

The background image shows a scenic waterfront. On the left, a path leads through green grass towards a large tree with vibrant pink cherry blossoms. In the center, a body of water reflects the overcast sky. On the right, several modern houses with grey roofs and white accents are situated along the water's edge. Tall, thin reeds and grasses are in the foreground, partially obscuring the view of the water.

# **Resilient Stafford Action Plan**

## *A Roadmap to Climate Resilience*

### **RESILIENT NJ**

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# Table of Contents

- Table of Contents ..... 2
- Acknowledgments..... 3
- List of Abbreviations ..... 4
- List of Figures ..... 5
- List of Tables ..... 5
- 1. Executive Summary ..... 6
- 2. Existing Conditions ..... 7
  - 2.1 Introduction ..... 7
  - 2.2 Regional Context ..... 7
  - 2.3 Sectors..... 9
  - 2.4 Planning Context .....12
- 3. Goals and Objectives.....14
- 4. Stakeholder and Community Engagement.....16
- 5. Summary of Vulnerability Assessment .....18
  - 5.1 Asset Identification .....18
  - 5.2 Flood Mapping .....21
  - 5.3 Buildout Analysis .....27
- 6. Resilience and Adaptation Actions .....31
  - 6.1 Introduction .....31
  - 6.2 Goal 1: Preservation of Natural Resources .....35
  - 6.3 Goal 2: Resilient Infrastructure Design .....48
  - 6.4 Goal 3: Civic Empowerment and Preparedness .....54
  - 6.5 Goal 4: Economic Development Initiatives .....60
- 7. Mud City Ecological Restoration and Resiliency Conceptual Plan .....63
- 8. Next Steps.....64
- 9. References.....65

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## **Disclaimer**

*The environmental assessments, data, and actions in this plan do not represent guidance or policy of the New Jersey Department of Environmental Protection or the National Oceanic and Atmospheric Administration and do not replace the need for regulatory review by the appropriate local, state, and federal agencies.*

## List of Abbreviations

ACS	American Community Survey
AEP	Annual Exceedance Probability
BBP	Barnegat Bay Partnership
BGI	Blue-green infrastructure
BRIC	Building Resilient Infrastructure and Community Grant
CDC	Center for Disease Control
CVA	Climate Vulnerability Assessment
CRS	Community Rating System
DCA	New Jersey Department of Community Affairs
DEP	New Jersey Department of Environmental Protection
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Administration
FIRMs	Flood Insurance Rate Maps
FMA	Flood Mitigation Assistance
HUD	Department of Housing and Urban Development
IRA	Inflation Reduction Act
LBI	Long Beach Island
MHHW	Mean Higher High Water
MLUL	Municipal Land Use Law
NACCS	North Atlantic Coast Comprehensive Study
NCS	Natural Climate Solutions Grant
NDRC	National Disaster Resilience Competition
NFIP	National Flood Insurance Program
NFWF	National Forest and Wildlife Foundation
NJBB	New Jersey Back Bays
NJDOT	New Jersey Department of Transportation
NJIB	New Jersey Infrastructure Bank
NJIT	New Jersey Institute of Technology
OPA	New Jersey Office of Planning Advocacy
NOAA	National Oceanic and Atmospheric Administration
OCUA	Ocean County Utilities Authority
OLA	Owen Little & Associates
PDM	Pre-Disaster Mitigation
PPI	Program for Public Information
RL	Repetitive Loss
SFHA	Special Flood Hazard Area
SLR	Sea Level Rise
SRL	Severe Repetitive Loss
SVI	Social Vulnerability Index
USACE	United States Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Services
WRDA	Water Resources Development Act

## List of Figures

<b>Figure 1:</b>	Aftermath of Superstorm Sandy	5
<b>Figure 2:</b>	Edwin B. Forsythe National Wildlife Refuge	6
<b>Figure 3:</b>	Regional Context Map of Stafford, New Jersey	7
<b>Figure 4:</b>	Stafford Township, SVI Map	11
<b>Figure 5:</b>	FEMA Flood Map Depicting the 100-year (1-percent-annual-chance) SFHA in Stafford	17
<b>Figure 6:</b>	Future Flood Map Depicting 2050 SLR, Projected 10% Annual Chance 24-hour Rainfall Event, Present-day MHHW tide, and 3 Feet of Storm Surge	20
<b>Figure 7:</b>	Map of Parcels with Latent Capacity of Residential Units Located within the 2050 Flood Risk Area	24
<b>Figure 8:</b>	Resilience and Adaptation Actions Map	27

## List of Tables

<b>Table 1:</b>	Existing Land Use	9
<b>Table 2:</b>	Summary of Latent Capacity of Residential Units Located within the 2050 Flood Risk Area	23
<b>Table 3:</b>	Resilience and Adaptation Actions Matrix	28 - 29

# 1. Executive Summary

As a coastal municipality, Stafford Township is all too familiar with the damage and destruction that climate impacts can cause. In October 2012, a post-tropical cyclone merged with a nor-easter forming the largest hurricane by area on record in the Atlantic. This hurricane, infamously known as Superstorm Sandy, brought tropical-storm-force winds, rain, and storm-surge that impacted the entire eastern seaboard, with particularly severe damage in New York and New Jersey.

Superstorm Sandy occurred a little over a decade ago and it is projected that the warming climate will cause an increase in both the frequency and intensity of storm events over the coming decades. This projected increase in extreme weather events will be further exacerbated by rising sea levels and higher storm surge events.

Due to these anticipated climate impacts, in addition to present-day flooding that occurs during modest storms, the Township of Stafford has acted to increase the Township’s resilience to storm and wind events, mitigate future flooding, and reduce the risk of other climate hazards, such as extreme heat and wildfires. Since Superstorm Sandy, many at-risk homes in Stafford have been elevated. The Township has also implemented more resilient building practices and made changes to its municipal land use regulations to reduce risk.

There is more to be done, however, and the Resilient NJ program has provided the Township with an opportunity to evaluate potential strategies to further reduce vulnerabilities and exposure. Administered through the New Jersey Department of Environmental Protection (DEP), the Resilient NJ program has offered the communities most affected by Superstorm Sandy funding and support to assess, plan, and implement local resiliency projects.

The Resilient Stafford Action Plan builds upon this statewide effort. The Project Team (Kleinfelder, Ramboll, Owen, Little, & Associates) worked closely with the DEP and the Township of Stafford on this effort. This report evaluates current and future risks in Stafford and provides recommended actions to mitigate that risk. The mitigation actions, discussed in Section 6, identify projects, studies, and regulatory actions that can be implemented, along with responsible parties, costs, timelines, regional connections, and innovative funding mechanisms to improve resilience to flooding and adapt to future climate concerns. The remainder of the report frames the planning process behind this project, providing critical background context, a description of the objectives and community engagement process, a summary of the vulnerability assessment, and recommended next steps.



**Figure 1: Aftermath of Superstorm Sandy**  
*Photo Credit: Stafford Township, Hurricane Sandy 2012 Photo Gallery*

## 2. Existing Conditions

### 2.1 Introduction

In order to assess effective mitigation measures to protect the Township against future flood risk, an understanding of the current conditions must first be established. This section provides an overview of Stafford’s regional context in relation to the surrounding communities, a brief description of the various sectors within the Township, and a discussion of prior planning efforts and initiatives that have informed the development of the Resilient Stafford Action Plan.

### 2.2 Regional Context

Located in Ocean County in the south-central portion of New Jersey, Stafford Township is situated along a low-lying coastal estuary that includes Barnegat Bay and Manahawkin Bay. Manahawkin Bay is located between Long Beach Island and the mainland. Barnegat Bay includes approximately 42 miles of brackish water, stretching along the New Jersey coast and is fed by several small rivers and creeks. In addition to the vibrant marine and coastal habitats, Stafford Township contains the Manahawkin Wildlife Management Area and a portion of the Edwin B. Forsythe National Wildlife Refuge. These conservation areas are owned and managed by federal, state, and county agencies, and provide valued habitats and coastal ecosystems to numerous plant and animal species.

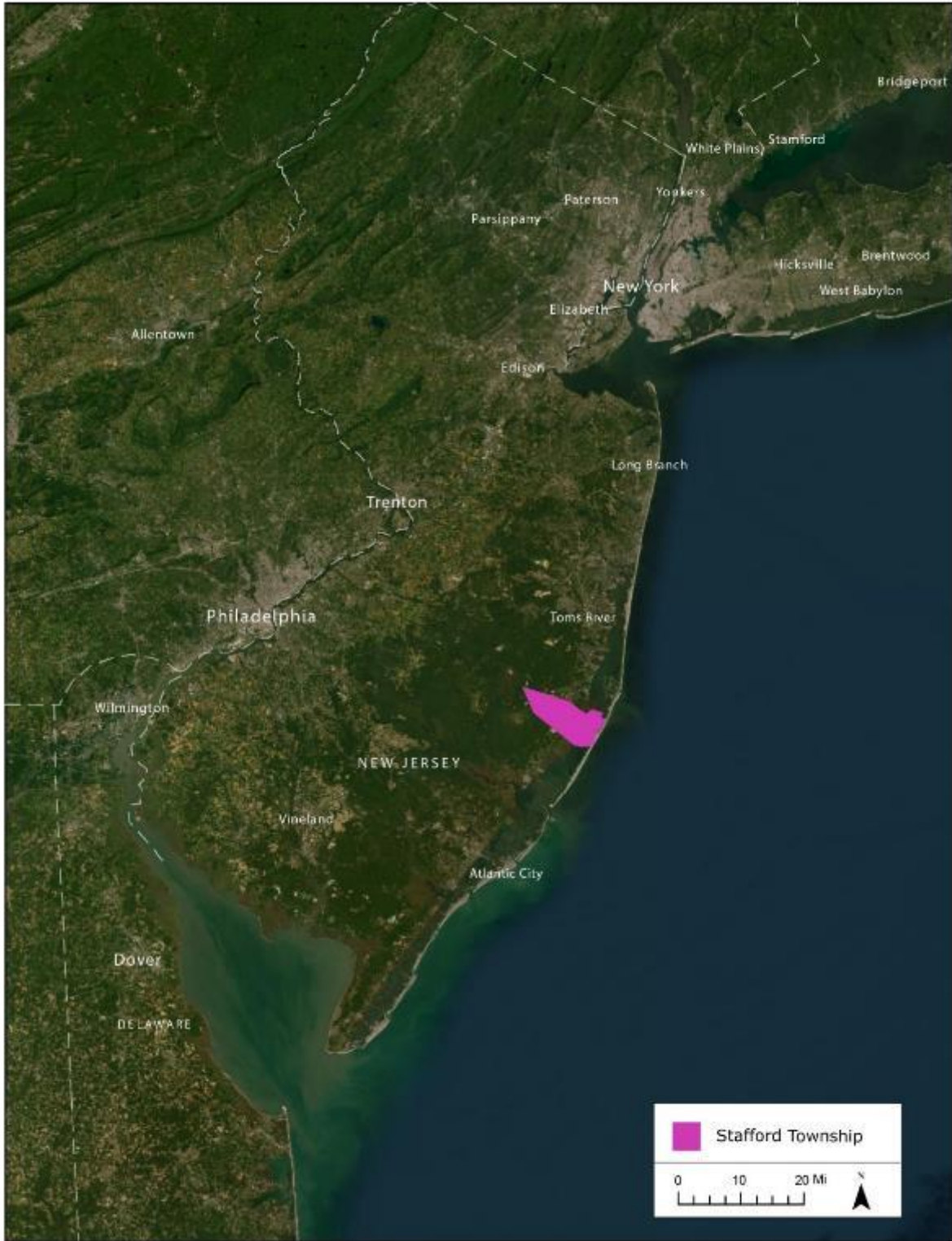
Beyond the Township’s ecologically significant lands, Stafford acts as a gateway to the residential and vacation communities on the barrier island of Long Beach Island, providing the sole access road, Route 72, via the Manahawkin Bay Bridge. In addition to providing this critical connection, Stafford Township also provides Long Beach Island with community facilities and services that cannot be located on the island due to geographical constraints, such as healthcare, full-time emergency services, larger school districts, and wastewater treatment infrastructure.

