarification can be provided following the call
    - Annual average losses were estimated for each scenario and analysis period
      a. Benefits were estimated as avoided losses from project implementation
    - Results and benefits were discussed (available in slide deck)
    - Legislator Fleming would like more detail on the avoided losses and the reason for the differences between benefit amounts for each different project site (emphasizing that human aspect of this is important to discuss)

a. Losses represent economic loss for residential and commercial buildings from a storm surge – Scully has more residential adjoining properties and roadways, Cupsogue has more of an impact on the beach itself and avoids washout events for the residential properties to the east as well as the county property within the park

6. Next Steps
    - Incorporate input from PAC
    - Finalize project memorandum
    - Provide the county with all project products – target by December 31st, 2023
    - Prepare environmental assessments for wetland restoration sites (under a separate contract)
        - Next step in the process for the progression of the wetland restoration projects through FEMA is the environmental assessment preparation for three projects
        - A scope and cost estimate are being developed to move those projects forward expeditiously
            - Draft scope has been provided to the county
        - Funding is being looked at currently, the best avenue identified thus far for this is the operating budget
    - Peter Scully provided closing remarks and the team provided acknowledgements

1.1.1.12 Action Items

- Updates to be made:
    - Change the map from 'priority' to 'locations' or add a note that there is no particular order for the priorities
    - Change the tables to indicate groupings rather than numeric order of priority list
- Highlights to be outlined in the final report:
    - Stormwater treatment to be listed as part of solutions
    - Recommendations for detailed assessments of Bergen Point wastewater treatment plant
    - Include detailed information on sea level rise projections and technical information
    - Discuss broader socioeconomic impacts
    - Personalize discussion to add a human aspect for justification of the project
    - Discuss lessons learned
- Send out meeting materials afterward to full list (slide deck & meeting notes)
- Clarify building & housing density definitions for Legislator Krupski
- Present to incoming legislators in the new year

APPENDIX D – FHWA ADAPTATION DECISION-MAKING ASSESSMENT PROCESS (ADAP)

The following document was developed by the Federal Highway Administration to describe the Adaptation Decision-Making Assessment Process (ADAP) approach. It is included here as an example of how to assess and determine which project alternative(s) is most practical and effective. It is not a tool for project prioritization.

TEACR Engineering Assessment

Adaptation Decision-Making Assessment Process (ADAP)

Introduction

The Adaptation Decision-Making Assessment Process (ADAP) is proposed as a tool for planners and designers to account for the increasing role of climate change in the design of civil works projects. ADAP is intended as a risk-based tool to aid decision makers in determining which project alternative makes the most sense in terms of life cycle cost, resilience, regulatory and political settings, etc. ADAP provides a framework for generating the information needed to identify preferred approaches to project design based upon costs and benefits. The process can be tailored to meet an agency's specific requirements. Although the framework lays out specific steps, unique situations may warrant adjustments within the general confines of the framework.