From a transportation perspective, Stafford is served by several major federal, state, and county roadways. The most prominent of these is the Garden State Parkway, which enters the Township from Eagleswood Township in the south and exits northward into Barnegat Township. The Parkway intersects with Route 72 at Interchange 63. In addition, U.S. Route 9 passes north-south through the center of Stafford, and Route 72 passes from the northwest to the southeast. The most significant county road that intersects the Township is CR 539, which traverses the western part of the Township. Additionally, both Manahawkin and Barnegat Bay are part of the Intracoastal Waterway. Stafford is located approximately 52 miles southeast of Trenton, 57 miles east of Philadelphia, and 80 miles south of New York City. A regional map of Stafford is provided in Figure 3.



**Figure 2: Edwin B. Forsythe National Wildlife Refuge**

*Photo Credit: Pennypack Ecological Restoration Trust*



**Figure 3: Regional Context Map of Stafford, New Jersey**



### 2.3 Sectors

Stafford Township is comprised of a variety of land uses including residential, mixed-use, farmland, commercial developments, education, and county, state, and federally-owned and managed conservation areas. For a complete list of existing land uses by acre, see Table 1 below. Additionally, a Climate Vulnerability Assessment (CVA) was conducted by Rutgers University in 2021 that provided a high-level description of several key sectors to consider in relation to flood impacts, including residential, social infrastructure, critical infrastructure, natural resources, population and health, and the economy, which is summarized below.

Existing Land Use 2017	Acres	Percentage
Residential	4,288	12.2%
Farms	83	0.2%
Business/Commercial	727	2.1%
Quarry	63	0.2%
School	395	1.1%
NJ Natural Lands Trust	30	0.1%
Public Utility	140	0.4%
Church, Charitable, or Quasi-Public Land	81	0.23%
Cemeteries/Graveyards	40	0.1%
Environmental Constrained Vacant Land	3,054	8.7%
Environmental Unconstrained Land	192	0.54%
Business Park	388	1.1%
Golf Course	493	1.5%
Municipal Land	607	1.8%
County Land	655	2%
State Land	9,032	25.7%
Federal Land	7,695	22%
Water/Wetlands	7,161	20%
<b>TOTAL</b>	<b>35,125</b>	<b>100%</b>

**Table 1: Existing Land Use**

Source: Stafford Master Plan 2017, Land Use Element

#### Residential

While the population on Long Beach Island is largely comprised of transient populations who come to spend their summers at the beach-side communities, Stafford has a dedicated year-round residential base with over 88 percent owner-occupied homes (U.S. Census Bureau, Stafford Township, 2020). Since its founding in 1749, the Township has grown to over 29,000 residents (U.S. Census Bureau, Stafford Township, 2021). Between 1970 and 1980, Stafford experienced significant population growth due to the expansion of the Beach Haven West and Ocean Acres communities, which are predominantly comprised of single-family homes.

There are twelve residential zoning districts located within Stafford Township in all, including several census-designated places, such as Manahawkin, Bonnet Island, Cedar Bonnet, Cedar Grove, Cedar Run, Ocean Acres, Beach Haven West, and several others. While most of the residential units located within Stafford are single-family homes, several mixed-use and multi-family residential zones are located in the Township, such as the Stafford Park Apartments and Cornerstone Apartments at Stafford.

An effort to elevate at-risk single-family homes in Stafford has been underway as a response to Superstorm Sandy, with a portion of the homes elevated on either stilts or piers. This effort is ongoing, with a goal to elevate all of the at-risk homes.

### Social Infrastructure

The social infrastructure sector includes public and quasi-public spaces and facilities that provide community services and foster social interaction and cohesion. This encompasses facilities such as community centers, religious institutions, senior centers, non-critical healthcare facilities (like doctor's offices and pharmacies), schools, parks and open spaces, and historically significant buildings and structures.

Stafford Township owns and maintains twelve parks, in addition to a county-owned park and one associated with the local high school (Coastal Vulnerabilities Assessment for Township of Stafford, New Jersey, 2021). Additionally, the Bay Avenue Community Center and Pine Street Recreation Center offer year-round schedules of organized activities for the community, such as painting, knitting, and Tai Chi.

Stafford has five public schools, serving students in pre-kindergarten through sixth grades. This includes the Oxycocus School, Ronald L. Meinders Primary Learning Center, Ocean Acres Elementary School, McKinley Avenue Elementary, and Stafford Intermediate School. For seventh through twelfth grades, public school students attend the Southern Regional School District, which serves the five municipalities in the Long Beach Island Consolidated School District.

### Critical Infrastructure

Critical assets are defined as facilities, buildings, or services that are crucial to the day-to-day functioning of a municipality as well as critical to health, safety, evacuation, and recovery during extreme weather events (Coastal Vulnerabilities Assessment for Township of Stafford, 2021). In Stafford, this category includes the Stafford Township Fire Department, the Stafford Township Police Department, designated evacuation shelters, critical healthcare facilities (such as the Southern Ocean Medical Center as well as nursing homes and assisted living facilities), and gas stations.

Additionally, there are several critical water and sewer system facilities and infrastructure located in Stafford. The Township owns and operates four water distribution/treatment systems, fourteen sewer pump stations, multiple wells, and five water storage facilities (Stafford Township, Water & Sewer).

### Natural Resources

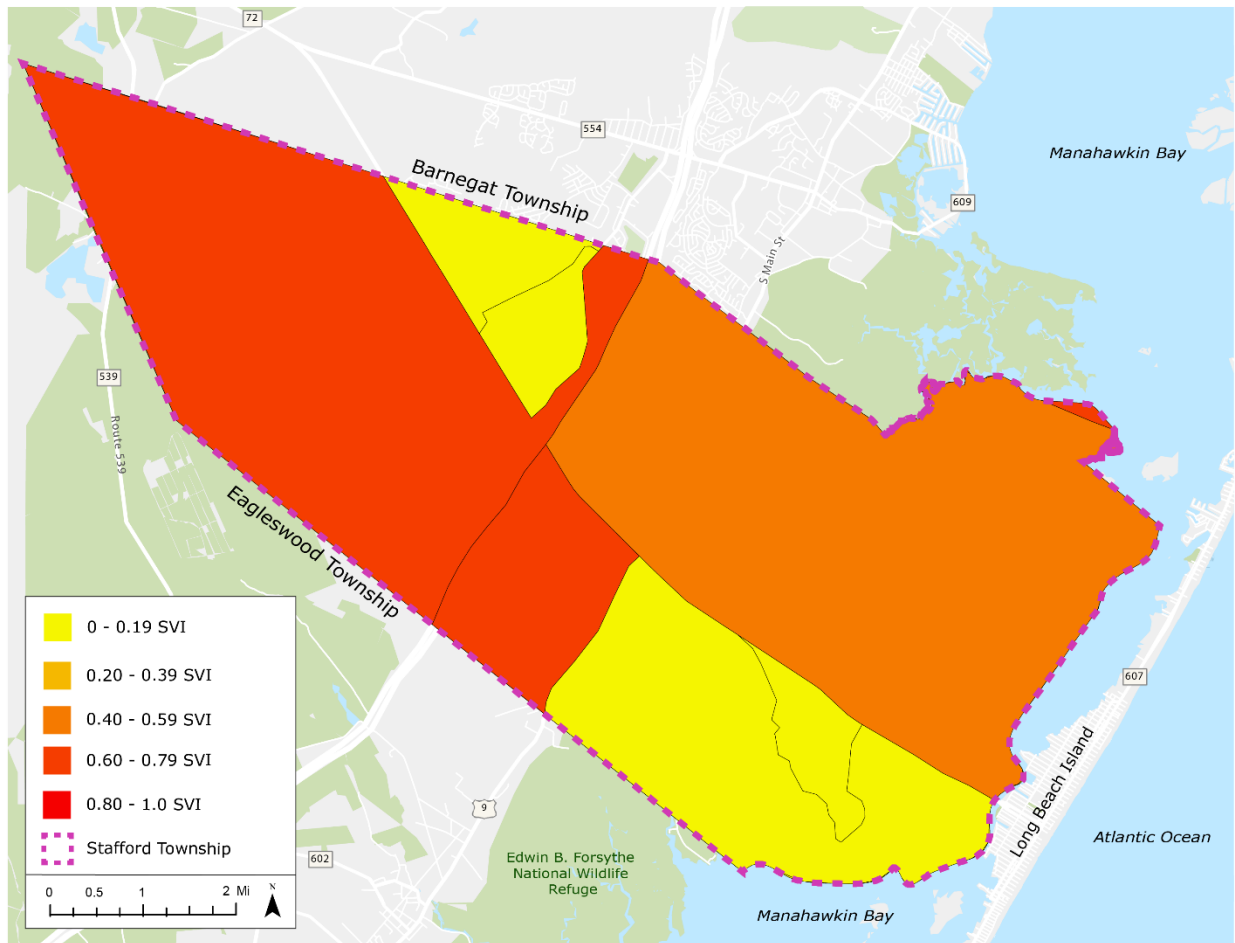
As a coastal community located within the Pine Barrens, Stafford contains several environmentally significant areas and ample natural resources. In fact, over 50 percent of the Township is undevelopable due to the presence of state and federally-managed wetlands and salt marshes located along the Bay (Stafford Land Use Element, 2017). These designated wilderness areas are acquired and preserved in collaboration with county, state, and federal agencies, in addition to several non-profit groups (Stafford Land Use Element, 2017). They include the Manahawkin Wildlife Management Area as well as a portion of the Edwin B. Forsythe National Wildlife Refuge, which, taken together, represents one of the few remaining large expanses of salt marsh and transitional woodland coastal habitats in New Jersey (Manahawkin Wildlife Management Area, 2016). These conservation zones provide crucial habitats for multiple species of birds whose populations have been impacted by development, as well as white-tailed deer, box turtles, and a wide variety of tree and plant species.

### Population and Health

Vulnerable populations are given special consideration in the wake of flooding events as the risk posed to these groups may be elevated due to physical limitations or limited access to healthcare, transportation, and/or financial resources. The Center for Disease Control (CDC) has created a social vulnerability index (SVI) that ranks communities at the census-tract level based on a number of factors, such as poverty, lack of access to transportation, disabilities, and crowded housing, that may weaken a community's ability to respond to a disaster. Each census-tract nationwide is assigned an SVI rating based on 2020

U.S. Census data between 0 – 1, with the top 10<sup>th</sup> percentile (0.9 – 1.0) indicating the most vulnerable populations.

As demonstrated in Figure 4, four of the seven census tracts in Stafford are ranked in the lowest 20<sup>th</sup> percentile in terms of SVI, indicating that these communities have low social vulnerability. These census tracts are primarily comprised of the residents of Ocean Acres and Beach Haven West. The tract containing Mud City and the mixed-use corridor along East Bay Avenue has an SVI of 0.56, and the two tracts primarily comprised of residents of Manahawkin and Cedar Run have SVI ratings of 0.65 and 0.66. This indicates that, while no tracts within Stafford are in the top 10<sup>th</sup> percentile of SVI on a national basis, there are discrepancies between different neighborhoods within the Township in terms of social vulnerability. Additional considerations should be provided to vulnerable residents in the Township following a flooding event or other natural disaster.



**Figure 4: Township of Stafford, Social Vulnerability Index (SVI)**

Additionally, there are several health impacts including, but not limited to, water and insect-borne diseases, mold, injury, and trauma that are associated with flooding that the Township should mitigate against. Potential hazardous sources include contaminated water, air pollutants, exposed soil, debris, and injury cause by flooding impacts, among others.

Economy

The local economy in Stafford is predominately driven by both commercial districts and small local businesses. The commercial districts include large stores such as Costco, Walmart, Target, and Lowe’s. They act as important drivers of the local economy by attracting regional shoppers to visit Stafford from neighboring Long Beach Island to purchase provisions, encouraging their exploration of Stafford’s small businesses and local restaurants while in the Township (Coastal Vulnerabilities Assessment for Township of Stafford, 2021). Furthermore, Manahawkin acts as the Township’s major commercial and mixed-use corridor, offering a variety of restaurants, services, and shopping centers. Local business corridors fan out from this area, particularly along Route 9, East Bay Avenue, and interspersed in the residential neighborhoods of Beach Haven West and Bonnet Island.

## **2.4 Planning Context**

Several key initiatives and prior planning efforts have informed the Resilient Stafford Action Plan and shaped proposed resilience and adaptation actions (Discussed in Section 6). These include both Stafford-led initiatives, as well as local projects and precedent analyses completed by state and federal agencies and academic institutions. Within these documents are stated goals, objectives, and vital background information on the current conditions and vision for the future development of Stafford that have been incorporated into the Resilient Stafford Action Plan. Below is a list of the key prior planning efforts that have been reviewed, though a complete list is included in the References section.

### Resilient NJ

In the wake of Superstorm Sandy, the U.S. Department of Housing and Urban Development (HUD) established the National Disaster Resilience Competition (NDRC), which made \$1 billion in relief funds available to communities struck by natural disasters. The State of New Jersey was awarded \$15 million as part of the competition, \$10 million of which is funding the Resilient NJ program. In recent years, as the program has expanded, additional sources of funding have contributed to funding the program, including NOAA’s Coastal Zone Management program. The Resilient NJ program is an assistance program to support local and regional climate resilience planning. The program, which is being administered through DEP, builds on the existing efforts and capabilities within the state to create and implement creative regional planning solutions to address current and future flood-related hazards, environmental resource protection, and the promotion of sustainable/smart growth development in both riverine and coastal communities (DEP, Resilient NJ, n.d.).

### Resilient LBI (2021)

The Resilient Long Beach Island Action Plan was completed in 2021 through a collaboration with DEP, Long Beach Township, and a consultant team led by Kleinfelder and Ramboll, as a project under the Resilient NJ program. The Action Plan identified regulatory solutions and infrastructure projects that are intended to mitigate future flood risk and well as build resilience to climate change impacts and extreme weather events. The Resilient LBI Action Plan has served as a precedent for the Resilient Stafford Action Plan. Additionally, given the geographical proximity of Stafford and Long Beach Island and their inter-municipal partnership, the recommended actions within the Resilient LBI Action Plan have been considered alongside the project proposals put forth in the Resilient Stafford Action Plan, such that the two projects strengthen resiliency measures for the community as a whole with respect to flooding and climate change impacts.

### 2017 Master Plan: Land Use Element (2017)

The Land Use Element of a Master Plan describes a municipality’s existing development patterns and summarizes the changes that have occurred since the last Master Plan update, which in Stafford’s case was in 2007. It is important to note that since Superstorm Sandy occurred in 2012, the recovery and resilience efforts that followed played a large role in shaping Stafford’s 2017 Land Use Element as the Township sought to rebuild and elevate homes while restricting future development in flood-prone areas. Therefore, the need to increase resiliency with respect to natural hazards and extreme precipitation events is of the utmost importance within the Township’s 2017 Land Use Element. The stated goals provided

within that document were vital to the development of this Resilience Action Plan. They include the following:

- Provide a land use pattern that preserves residential neighborhoods, strengthens commercial districts, preserves and enhances parks and open spaces, and accommodates community facilities.
- Improve the resiliency of the Township's coastal areas through acquiring properties that are at risk of flooding, elevating existing homes in the floodplain, and implementing hazard mitigation techniques including green and grey infrastructure.
- Encourage the adaptive reuse and rehabilitation of older housing in the Township.
- Periodically review land use patterns in all zoning districts to identify necessary amendments to the Township Zoning Ordinance in order to protect the desired character of Stafford.
- Implement more resilient building practices in existing floodplains and more resilient building requirements in areas where Superstorm Sandy had immense land use impacts.

#### 2021 Coastal Vulnerabilities Assessment for Township of Stafford, New Jersey (Rutgers CVA)

In 2021, Rutgers University completed a CVA on behalf of Stafford, which was submitted to the New Jersey Office of Planning Advocacy (OPA) to supplement the Township's Municipal Self-Assessment, with the intent of helping relevant state agencies understand the impacts of coastal flooding. The CVA identifies current vulnerabilities across various sectors for the possible impacts of inundation under different flood scenarios, which has been updated and built upon in this report (Section 5).

#### 2021 Stafford Lagoon Study

Stafford Township completed the Stafford Lagoon Study in 2021 to determine the amount and composition of dredge material in waterways within the Township, determining that the dredge material found in the Beach Haven West lagoons is suitable to utilize for wetland restoration and shoreline stabilization. The projects proposed in Section 6 build upon the findings of this report.

#### New Jersey Back Bays Coastal Storm Risk Management Study (USACE Back Bays Study)

The United States Army Corp of Engineers (USACE), in coordination with the U.S. Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), and the U.S. Fish and Wildlife Service (USFWS), conducted a feasibility study and Environmental Impact Statement to investigate coastal storm risk management strategies to increase resilience and reduce risk from future storm events and compounding impacts of sea level rise (SLR) for the New Jersey Back Bays (NJBB) region. The findings of this study and proposed projects, including three storm surge barriers, two cross-bay barriers, and the elevation of more than 18,000 structures in the NJBB region, have been referenced and considered during this effort (USACE, 2021).

#### Community Rating System

Stafford Township is a participating municipality in the Federal Emergency Management Agency (FEMA) Community Rating System (CRS) under the National Flood Insurance Program (NFIP). The program is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements, providing flood insurance policy holders discounts on their annual premiums, depending on their flood zone and the Township's CRS Rating (Flood Information, Stafford Township, n.d.). Stafford has a CRS rating of five which provides up to a 25 percent discount on individual policy holder's premiums, resulting in a savings of nearly \$1 million for local property owners (Flood Information, Stafford Township, n.d.).

### 3. Goals and Objectives

Based on the stated goals and objectives contained within the prior planning efforts and through an integrated community and stakeholder engagement process (described in Section 4), four distinct goals were identified to ensure the Resilient Stafford Action Plan aligns with the community’s vision and priorities. These goals, listed below, guided the project recommendations within this report (discussed in Section 6) and are supported by specific corresponding objectives.

#### Goal 1: Preservation of Natural Resources

Protect coastal natural resources from flooding, storm surge, and erosion while promoting conservation and biodiversity. Objectives include:

- Stabilize the developed shoreline and coastal wetlands with bulkheading and shoreline protection including but not limited to bulkheading and beneficial reuse of dredge material or shellfish habitat
- Preserve saltmarsh and wetlands in Stafford Township, including Federal, State- and privately-owned properties
- Enhance native vegetation and protect habitats of bayside ecosystems
- Improve watershed-scale management with an understanding of projected sea level rise, stormwater management and impacts
- Improve water quality of the Manahawkin Bay, Mill Creek and lagoons, and surrounding waterways

#### Goal 2: Resilient Infrastructure Design

Enhance critical infrastructure design to ensure continued service (mobility, stormwater management, utility) to all communities in the face of intensifying storms and sea level rise. Objectives include:

- Rehabilitation and replacement of the sewer collection system to service projected storm volumes and the current sewer system
- Incorporate Blue-Green Infrastructure into urban and open spaces to support stormwater management, water/air quality, heat reduction, and community vibrancy.
- Identify vulnerabilities in critical facilities and perform necessary upgrades to ensure operational resilience
- Assist Substantially Damaged, Repetitive Loss and Severe Repetitive Loss property owners in elevating their homes in the floodplain
- Following the achievement of the above Goal 2 objectives, a long-term undertaking is to elevate roadways to meet updated design flood elevations and regrade to optimize stormwater runoff to ensure accessibility of evacuation routes

#### Goal 3: Civic Empowerment and Preparedness

Empower community members to provide input on Township projects and make informed decisions for their own properties. Ensure resilience strategies are equitable for all communities to minimize vulnerability and avoid displacement. Objectives include:

- Produce business-owner and homeowner guides for targeting resources and outreach on topics like elevating and floodproofing properties and utilizing FEMA’s Flood Mitigation Assistance (FMA)
- Continue the work of the Program for Public Information (PPI) Committee to provide input on resilience projects and serve as advocates within the community
- Preserve and enhance neighborhood character and the features prioritized by residents

#### Goal 4: Economic Development Initiatives

Create a sustainable local economy with emphasis on workforce development opportunities, new revenue/funding streams, and mitigation of property value loss. Objectives include:

- Diversify the local economy to create economic resilience and build a local workforce in sectors related to resilience-building
- Strengthen research and educational efforts in the region to progress innovation and build knowledge base
- Explore new funding paradigms to finance resilience projects in Stafford Township and encourage collaboration with private, local, state, and federal partners

In Section 6, a description of all proposed resilience and adaptation actions is offered, organized according to these goals and objectives.

## 4. Stakeholder and Community Engagement

At key points during the Resilient Stafford project, the project team held public workshops and arranged meetings with various stakeholders to accomplish several key objectives. Namely, these workshops provided an opportunity to both inform the public of the work being done during this process and to elicit feedback on the goals of the project and the development of the resiliency actions. This process facilitated an iterative feedback loop wherein the project team incorporated the public's comments into the project approach through multiple touch points.

An initial workshop was held in the summer of 2022 and two additional workshops will take place during the spring of 2023. The project team also met with the PPI advisory group to garner additional insights into the Township and receive feedback on the proposed actions. Below is a high-level summary of those meetings and the discussions that took place.

### Public Workshops

Workshop 1 was held on July 28<sup>th</sup>, 2022, at the Stafford Township municipal building. During this initial workshop, the project team provided background information on both the Resilient NJ Program, the Resilient LBI project, and explained why Stafford is well-suited to carry forth this effort. This workshop also included a discussion of ongoing projects that Stafford has initiated to mitigate flooding, such as the sanitary sewer upgrades in Beach Haven West, the Neptune Basin Expansion, and the stormwater pipe replacements in Ocean Acres. This meeting provided an opportunity for the residents to offer additional insights into areas of problematic flooding within Stafford and elicit ideas for mitigation actions for the team to develop further.