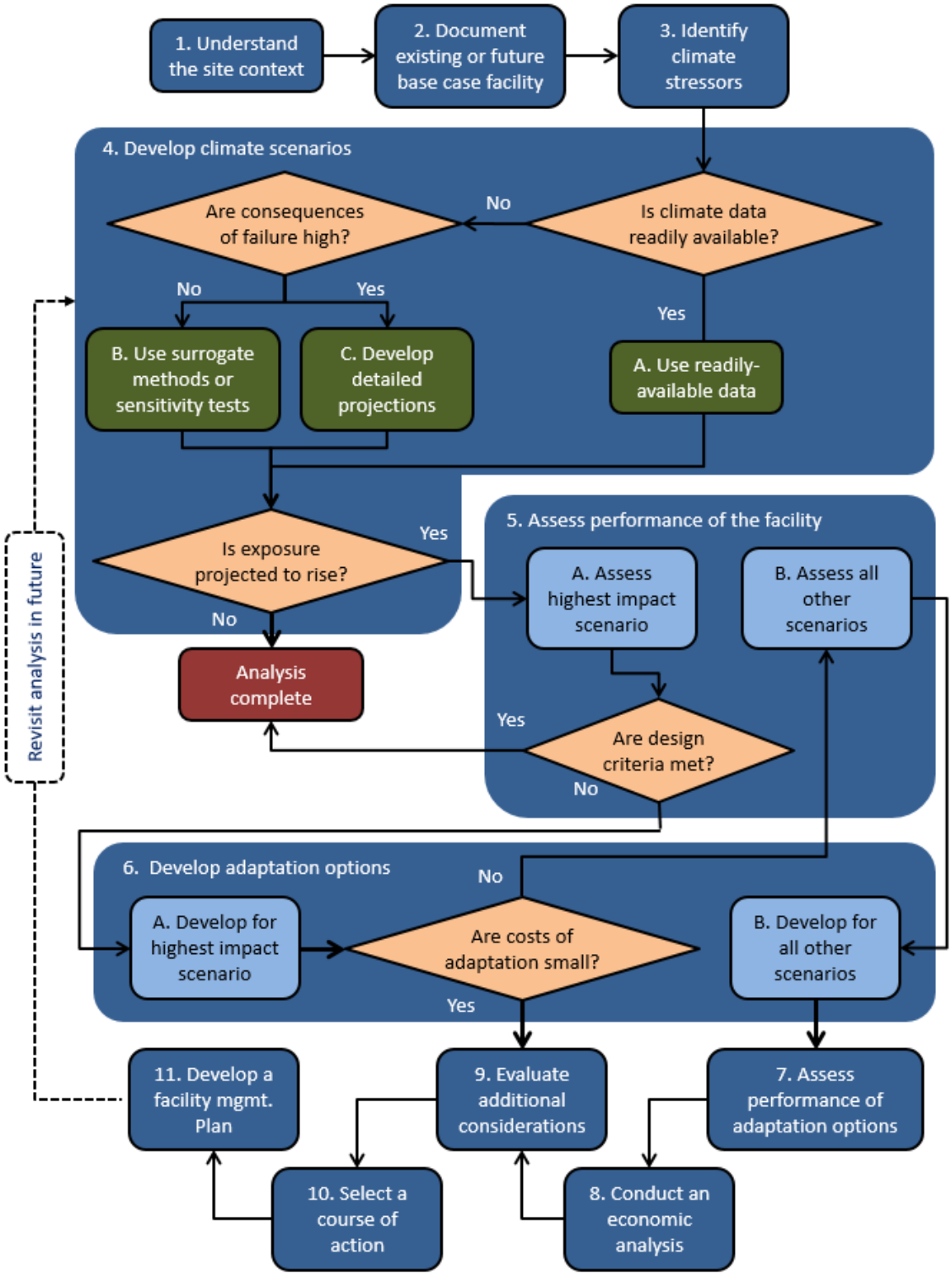
ADAP can be used in two ways: (1) to assess existing assets for their sensitivity to projected climate changes and (2) for the design of new infrastructure projects. For new projects, it is intended to be applied during the planning stage of project development so as to provide the maximum opportunity to explore project alternatives.

ADAP was also designed to be general enough to apply to the entire spectrum of climate-influenced highway infrastructure, from a small drainage culvert on a country road to a complex bridge in a major urban area. Determining which facilities/projects ADAP should be applied to will be a policy decision made by each agency. Agencies may choose to apply ADAP to existing or new projects. Some agencies may use ADAP for all projects, while others use it only when projects meet certain criteria related to cost, importance, potential vulnerability, etc. ADAP may not be the ideal process to follow in all situations; however, it lays out the range of considerations that should inform an agency's thinking about climate change vulnerability and adaptation options.

Finally, ADAP is designed from the perspective of assessing a single asset, but it could be easily adapted to consider more system-level considerations, such as a system of culverts within a watershed. The language in this document assumes that a single asset is being evaluated. If a system approach is taken, then the same ADAP steps should also be followed, but adjusted as needed to account for system-level considerations.

The ADAP steps are captured in the decision tree in Figure 1. As can be seen, not all steps are required in all situations. The process is setup to minimize the evaluation process in situations where the consequences of asset failure are low and where the cost of adapting to climate change is relatively small. The steps are explained in more detail in the following sections.

Figure 1: Decision Tree of the ADAP Steps



Contents

Step 1: Understand the Site Context

Understanding the context of a facility is a critical step in setting up a proper assessment. The context to be considered includes both the facility's function within the broader transportation network and its location within the natural environment. These considerations include the long-term functional life of a facility given projected climate impacts on land uses served by the facility. Step 1 should involve coordination with other government agencies on their adaptation strategies.