The second public workshop was also held in-person on March 14<sup>th</sup>, 2023, at the Stafford Township municipal building. This workshop provided the project team an opportunity to provide a project update to the public. All of the resilience and adaptation action project profiles were presented, and the public provided feedback, commentary, and questions based on the different projects and plan elements. Further, during this meeting, the issues of accelerated erosion caused by boat wakes and flooding along Newell Avenue were raised by public and have been incorporated into this plan.

The third and final public meeting was held on September 20, 2023. This virtual meeting was focused on gathering feedback about the Mud City Resilience and Ecological Enhancement Plan. This project is one of the recommendations of this Action Plan. In addition, NJDEP provided additional funding to Stafford Township to further explore this project recommendation. During this virtual meeting, approximately 25 attendees joined to learn about the Resilient Stafford Action Plan, and to hear details about the Mud City Resilience and Ecological Enhancement Plan. The key feedback from community members during this meeting is the need for solutions to address persistent tidal flooding that impacts properties and blocks transportation routes. The Mud City project, which will be included in Section 7 of this report, will offer recommended actions to address wetland restoration and flood mitigation in the Mud City area.

### Meetings with the PPI Advisory Committee and Other Stakeholder Groups

The project team first met with the PPI Advisory Committee on December 6, 2022, via Zoom. The PPI Advisory Committee is a local advisory group that was formed to comply with the Township's certification for FEMA's CRS program under the NFIP. The PPI is an ongoing local effort to identify, prepare, implement, and monitor a range of public information activities to coordinate information and deliver resources for flood-related community needs. The objectives of this meeting were to build upon the input the project team received from the Township during the public workshop, to elicit feedback on the preliminary goals and objectives (discussed in Section 3), and to initiate a discussion on potential mitigation projects. Additionally, this meeting included discussion topics such as expanding the roadway elevation project to Mud City and Cedar Bonnet Island and reaffirmed the community's interest in the Popular Point dredging project. A second meeting with the PPI will be held in the spring of 2023 to prompt feedback on the proposed mitigation projects.



Furthermore, in addition to the public workshops and meetings with the PPI Advisory Committee, the project team had various meetings with other local groups such as the American Littoral Society and representatives from New Jersey Institute of Technology (NJIT) during this project to coordinate ongoing work and further discuss proposed project details.

## 5. Summary of Vulnerability Assessment

### 5.1 Introduction

The following is a summary of the Climate Change-Related Vulnerability Assessment completed in coordination with the Resilient Stafford Climate Action Plan. The complete CCRHVA is included in the Appendix.

In September 2021, Rutgers Resilience Climate Corps (hereafter “Rutgers”) completed a Coastal Vulnerabilities Assessment for Stafford Township with the goal of providing an analysis of possible impacts of different flood scenarios for the community at a neighborhood level for future planning and potential exposure identification. Rutgers assessed the impact of two-, three-, five- and seven-feet of flooding above 2000 mean higher-high water levels (MHHW) which is the tidal elevation determined by averaging the higher of each day’s two high tides at a particular tide station using data collected between 1983 and 2011. The Vulnerability Assessment analyzed two-, three-, five- and seven-foot MHHW, along with the 100-year and 500-year FEMA Flood Insurance Rate Maps. When conducting the assessment, Rutgers identified current vulnerabilities associated with housing, local economies, public assets, natural resources, among other social and physical Stafford assets. Ultimately, this assessment provided an overarching view of the Township’s exposure to future flooding impacts along a broad spectrum of parameters which allowed local stakeholders to focus on areas where additional detailed analysis may be required.

On February 4, 2021, Governor Murphy signed into law P.L.2021, c6, effective immediately, which requires that municipalities incorporate a Climate Change-Related Hazard Vulnerability Assessment (hereafter “CCRHVA”) into any Master Plan Land Use Element adopted after the effective date. According to the law, the CCRHVAs must rely on the most recent hazard projections and best available science provided by the New Jersey Department of Environmental Protection (hereafter “NJDEP”) and municipalities must also consider environmental effects associated with climate change, including, but not limited to, extreme weather, temperature, drought, fire, flooding and sea-level rise and also contain measures to mitigate reasonably anticipated natural hazards, such as coastal storms, shoreline erosion, flooding, storm surge and wind. More specifically, the law requires:

1. *Municipalities to analyze current and future threats to, and vulnerabilities of, the municipality associated with climate-change related natural hazards, including, but not limited to increased temperature, drought, flooding, hurricanes and sea-level rise;*
2. *Include a build-out analysis of future residential, commercial, industrial, and other development in the municipality, an assessment of the threats and vulnerabilities identified above related to that development;*
3. *Identify critical facilities, utilities, roadways, and other infrastructure that is necessary for evacuation purposes and sustaining quality of life during a natural disaster, to be maintained at all times in an operational state;*
4. *Analyze the potential impact of natural hazards on relevant components and elements of the master plan;*
5. *Provide strategies and design standards that may be implemented to reduce or avoid risks associated with natural hazards;*

6. *Include a specific policy statement on the consistency, coordination, and integration of the climate-change related hazard vulnerability assessment with certain other plans adopted by the municipality; and*
7. *Rely on the most recent natural hazard projection and best available science provided by the NJDEP.*

In August 2022, Stafford Township obtained funding from Sustainable Jersey to complete a CCHRVA as an addendum to the Coastal Vulnerability Assessment completed by Rutgers to address the recent amendment to the Municipal Land Use Law. This CCHRVA evaluates risks to identified municipal assets within the Township’s Special Flood Hazard Area by visualizing vulnerability through mapping and then assessing that vulnerability utilizing the NJDEP specific Vulnerability Assessment Matrix which is a qualitative self-assessment tool aimed at assisting municipalities with assessing and ranking each of their pre-determined assets under different climate related hazards. Once complete, the matrix calculates both an adaptive capacity as well as an overall vulnerability rating with both being represented by a 3-point low to high scale.

The following climate change scenarios, which include MHHW tide, anticipated increased precipitation as well as projected Sea Level Rise rates and storm surge levels, were all considered within five different specific scenarios as follows:

- Present Day Scenario** → MHHW Tide (+) Present Day Precipitation Event
- 2030 Scenario** → 10-Year Precipitation
- 2050 Scenario** → MHHW Tide (+) 2050 10-Year Precipitation Event (+) 2050 SLR (+) 3 FT Storm Surge
- 2070 Scenario** → MHHW Tide (+) 2070 10-Year Precipitation Event (+) 2070 SLR (+) 3 FT Storm Surge
- 2070 Scenario** → MHHW Tide (+) 2070 10-Year Precipitation Event (+) 2070 SLR (+) 3 FT Storm Surge
- 2070 Scenario** → MHHW Tide (+) 2070 10-Year Precipitation Event (+) 2070 SLR (6 FT Surge) (+) 6 FT Storm Surge

Utilizing the Vulnerability Assessment Matrix along with Individual Local Asset Profiles, twenty-two municipal assets were analyzed against each specified scenario and a description of anticipated climate impacts which resulted in the auto-generated Adaptive Capacity and Vulnerability Rankings.

**Summary of Vulnerability Assessment Matrix Analysis and Findings**

Analysis of the results of the Vulnerability Assessment Matrix indicate that four (4) Municipal Assets including the Dorland J. Henderson Memorial Bridge, the Shell Gas Station, the Morris Boulevard Bridge,

and the Well Family Medical Urgent Care Center all represent low vulnerability to all four projected climate change scenarios as well as the present-day scenario and medium to high adaptive capacity for future necessary mitigation, if required. Although an asset such as the Dorland J. Henderson Memorial Bridge is represented as low vulnerability, the 2070 Scenario is represented by a level 4 – high impact expectation which is attributed to inundation at the base of the bridge only which is a similar expectation for the Morris Boulevard Bridge as well as the Well Family Medical Urgent Care Center where access to the site would be impacted.

Six (6) Municipal Assets represent Medium Vulnerability whereas the near future scenarios, to year 2050, are anticipated to have minimal to no site impacts, however, by the 2070 Scenarios, impacts to these assets are more severe. In several cases, such as those related to critical infrastructure at the municipal infrastructure facility located at 800 Mill Creek Road, the entire site will be impacted by the 2070 Scenario and a concern exists for site access. Each of these sites in this classification category should be monitored in the future to ensure that mitigation measures are implemented or completed in advance of these climate change related impacts.

Twelve (12) of the Municipal Assets are considered to be highly vulnerable and all are critical infrastructure or natural resources. These impacts range from site inundation by 2050 to inundation of roadways that could limit evacuation of residents in low-lying vulnerable areas with the most vulnerable asset being the Edwin Forsythe National Wildlife Refuge, a local natural resource. The Local Asset Profiles, provided within this report, offer additional detail for each specific asset and the anticipated impacts expected in the future.

With many of the assets analyzed being government owned, either by local, county or state agencies, the adaptive capacity is considered medium to high for approximately 75% of the assets which is positive for the community and the individual assets. Based on this ownership, there is a high likelihood that these specific sites will have access to the financial and professional resources necessary to mitigate climate change related impacts, as required.

At the present time, Fred’s Garage/Woody’s Garage, Edwin Forsythe National Wildlife Refuge and the Manahawkin Wildlife Management Area are the only assets that may be impacted by the present-day scenario. Fred’s Garage is located on East Bay Avenue and appears to be in a low-lying area based upon site inspection which substantiates the rankings noted on the matrix but may be impacted at a faster rate than other sites in the town. The remaining two sites are natural resource areas and impacted during the present-day scenario which is expected given the low grade elevation, however, the federal agencies responsible for these land areas are cognizant of the possible impacts of storm surge, sea level rise and anticipated increased precipitation rates. In addition, the Township of Stafford is also aware of the possible impacts to these natural resource areas and coordinates with state and federal agencies on a regular basis to sustain these areas and prepare for future climate change impacts.

Stafford Township has numerous assets within its municipal boundaries that are susceptible to increased tide levels, precipitation, sea level rise and storm surge. Ultimately, the 2070 Scenario with 6 FT of storm surge will dramatically impact more than 90% of the assets in the community and Stafford Township should continue to monitor best available data as it is released in future years by the New Jersey Department of Environmental Protection as well as other advisory agencies so as to best prepare for these climate change impacts.

In addition to vulnerability to coastal flooding, the CCRHVA also evaluated vulnerability to the following climate hazards:

- Increased Temperature.
- Drought and Wildfire.
- Flooding, Sea Level Rise, and Storm Surge.
- Hurricanes, Coastal Storms, and Wind.
- Shoreline Erosion.

The CCRHVA also includes a summary of potential impacts of natural hazards on components of the Stafford Master Plan. In 2017, Stafford adopted its Comprehensive Master Plan which evaluated and established guidance for the future development of the Township over the next ten years. While the plan is encompassing in nature and considers a wide array of factors, the Housing, Land Use, Circulation, Open Space, and Environment elements are directly related to this climate change-related hazard vulnerability assessment (CCRHVA). These elements are described in detail in the CCRHVA.

Finally, the CCRHVA includes an outline of future actions and strategies, as well as a consideration of consistency with relevant resilience plans in the region and policy considerations for Stafford’s next Master Plan update. The objective of the CCRHVA is to provide analysis of vulnerability to climate hazards so that the Township can make informed policy decisions in the future, including when completing the next Master Plan update.

## **5.2 Flood Mapping**

The project team utilized two different flood mapping approaches in the Resilient Stafford Action Plan. The first is FEMA’s designated flood zone, which delineates flood risk areas based on historic flooding events and several other property characteristics and topographic factors. The second flood mapping approach focuses on assessing future flood risk by modeling aspects related to sea level rise, projected precipitation, and storm surge.

### FEMA Flood Zones

FEMA has identified various flood zones nationwide to inform the Flood Insurance Rate Maps (FIRMs), a fundamental element of the NFIP. These maps were created to offer flood protection guidelines to communities and provide a national program for floodplain management, encouraging communities to adopt and enforce regulations such as zoning codes, building codes, subdivision ordinances, and rebuilding restrictions in floodplains (First Street, 2019).

Additionally, these maps allow mortgage lenders to determine insurance requirements, offering varying levels of insurance coverage and premium rates based on factors including the property’s location in a flood zone, the location of the property relative to elevation, characteristics such as building type, number of floors, presence of a basement, and the year a structure was built (First Street, 2019). Additionally, FEMA considers the types and strengths of storms that historically have affected the region when creating the FIRMs.

Several flood zones are delineated on these FIRMs including Special Flood Hazard Areas (SFHAs), moderate flood hazard areas, and minimal flood hazard areas. According to FEMA, SFHAs are considered at the highest risk for flooding and “are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year” (FEMA Flood Zones Glossary, 2020). The 1-percent annual chance flood is also referred to as the base flood or 100-year flood. FEMA defines moderate flood hazard zones as areas that are between the limits of the base flood and the 0.2-

percent-annual-chance (or 500-year) flood. And, finally, minimal flood hazard areas are outside of the SFHA and higher than the elevation of the 500-year flood zone (FEMA Flood Zones Glossary, 2020).

The map in Figure 5 depicts FEMA's 100-year flood zone (1-percent-annual-chance) and the 500-year (0.2-percent-annual-chance) flood zone. The minimal flood zone is not included in this map as the chance of flooding is considered low.



**Figure 5: FEMA Flood Map Depicting the 100-year (1-percent-annual-chance) SFHA in Stafford**

## Ramboll Flood Projections

While the FEMA flood maps are considered the gold standard for understanding flood risk in the United States and are fundamental to the NFIP, these maps do not consider future environmental changes in the risk projections and are instead based on historical flooding events as predictors of current flood risk. As such, the project team, in consultation with DEP, developed multiple flood scenarios for the Resilient Stafford project to understand near-, mid-, and long-term impacts to better assess mitigation actions. These scenarios are based on degrees of sea level rise, projected precipitation events, estimates of mean higher high water (MHHW), and storm surge. Below are several key definitions that are useful in understanding the flood mapping approach.

### *Sea Level Rise*

The amount by which the sea level is expected to increase over an indicated time horizon. Present-day sea level rise was modeled for this effort along with 2030, 2050, and 2070 sea level rise projections with 50 percent likelihood, which were derived from the Report of the 2019 Science and Technical Advisory Panel.

### *Precipitation*

A ten percent (10%) annual chance 24-hour rainfall event was chosen for this analysis for both present-day and projected scenarios. This indicates the total rainfall in 24 hours for a precipitation event with an annual probability of occurrence of 10 percent. For present-day Stafford, this amount of rainfall is equivalent to 5.36 inches over a 24-hour period. In the projected scenario, this corresponds to 5.91 inches of rainfall over a 24-hour period. For reference, Superstorm Sandy brought about 6 inches of rain in a 24-hour period.

### *Mean Higher High Water*

The MHHW is the average of the higher, high tide height for every day observed over the National Tidal Datum Epoch, which is a 19-year period established by the National Ocean Service for collecting observations on water levels and calculating tidal datum values (e.g., mean sea level, mean lower low water). In all scenarios, a present-day MHHW tide at 2.41 feet was modeled based on the Mullica-Toms watershed in relation to the NAVD88 geodetic datum.

### *Storm Surge*

Several storm surge events were incorporated into this modeling effort including a three-foot storm surge under the 2050 and 2070 sea level rise scenarios, as well as a six-foot storm surge event under the 2070 sea level rise case to demonstrate worst-case scenario conditions.

### *Results*

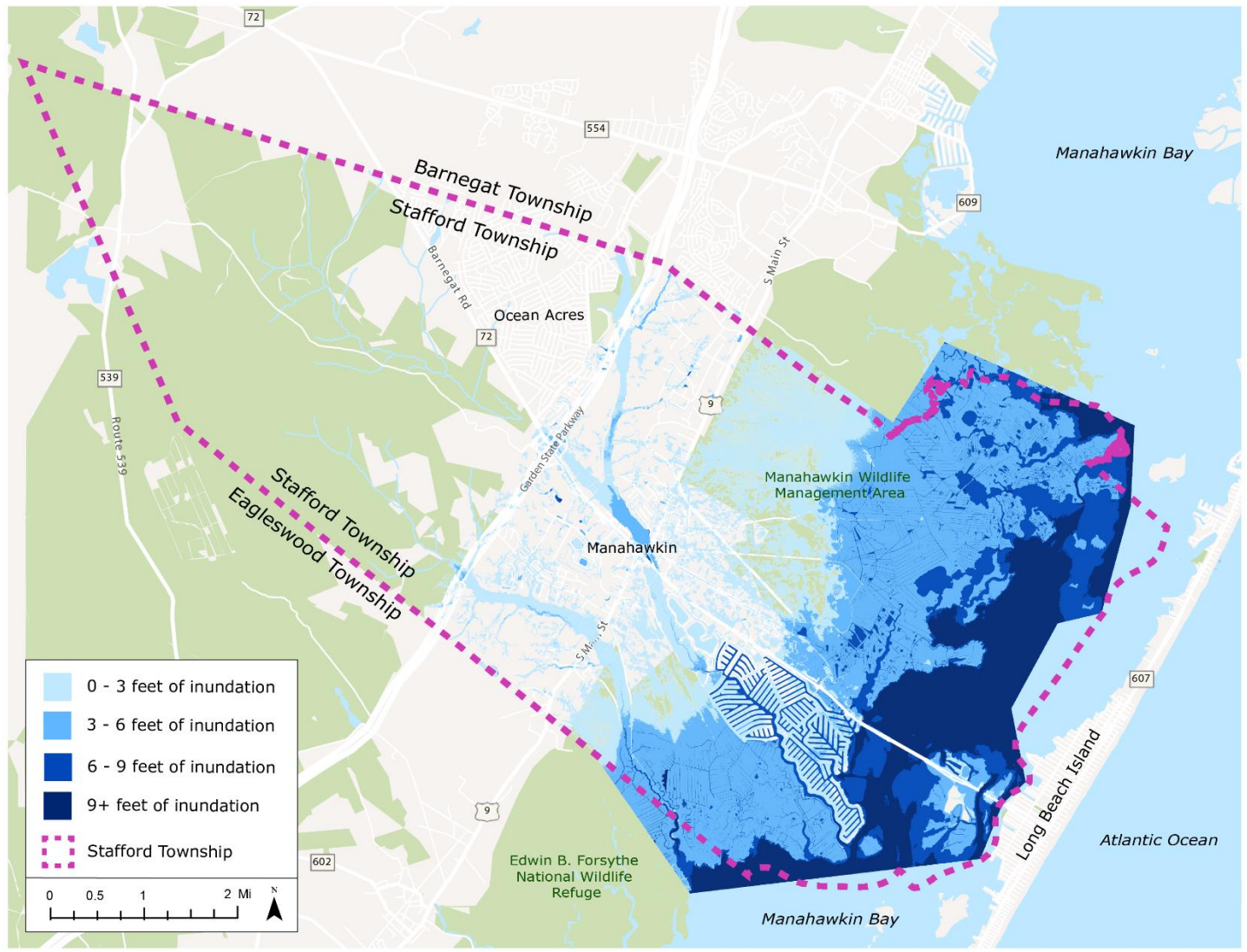
While multiple scenarios were modeled, the mid-term scenario is depicted in this report (Figure 6). It demonstrates maximum water depths in feet for sea level rise under the 2050 scenario (1.41 feet), a projected 10 percent annual chance 24-hour rainfall event (5.91 inches), present-day MHHW tide (2.41 feet), and three feet of storm surge.

The resulting map indicates that several Stafford communities located along the Bay are projected to experience varying levels of inundation given the projected sea level rise, precipitation, and storm surge conditions described above, assuming present-day MHHW tides. The most impacted areas lie to the southeast of Route 9, including the neighborhoods of Beach Haven West, Mud City, Cedar Bonnet Island, and to a lesser degree, Manahawkin.

Of the residential neighborhoods, Cedar Bonnet Island is projected to experience the highest level of flooding, with the outlying portions of the island receiving up to nine feet of inundation and the center of



the island experiencing between zero and six feet. Mud City is similarly impacted, with most of the community projected to experience between three and six feet of flooding. Beach Haven West, which contains the highest concentration of properties in the inundation zone, is projected to receive up to three feet, with discrete areas receiving up to six feet of flooding. Up to three feet of flooding is projected to occur at dispersed locations within Manahawkin as well, particularly along Mill Creek and surrounding Manahawkin Lake.



**Figure 6: Future Flood Map Depicting 2050 SLR, Projected 10% Annual Chance 24-hour Rainfall Event, Present-day MHHW tide, and 3 Feet of Storm Surge**

### 5.3 Buildout Analysis

Based on the projected 2050 flood map described in the previous section, the project team conducted a buildout analysis to help the Township understand the number of potential new development that could occur within the projected flood risk area based on current zoning and land use regulations. In addition to helping the Township estimate at-risk development and develop land use policies that minimize that risk, the buildout analysis is a required provision of the New Jersey Municipal Land Use Law (MLUL).

The MLUL is the enabling legislation that establishes New Jersey municipalities' power to enact land use regulations. A recent change to the MLUL requires municipalities to align local land use policies and capital planning with future climate change projections (P.L. 2021, c. 6). Any land use plan element of the municipal master plan adopted or amended after February 4, 2021 must include a climate change-related hazard vulnerability assessment, an inventory of existing development, and an assessment of latent development capacity (buildout analysis). The required buildout analysis must be a component of the Master Plan's Land Use Element, the element used to implement the municipal zoning ordinance. Stafford Township's Master Plan is scheduled to be updated next in 2027.

#### *Latent Capacity*

In this buildout analysis, latent capacity is defined as the total number of *potentially* developable residential units based on the current zoning regulations of properties that are located within the flood risk area. This exercise considers both single- and multi-family homes that could be developed within the 2050 flood inundation area as they would be vulnerable to storm and flood damages and costly to maintain/repair; a challenge that will increasingly shape land use regulation as sea level rise impacts properties and infrastructure. Based on this analysis, Stafford's latent capacity is a total of 617 new residential units that *could* be developed within the 2050 floodplain, as summarized in Table 2 and depicted in Figure 7.

This analysis focuses on potential residential units based on the zoning districts where the potential development sites are located. Virtually all of the vacant parcels located within the flood risk areas are zoned either residential or mixed-use. There were no vacant commercial parcels within the flood risk area. For parcels located within mixed-use zoning districts, it was assumed that future development is more likely to be residential than commercial. One exception is on Bonnet Island. Because this area is largely built-out, it does not appear in the data for the build-out analysis. However, the Township is considering a redevelopment study for the area, which could consider potential changes in land use. Much of the island is currently developed as single-family homes. A potential redevelopment study may consider other uses that are focused on tourism. As with and redevelopment study and/or zoning change, the Township should consider the projected flood exposure provided in this study to aid in evaluating appropriate future uses and development types.