Step 2: Document Existing or Future Base Case Facility

For existing facilities, this step involves documenting and understanding the dimensions, design criteria, and remaining design life of the existing facility being studied. For proposed facilities, this step entails understanding appropriate design and design standards for the project based on current, observed climate data. Although a full design for the asset may not be necessary, this step should involve sufficient understanding of the potential design to be able to evaluate whether adaptation is cost-effective.

Step 3: Identify Climate Stressors

This step involves documenting the climate stressors (e.g. precipitation, temperature, storm surge, wave heights, etc.) that affect the design of the facility. Some facilities might be affected by multiple or compounding climate stressors; each of these stressors should be noted and considered in the analysis.[1] Near coastal areas, practitioners should be careful to consider possible impacts from sea level rise amplified by higher storm surges, even in areas not currently affected by these stressors. Sea level rise could also interact with precipitation runoff, which may be an important compounding effect to consider. Impacts to the natural environment caused by changes in climate stressors (e.g. loss of forest cover due to conditions brought on by climate change) may also warrant consideration to the extent that they could impact the facility.

Step 4: Develop Climate Scenarios

Scenarios represent different storylines on how climate could change over the design life of the facility. They should be developed such that they capture the range of uncertainty in future climate projections. Any number of scenarios can be generated for use in the analysis; however, in most cases two to three scenarios (e.g. "high", "medium", and "low" change) are proposed as

[1] Some analysts may choose to look at only the predominant climate stressor whereas others may choose to look at the full range of climate stressors that could affect a facility. Looking at the full spectrum of climate stressors is most important when interactions are possible amongst the impacts.

the minimum to provide an understanding of future changes without making the analysis too unwieldy.

In cases where a facility is being evaluated for the combined effects of multiple climate variables, it may be useful to maintain consistency in assumptions and modeling approaches when developing the climate projections. Maintaining such consistency may mean that more moderate values for some climate variables are selected. However, it is important to remember that it may not be appropriate to simply choose the "worst case scenario" for all variables, because it may be unlikely that the worst case will occur for all climate variables together at any given point in time.

When developing climate scenarios, decisions must also be made about which timeframes to consider. Timeframes are sometimes selected based on the expected lifetime of the asset being evaluated, but transportation agencies may wish to consider nearer term, or longer term timeframes as well.[2]

Climate projections in a format useful to highway designers are increasingly available from federal, state, and local agencies; academic institutions; non-profit groups; and private software vendors. For example, the U.S. Department of Transportation developed the *CMIP Climate Data Processing Tool*[3] to enable users to easily download and process local climate projection data for temperature and precipitation. Meanwhile, FHWA's HEC 25-Volume 2[4] presents sea level rise projections appropriate for coastal areas and includes an example using the US Army Corps of Engineer's sea level rise calculator[5]. In such cases, site specific scenarios can typically be generated with modest effort using in-house staff with some basic training in the science of climate change (Step 4A).

That said, there are still many climate variables for which there is a translation gap between what is available from climate models and what is needed by highway designers. In these cases, where the necessary climate data is not readily available, practitioners will need to determine what level

[2] Note that, in some cases, changes in how the asset is operated over its lifetime may influence when the greatest impacts will occur. For example, in cases where there is a plan to reduce service and eventually discontinue use of an asset, the most important impacts might occur early on when climate effects are less but the service impacts are higher. In these situations, it may be more important to consider nearer-term timeframes. Alternatively, the use of some assets may persist beyond their design life so consideration of the realistic service life may be more appropriate when selecting timeframes.

[3] The CMIP Climate Data Processing Tool is available on FHWA's website at: https://www.fhwa.dot.gov/environment/climate_change/adaptation/adaptation_framework/resources/resource.cfm?resourceid=435&tagid=4.

[4] Highways in the Coastal Environment: Assessing Extreme Events: Volume 2 (HEC 25-Volume 2) is available at: https://www.fhwa.dot.gov/engineering/hydraulics/library_listing.cfm.

[5] The US Army Corps of Engineer's sea level rise calculator is available online at: http://www.corpsclimate.us/ccaceslcurves.cfm.

of effort they wish to pursue in developing the climate data. Generally speaking, the higher the dollar value of the facility being studied or the greater the consequences of its failure, the more effort should be expended in developing detailed climate projections. Higher levels of effort may involve climate modeling and the assistance of climate scientists (Step 4C) whereas sensitivity tests using possible values may be sufficient for lower levels of effort (Step 4B).

Agencies should also consider opportunities to fill climate change data gaps across broad geographies (as opposed to doing so on a project-by-project basis) so as to achieve economies of scale across many assets. When doing so, opportunities to share costs with other agencies that could make use of the data should also be explored.

After generating the climate scenarios, practitioners should assess whether the projected changes actually translate to increasing exposure for the facility relative to current conditions. If not, then adaptation will not be required and the analysis is complete.

Steps 5 & 6: Assess Performance of the Facility and Develop Adaptation Options

Steps 5 and 6 are presented together because they are not necessarily conducted in a simple linear manner. An assessment of the highest impact scenario is conducted first (under Step 5), because if the facility can withstand the highest impact scenario, it will likely be able to withstand lesser scenarios, and there is no need to develop adaptation measures under Step 6. If adaptation is necessary, but the costs of adaptation are relatively small, then it may make sense to simply adapt to the highest impact scenario under Step 6. However, if the cost of adaptation is high, then practitioners should return to Step 5 and evaluate the asset against other climate scenarios and then identify appropriate adaptation options under those scenarios, so that the most robust and cost-effective adaptation approach can be identified.

Step 5A: Assess Performance of the Facility under the Highest Impact Scenario

This step involves determining whether the existing or proposed new facility meets design criteria under the highest impact scenario. The highest impact scenario is used for an initial sensitivity test to make the process more efficient: if the facility performs adequately under the highest impact scenario, then it will likely perform adequately under all the other scenarios of lesser impact, and adaptation will not be required. In these situations, the analysis is complete and the design team should either maintain the existing facility as is (for existing assets) or build the traditional design based on historic data (for new assets). In either of these conditions, facility managers should plan to monitor facility performance as the climate changes. On the other hand, if the facility does not perform adequately under the highest impact scenario, further analysis will be required and the practitioner should proceed to Step 6A.

In defining the highest impact scenario, practitioners should be aware that the most extreme climate scenario is not always responsible for the greatest impacts on a facility. For example, with storm surge, a higher scenario that overtops a structure may actually be less damaging than a lower scenario that entails waves hitting the side of the facility for a longer time period. Also, when considering multiple climate variables affecting a single facility, one should be aware of the possibility of interactions amongst the climate variables that may amplify impacts to generate the highest-impact scenario. Thus, in a few cases, the scenario that is most impactful will not be immediately apparent and two or more scenarios may need to be evaluated to determine which causes the greatest harm to the asset.

Step 6A: Develop Adaptation Options for Highest Impact Scenario

This step is a continuation of the process from Step 5A. Under this step, the practitioner should develop adaptation option(s) that enable the facility to meet design criteria under the highest impact scenario. Practitioners should be cognizant of the range of possible actions when developing adaptation options. These potential actions include design options with flexibility built in so that designs can be readily altered as conditions warrant, as well as the use of climate-variable based thresholds that trigger specific actions in the future when reached.

When multiple climate variables are being tested for a single asset, decisions need to be made about which scenarios to use for each variable. One option is to use the highest impact scenario for each variable; for example, using the highest sea level rise scenario along with the highest storm surge scenario—even if this combined scenario is considered to be on the extreme end of what could occur. Doing so would represent a more conservative design. Some people may find such assumptions to be overly conservative, however, and may opt to use more moderate scenarios for both variables.

Cost estimates for each adaptation option should then be developed. If it is found that adapting to the highest impact scenario entails only a small increase in costs,[6] then the practitioner should skip to Step 9 and forego the detailed performance and economic analyses. On the other hand, if the costs are more substantial, a full benefit-cost analysis should be undertaken to ensure a cost-effective decision is made. In this case, practitioners should loop back to Step 5B to generate information that will allow consideration of the full array of climate scenarios and adaptation options in the benefit-cost assessment.

[6] The definition of what constitutes a small cost increase is a policy decision to be made by each agency. Practitioners should consider the costs of doing a full economic analysis relative to the benefits to be gained when making this determination. It is possible that, for some low-cost facilities, a full benefit-cost analysis may cost as much as, or even more than, simply implementation adaptation measures for the highest-impact scenario.

Step 5B: Assess Performance of the Facility under All Other Scenarios

This step involves assessing the performance of the existing or proposed new facility under each of the remaining climate scenarios through the remainder of its design life. This step should be conducted if a full economic analysis is necessary to select the appropriate adaptation option, or if additional information is desired about the other scenarios.