It should be noted that this analysis uses a conservative approach when estimating the possible number of units. For instance, a portion of the latent capacity units are located on parcels that have already been developed but could be subdivided further, however, in many cases this is unlikely. As such, this analysis assumes any lot size less than 0.25 acres will not be further subdivided. Also in this study, latent capacity is mitigated by geography such that parcels located on wetlands are not considered developable, even if current zoning may officially allow for it.

#### *Methodology*

Using the buildout analysis, Stafford can estimate the potential number of developable housing units that could be built within the flood-risk area based on current zoning and therefore particularly vulnerable to the impacts of flooding. The steps include:

1. Assemble and mapping of available data: existing parcels, building footprints, zoning districts, land use, major and minor roadways, etc.

2. Overlay Stafford Future Flood Inundation projections (2050 sea level rise, with three feet of storm surge, and a 10-year rain event)
3. Exclude all properties located outside of the future flood-risk area
4. Exclude all properties in non-residential zoning districts (i.e. include only residential zoning districts: RA, RA-4, RA-5, R-2, R-3, R-4, R-90, R-75, RR-1, RR-2, RR-2A, MU, and ARMFAH)
5. Determine the latent development capacity of new residential units
  - a. For vacant parcels, divide parcel acreage by minimum lot size as per the current zoning code (i.e. for a vacant lot located within an R-90 district, divide parcel acreage by 9,000 square feet)
  - b. For developed parcels, subtract the minimum lot size of parcels with existing structures then divide by the minimum lot size as per the current zoning code (i.e. for a developed lot located within an R-90 district, subtract 9,000 square feet from the parcel acreage, then divide by 9,000 square feet)
- A. Clean data and apply assumptions
  - a. Investigate outliers
  - b. Round down results to the nearest whole number (i.e., 1.9 units = 1 unit)
  - c. Remove parcels located within wetland areas (i.e., much of Mud City)
  - d. Assume any parcel less than 0.25 acres will not be further sub-divided

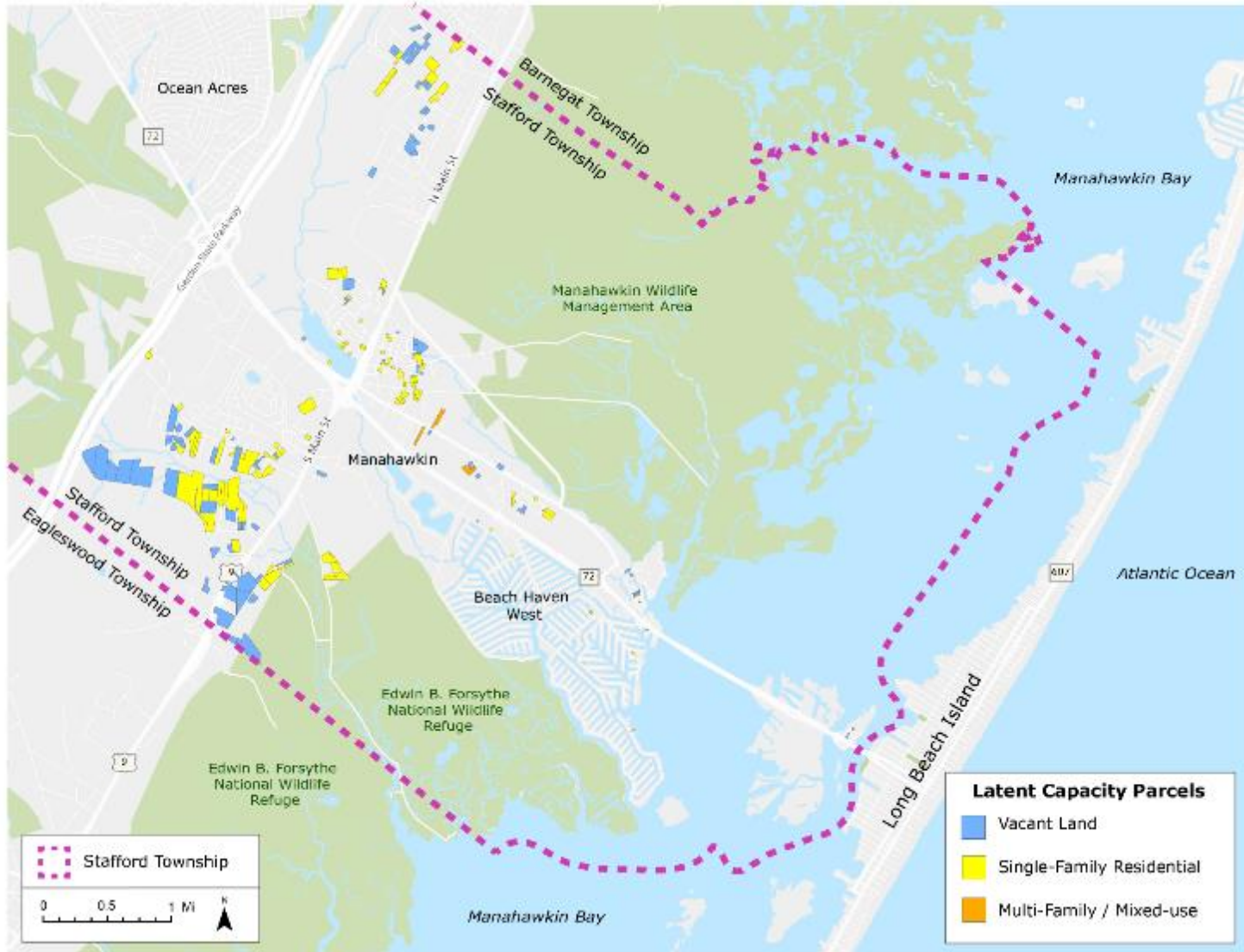
### *Looking Ahead*

As Stafford initiates an update to their Master Plan in 2027, key next steps include:

1. Identify concentrations of properties and uses with present and future high risks.
2. Identify low risk locations for concentrating future development capacity.
3. Continue to elevate existing properties located within the flood risk area.
4. Evaluate policy changes that could shift investment to areas that will be less susceptible to sea level rise risk. There are actions over and above existing Flood Damage Prevention Ordinances that can moderate future climate-related risks. For instance, using safety criteria, such as access to evacuation routes, planners can assess latent development and expansion potential for locations that could support elevated multi-story, mixed-use buildings, a building type that is currently permitted in relatively few zoning districts in Stafford. Other tools, such as a hazard overlay, could encourage resilient design moderating heat islands, managing stormwater, reducing albedo, and encouraging planted cover.
5. Use future flood modeling to inform land use decisions.
6. Continue to evaluate flood hazard laws and policies, revise as needed to ensure future flood scenarios are accounted for, and enforce flood hazard laws and policies to limit new development within the flood risk area.
7. Use the Build Out Analysis to establish planning and land use considerations that should be incorporated into the upcoming Master Plan and/or Reexamination Report and the relationship to other elements of the Master Plan.

Zoning Code	Zoning Description	Undeveloped Acreage	Total Acreage	Potential New Units
RA	Rural Residential Zone	231	251	181
RA-4	Low-Density Rural Residential Zone	-	1	-
RA-5	Environmentally Sensitive Rural Residential Zones	-	5	17
R-2	Residential Zone	40	43	75
R-3	Residential Zone	22	30	53
R-4	Residential Zone	-	0	-
R-90	Residential Zone	5	12	7
R-75	Residential Zone	48	76	179
RR-1	Residential Zone	3	31	1
RR-2	Residential Zone	13	40	27
RR-2A	Residential Zone	13	94	8
MU	Mixed Use	32	34	69
ARMFAH	Age Restricted, Multi-Family Affordable Housing	-	5	-
<b>TOTAL</b>	-	<b>376</b>	<b>584</b>	<b>617</b>

**Table 2: Summary of Latent Capacity of Residential Units Located within the 2050 Flood Risk Area**



**Figure 7: Map of Parcels with Latent Capacity of Residential Units Located within the 2050 Flood Risk Area**

## 6. Resilience and Adaptation Actions

### 6.1 Introduction

Based on the flood mapping assessment, vulnerability analysis, and community and stakeholder engagement, the project team has prepared a list of resilience and adaptation action items for Stafford Township. The actions within this document include planning measures, policy recommendations, and proposed projects that can be linked and built upon one another, resulting in multi-tiered benefits and interconnected resilience measures. Further, the recommended actions within this document have been considered and coordinated with the efforts stemming from the Resilient LBI action plan, such that the two projects strengthen resiliency measures for the community with respect to flooding and climate change impacts.

These actions are intended to support current efforts to make the Township more resilient to present-day flood impacts as well as to provide recommendations for climate change adaptation measures that will provide benefits well into the future. Therefore, the timeline for implementing these actions is wide-ranging. Several of the actions are already in progress or are recommended for immediate implementation to protect assets ahead of the next large storm, such as sewer system upgrades and elevating homes. Another sub-set of these actions includes mid-term projects that are expected to take between five and ten years to complete with the intent of providing greater overall community resilience through measures such as bulkhead installations, lagoon dredging, and seeking resiliency grant funding. Finally, a number of these actions are included to identify long-term projects that will help the Town be better prepared for climate change impacts ten to twenty years from now.

The map in Figure 8 below demonstrates the location of all the actions included in this document, organized by the four goals described in Section 3. The matrix in Table 3 provides a summary of the Resilience and Adaptation Actions, followed by a more thorough description of each action in the following section.

#### Notes on Recommended Resilience and Adaptation Actions

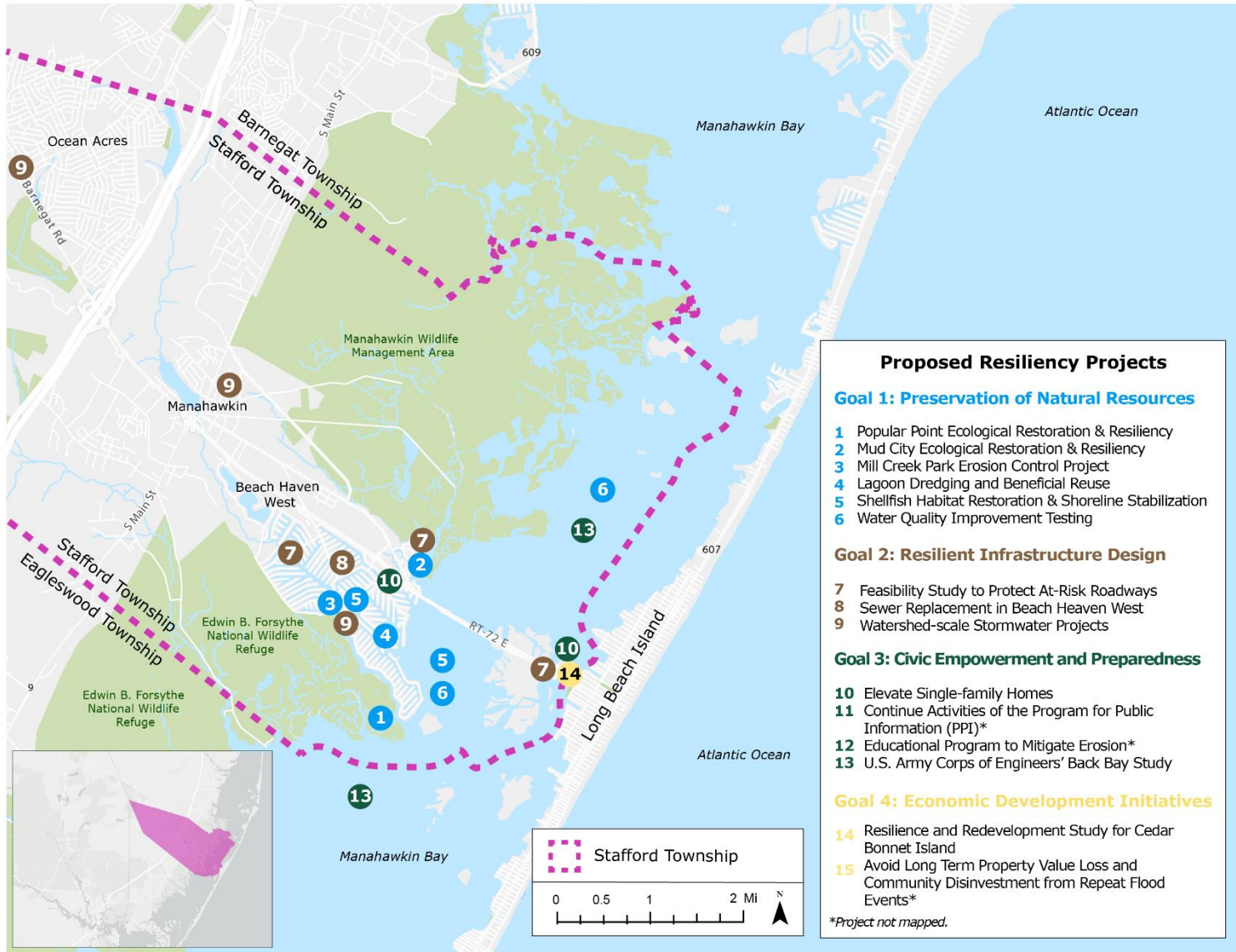
These Recommended Resilience and Adaptation Actions and site locations have been identified through modeling and analysis as potential locations for flood mitigation and resiliency projects. Further outreach and coordination may be needed to determine site feasibility and willingness to participate by private property owners, state agencies, and federal agencies.

Order-of-magnitude cost estimates are provided using the following scale:

- \$ Less than or equal to \$25,000
- \$\$ Greater than \$25,000 but less than \$250,000
- \$\$\$ Greater than \$250,000 but less than \$1 Million
- \$\$\$\$ Greater than \$1 Million
- \$\$\$\$\$ Greater than \$10 Million

Timeframes for Implementation are provided using the following scale:

- Short-term: 1 – 5 years
- Mid-term: 5 – 10 years
- Long-term: 10 - 20 years



**Figure 8: Resilience and Adaptation Actions Map**

Resilient Stafford Action Plan  
**Section 6: Resilience and Adaptation Actions**



GOAL	#	PROJECT	PROJECT DESCRIPTION	LOCATION	BENEFITS & CO-BENEFITS	COST ESTIMATE	POTENTIAL FUNDING SOURCE	PROJECT OWNER	PROJECT PARTNERS	TIMEFRAME
Goal 1: Preservation of Natural Resources	1	<b>Popular Point Ecological Restoration &amp; Resiliency</b>	Complete wetland and shoreline restoration along the Manahawkin Bay at Popular Point to provide improved wave attenuation for the Beach Haven West neighborhood.	Forsythe National Wildlife Refuge	Marsh Restoration Enhanced Biodiversity Carbon Sequestration Flood Risk Reduction Improved Water Quality Improved Navigability of Waterways	\$\$\$\$	DEP NOAA NJDOT	Stafford Township	USFWS NJDOT Save Barnegat Bay	Short-term
	2	<b>Mud City Ecological Restoration &amp; Resiliency</b>	Evaluate wetland restoration and flood mitigation measures in the wetland areas surrounding the Mud City neighborhood, which have been identified as highly vulnerable to sea-level rise, storm surge, and wave action.	Mud City	Storm surge and wave energy dissipation Flood Risk Reduction Marsh Restoration Enhanced Biodiversity Carbon Sequestration Improved Water Quality	\$\$ - \$\$\$\$\$	DEP NFWF NOAA	Stafford Township DEP	NJDOT Mud City property owners USFWS (Edwin B Forsythe)	Short - to mid-term
	3	<b>Mill Creek Park Erosion Control Project</b>	This project includes bulkheading the shoreline, adding berms to the interior park areas, and smaller landscaping elements to protect critical infrastructure from flooding and erosion damage. Preliminary drawings were prepared and submitted for FEMA BRIC funding in 2021. Note: Project may change with the Littoral Society.	Beach Haven West	Protection for critical infrastructure Protection of adjacent properties and stabilization of shared shoreline Enhanced public spaces, recreation spaces, livability Increase biodiversity	\$\$\$\$	FEMA NFWF DEP	Stafford Township	Ocean County Utilities Authority	Short-term
	4	<b>Lagoon Dredging and Beneficial Reuse</b>	Dredging lagoons and reusing material for berm construction is proposed to help to dissipate storm surge and enhance native ecosystems in the back bay which are experiencing disrupted marine navigation and exacerbated sea level rise due to sediment transport and deposition.	Beach Haven West	Storm surge mitigation Shoreline stabilization Ecosystem restoration/enhancements Increase biodiversity (wetland expansion)	\$\$\$\$	NOAA NJDOT	USACE	DEP NJDOT	Mid-term
	5	<b>Shellfish Habitat Restoration &amp; Shoreline Stabilization</b>	Stafford Township is partnering with the American Littoral Society to identify additional oyster reef opportunities as shellfish habitat restoration has been shown to promote biodiversity and stabilize shorelines in the New Jersey back bays.	Manahawkin Bay	Shoreline stabilization Increase biodiversity Water Quality Improvements	\$\$\$\$	NFWF	Stafford Township	American Littoral Society Save Barnegat Bay Stockton University Marine Field	Mid-term
	6	<b>Water Quality Improvement – Testing</b>	Project proposes water quality testing in the bay to assess the remediation of water quality issues stemming from human activity, including boat fuel leaks and illegal dumping.	Bay	Improved water quality in the Bay Habitat restoration and welfare Enhanced public awareness	\$\$	Stafford Township Barnegat Bay Partnership Academic Institutions	Stafford Township	Save Barnegat Bay Barnegat Bay Partnership DEP	Short-term

**Table 3: Resilience and Adaptation Actions Matrix**

GOAL	#	PROJECT	PROJECT DESCRIPTION	LOCATION	BENEFITS & CO-BENEFITS	COST ESTIMATE	POTENTIAL FUNDING SOURCE	PROJECT OWNER	PROJECT PARTNERS	TIMEFRAME
Goal 2: Resilient Infrastructure Design	7	Feasibility study to Protect At-Risk Roadways	The proposed project is to conduct a feasibility study examining the probability, potential causes, and predicted extent of the future inundation of roadways in Beach Heaven West, Mud City, and Cedar Bonnet Island and other at-risk neighborhoods, with the purpose of suggesting solutions and determining the cost of flood prevention.	Beach Haven West, Mud City, and Cedar Bonnet Island	Future flood risk mitigation Protection for critical infrastructure Protection of adjacent properties and stabilization of shared shoreline	\$\$\$ - \$\$\$\$\$	FEMA FMA Grant	Stafford Township NJDOT	N/A	Long-term
	8	Sewer Replacement project in Beach Heaven West	An existing, sewer line connection system will be replaced in the Beach Heaven West section of Stafford Township to remove and replace deteriorated pipes.	Beach Haven West	Flood risk mitigation Protection of critical infrastructure Protection of property	\$\$\$\$	Stafford Township NJ I-Bank	Township of Stafford	DEP NJDOT Save Barnegat Bay New Jersey Natural Gas	Mid-term
	9	Watershed-scale Stormwater Projects	This project proposes the funding and development of a watershed-scale stormwater study to identify sources of flooding in Ocean Acres and assess the impact, feasibility, and efficacy of mitigating flooding through blue-green infrastructure (BGI) in coordination with traditional grey infrastructure solutions.	Ocean Acres Beach Haven West Manahawkin	Stormwater flooding mitigation Water and air quality improvements Enhanced biodiversity Enhanced public realm	\$\$\$\$	FEMA State of NJ	Stafford Township	Barnegat Township Ocean Acres property owners NJDOT	Short-term
Goal 3: Civic Empowerment and Preparedness	10	Elevate single-family homes	The proposed project would allow for the continuation of elevating homes in repetitive loss and severe repetitive loss areas in primarily located in the Beach Haven West, Cedar Run, Mud City, and Bonnet Island areas.	Beach Haven West, Cedar Run, Mud City, and Bonnet Island	Flood Risk Reduction Property loss avoidance	\$\$\$\$	FEMA	Stafford Township Private property owners	N/A	Ongoing
	11	Continue Activities of the Program for Public Information (PPI)	The proposed project will be a continuation of the work completed this year by the Stafford PPI Committee by expanding outreach to residents in flood prone areas regarding flood insurance availability, and home elevating opportunities will aid in reducing flood risk and improving overall preparedness for flood related disasters.	Townwide	Flood Risk Reduction Increasing awareness/engagement	\$	Sustainable NJ	Stafford Township PPI Committee	N/A	Ongoing
	12	Educational Program to Mitigate Erosion caused by Boat Wakes	The Township of Stafford should create a program of educational outreach to homeowners, tourists, and recreational boaters within Stafford to enforce maritime speed limits, educate the public on the erosion potential of boat wakes, and reinforce boating safety in general.	Townwide	Flood Risk Reduction Increasing community awareness/engagement Improve safety	\$	Stafford Township	Stafford Township	Stafford Police Department Residential homeowners	Near-term
	13	U.S. Army Corps of Engineers – Back Bay Study for mitigation	Stafford Township is open to relevant recommendations within the U.S. Army Corps of New Jersey Back Bays Coastal Storm Risk Management Study, as it pertains to flood prone structures. This work is ongoing, with the Beach Haven West neighborhood as the primary focus, among others.	Beach Haven West	Flood Risk Reduction	\$\$\$\$	Disaster Relief Appropriations	USACE	N/A	Ongoing - Long-term
Goal 4: Economic Development Initiatives	14	Resilience and Redevelopment Study for Cedar Bonnet Island	A Redevelopment Study for the Cedar Bonnet Islands is necessary in order to determine the potential for future land use changes on the islands to ensure the safety of residents and businesses, while also maintain the Township's tax base and preserving natural resources and wetland habitat.	Cedar Bonnet Island	Flood risk reduction Economic development	\$	Already funded by New Jersey Department of Community Affairs	Stafford Township	N/A	Short-term
	15	Repetitive Loss (RL) Analysis	Stafford has been working for several years with FEMA and property owners to elevate homes as a way to reduce repetitive loss and maintain property values. In coordination with the NJIT Repetitive Loss Analysis, the Township should continue work to make existing properties more resilient and provide options for property owners of severe repetitive loss properties.	Townwide	Flood risk reduction Property damage avoidance Community disinvestment avoidance	\$	NJIT	Stafford Township	FEMA NJIT	Short-term

**Table 3: Resilience and Adaptation Actions Matrix (Cont'd)**

Resilient Stafford Action Plan

**Section 6: Resilience and Adaptation Actions**

## **6.2 Goal 1: Preservation of Natural Resources**

*Protect coastal natural resources from sea level rise, storm surge, and erosion while promoting conservation and biodiversity.*

### *Popular Point Ecological Restoration & Resiliency*

#### *Project Description*

The proposed project would allow for a collaboration between the Edwin B. Forsythe National Wildlife Refuge, the New Jersey Department of Transportation (NJDOT), and the Township of Stafford to complete wetland and shoreline restoration along the Manahawkin Bay at Popular Point. The objective of this project is to restore the Popular Point wetland to provide improved wave attenuation for the Beach Haven West neighborhood.