This step will demonstrate how the facility would perform across the range of selected scenarios, which helps bound the potential impacts that engineers should consider, and also illustrates the effect that uncertainty in the climate assumptions has on the ultimate impact. This step also provides important baseline information for the economic analysis; a reference point for determining the costs avoided through undertaking the adaptation option.

Step 6B: Develop Adaptation Options for all Other Scenarios

If Step 5B is completed, adaptation options that are appropriate for or optimized for each remaining climate scenario should be developed. Doing so will allow for the comparison of a range of different adaptation levels to determine which is most cost-effective. Cost estimates for each adaptation option should also be determined in this step.

Step 7: Assess Performance of the Adaptation Options

In this step, the performance of each adaptation option should be assessed against each climate scenario. This assessment will provide an understanding of the robustness of the strategies across the various scenarios.

In addition, economic data (climate stressor-cost functions relating the degree of facility physical damage to the magnitude of the climate stressor(s)) should be developed if needed for the economic assessment.

Step 8: Conduct an Economic Analysis

The economic analysis provides key information for decision making, the final output being an understanding of the comparative costs and benefits of each adaptation option (relative to the base case) under each climate scenario. Decision makers can use this information to select the adaptation option that performs best (i.e., most robustly) across the range of possible future climate conditions.

A variety of techniques exist for doing benefit-cost analyses including standard engineering approaches like Equivalent Uniform Annual Cost, regional impact modeling, calculus-based methods and Monte Carlo analysis. Such analyses can be undertaken with generally modest effort by an engineer or a trained economist for the more complex analyses.

The cost of the facility and various contextual factors can help determine the level of effort to expend. Generally speaking, lower cost facilities may entail greater use of assumptions regarding various economic parameters whereas more expensive facilities may call for more work to develop better estimates. Contextual factors include whether the failure of the facility may cause widespread disruptions throughout a transportation network: if so, the use of a travel demand model may be warranted to develop better estimates of the cost to the traveling public. In many cases, however, simple assessments of the cost of the additional travel time associated with the detour are likely to be sufficient. If the facility is a major freight corridor, freight modeling might be desired to help understand the consequences of failure on freight flows. For the vast majority of facilities, however, simple calculations on the cost of the additional travel time for goods associated with the detour will be more appropriate. If nearby properties are affected by effects related to the design of the asset (e.g. if an undersized culvert causes flooding of upstream properties), the cost of flood damage to these structures caused by the facility should be accounted for. In special cases where no network redundancy exists, other broader societal cost impacts tied directly to the accessibility afforded by the structure may be prudent to include (e.g. lost income from tourism on a barrier island accessible by a single bridge may be relevant to that bridge's valuation).

Step 9: Evaluate Additional Considerations

A variety of factors beyond purely economic considerations—such as environmental permitting constraints, site context, public acceptance, and environmental justice—are important to making the right decision on a project. What might be optimal from a purely economic perspective might not be optimal for these other considerations. This step is intended to ensure these concerns are considered before settling on a course of action.

Step 10: Select a Course of Action

This step entails selecting the option that makes the most sense considering both the economic and non-economic factors. The selected option may entail a single action at one point in time, the adoption of climate variable threshold values that will trigger specific actions when crossed, or some combination of these approaches.

Step 11: Develop a Facility Management Plan

Once a course of action has been decided, a facility management plan should be developed to ensure the project continues to perform as designed. The plan would include ongoing monitoring as the climate changes and require that corrective actions be considered.

Revisit Analysis in the Future

Though not an official step in ADAP, it may be important to revisit the analysis and conclusions in the future. Thus, the ADAP diagram shows a dotted line from Step 11 going back to Step 4 (Develop Climate Scenarios). There are several reasons to revisit this analysis in the future:

- Land-use or demographic changes may change the functional use of the asset. An asset that used to be essential to the functioning of a community may become less critical if new alternate routes are built, or a more minor asset could become more critical as the community grows and develops. The relative costs and benefits of adaptation may consequently change as well.
- Climate projection data and wave/surge/flooding modeling will likely improve over time. Assumptions about how the asset will be exposed to climate change stressors could change as information improves.
- Advancements in engineering may make new adaptation measures feasible, or lower the costs of others. Therefore, the most cost-effective approach may change over time.