Stafford Township completed the 2021 Stafford Lagoon Study to determine the amount and composition of dredge material that has silted in waterways within the Township. Through that study and survey work, it has been determined that dredge material found in waterways in the Beach Haven West lagoons is suitable to utilize for wetland restoration and shoreline stabilization.

Stafford Township has been awarded grant funding through the Natural Climate Solutions (NCS) grant program and submitted a grant through the NOAA's Transformational Habitat Restoration and Coastal Resilience grant program, in partnership with NJDOT and Edwin B. Forsythe National Wildlife Refuge. These funds will be used for wetlands restoration, shoreline stabilization, and increased carbon sequestration to the expansive Forsythe National Wildlife Refuge in Stafford Township, using dredge material sourced from dredging the lagoons in and around Beach Haven West.

As the wetlands in Manahawkin Bay have eroded over time, this erosion has both weakened flood mitigation benefits of the wetlands and deposited siltation in navigable waters of the bay and lagoons. The project would restore and stabilize wetlands within the Forsythe National Wildlife Refuge in Stafford Township. Along with improved habitat, the restoration will allow for significant amounts of carbon to be sequestered in the form of plants, roots, and soil and should be designed to mitigate inland flooding impacts, such as those observed along Newell Avenue. The project would also provide a location to deposit dredge material identified in the 2021 Stafford Lagoon Study, utilizing that material to help stabilize the refuge. In short, this project would help to rebuild the wetlands, while freeing the lagoons of the dredge material and providing added resilience against future flooding for area residents.

The project expects to utilize approximately 150,000 cubic yards of dredge material combined between the NJDOT and the Township to stabilize and restore the wetlands. A total of approximately 120 acres is expected to be enhanced as a part of this project. This would be an extensive pilot project to show how wetlands may be restored in this region using locally-sourced dredge material and demonstrating co-benefits such as carbon sequestration through healthy vegetated marshes. The Natural Climate Solutions grant application included a concept design for Popular Point. The dredge material would be taken from within the system, saving disposal and transport costs, while restoring the wetlands back to their original state with their original material (Natural Climate Solutions Grant Application, 2022).

*Location*



*Resilience Benefits and Co-Benefits*

- Marsh restoration
- Enhanced biodiversity
- Carbon sequestration
- Flood risk reduction
- Improved water quality
- Improved navigability of waterways

*Cost Estimate*

- \$\$\$\$
- The Township has been awarded \$4,998,109 from the NCS grant to be a part of the larger project and to add the sandier dredge material, from the same ecosystem, to the project to allow the stabilization to occur. The Township of Stafford contributed \$600,000 to conduct the 2021 Stafford Lagoon Study, permitting, and continued analysis to allow this project to be a possibility.

*Potential Funding Source*

- DEP NCS 2022 grant (awarded)
- NOAA Transformational Habitat Restoration and Coastal Resilience Grant (pending)
- NJDOT

*Project Owners*

- Stafford Township

*Project Partners*

- USFWS (as pertaining to Edwin B. Forsythe)
- NJDOT
- Save Barnegat Bay (non-profit organization)

*Regional Connections*

- USACE Back Bays Study

Resilient Stafford Action Plan

**Section 6: Resilience and Adaptation Actions**

- NJDOT Stafford Dredging Project
- 2021 Stafford Lagoon Study

#### *Timeframe for Implementation*

- Short-term
- The project will be completed in four primary phases. Phase 1 will consist of the sill formation and placement to ensure infill is contained and provides shoreline stabilization at the surveyed locations. Phase 2 will consist of the infill of sediment into the area between the sill and the shoreline to the set elevation. Phase 3 will consist of planting the areas that were previously not vegetated to ensure more efficient carbon sequestration and plant growth, support habitat creation, and increase ecosystem resilience. Phase 4 will be completed over the following years and will consist of monitoring of site elevation, ecosystem resilience, and vegetation growth.

#### *Regulatory Requirements*

- [DEP Dredging Permit](#) (received)
- USACE Standard Permit (received)

#### *Background Information*

- 2022 Natural Climate Solutions Grant Application
- Watershed Management Study (Jacques Cousteau/Rutgers University)
- Repetitive Loss Study (Stevens Institute)
- USFWS Mastic Beach Wetland Restoration and Resilience Project
- Coastal Vulnerability Assessment (Rutgers University)
- Natural Resource Inventory (OLA)

## Mud City Ecological Restoration & Resilience Study

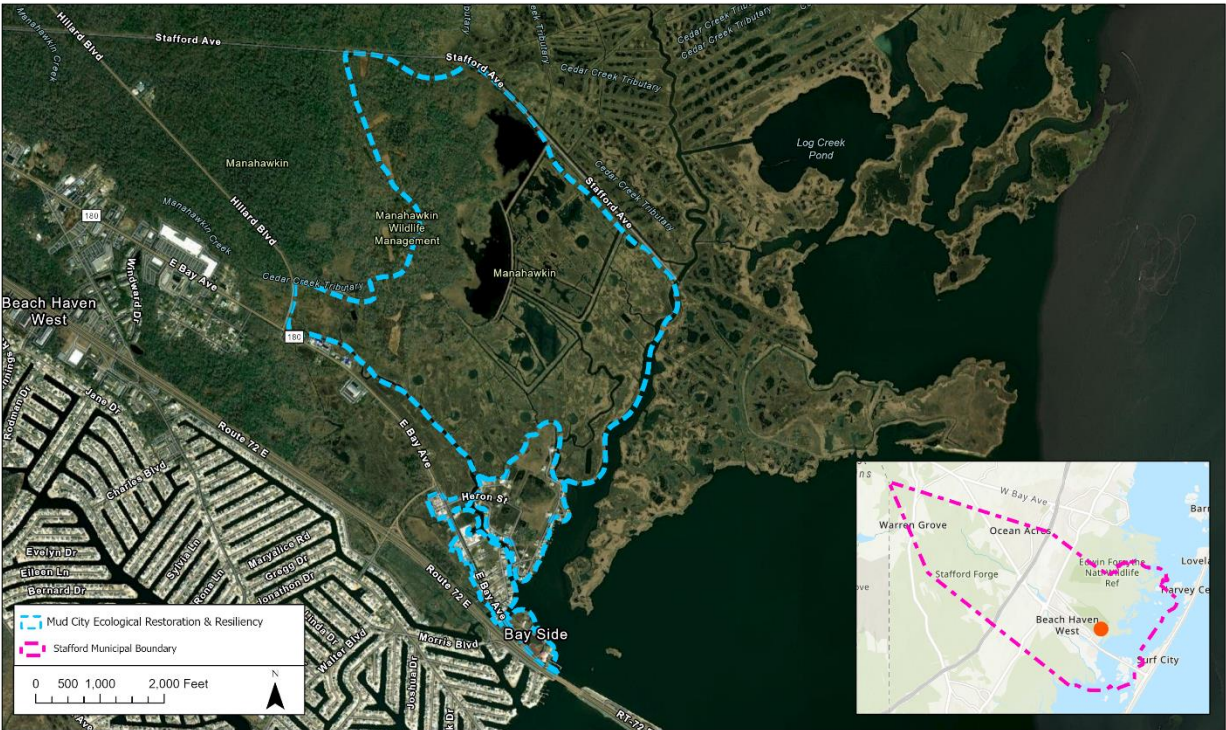
### Project Description

The objective of this project is to evaluate wetland restoration and flood mitigation measures in the wetland areas surrounding the Mud City neighborhood. This area was identified by Stafford Township staff as highly vulnerable to flooding, storm surge, and wave action. A formal feasibility study and vulnerability assessment specific to the neighborhood has yet to be conducted, but an understanding of the impacts is informed by the 2021 Stafford Lagoon Study. Bathymetric surveys indicate high levels of sediment deposition along the shoreline.

Properties in Mud City include a mix of ownership: private residential properties, local businesses (especially marine, boating, and fishing related), preservation lands, and Edwin B. Forsythe wetlands. There are 500 acres of marshlands bordering Mud City to the north under DEP ownership, proposed for ecological restoration and resilience use. Future wetland restoration and flood mitigation measures require coordination and outreach to the wide variety of property owners and other neighborhood stakeholders.

Following completion of the Draft Resilient Stafford Action Plan in Spring 2023, NJDEP provided support for completion of the Mud City Ecological Restoration & Resilience Study, which has been included as an appendix to this document. The Study provided conceptual plans for ecological restoration and coastal resilience, based on targeted community outreach in the Mud City area, to support future grant applications. The Study provides additional foundation for future work, which may include detailed planning, engineering design, and implementation. Conceptual plans integrate hybrid solutions to dredge waterways and utilize material, support local marine industry, restore natural habitats, and buffer against flood forces.

### Location



Recommended solutions in the Mud City Ecological Restoration and Enhancement Study include:

- Shoreline stabilization measures to enhance existing hardened shoreline (living shoreline, vegetated rip rap, wetland restoration) and protect properties.
- Stormwater management solutions to mitigate flooding of roadways.
- Wetland restoration and expansion surrounding Mud City to support floodwater absorption, water quality filtration, enhanced biodiversity, and carbon sequestration.

*Resilience Benefits and Co-Benefits*

- Storm surge and wave energy dissipation
- Flood risk reduction
- Marsh restoration
- Enhanced biodiversity
- Carbon sequestration
- Improved water quality

*Cost Estimate*

- Feasibility Study: \$\$
- Engineering Design and Implementation: \$\$\$\$

*Potential Funding Sources*

- DEP NCS Grant
- National Forest and Wildlife Foundation (NFWF) Coastal Resilience Fund
- NOAA Transformational Habitat Restoration and Coastal Resilience Grant

*Project Owner*

- Stafford Township
- DEP

*Project Partners*

- NJDOT
- Mud City property owners
- USFWS (Edwin B Forsythe)

*Timeframe for Implementation*

- Feasibility Study: Short-term
- Engineering Design and Implementation: Mid-term

*Regulatory Requirements*

- [DEP Dredging permit](#)
- USACE Standard permit

*Background Information*

- Stafford Lagoon Study Final Report-8-24-2021
- May 2021 Sediment Analysis Report (ACT Engineers)
- [Property Ownership](#)
- USFWS Mastic Beach Wetland Restoration and Resilience Project

## Mill Creek Park Erosion Control Project

### Project Description

The Mill Creek Park Erosion Control Project was initiated by Stafford Township to address flooding and erosion damages. Mill Creek Park, located in Beach Haven West, is predominantly Township owned, except for the pump station area which is owned and operated by the Ocean County Utilities Authority (OCUA). The Township water tower, OCUA pump station, and water & sewer building are located within Mill Creek Park, therefore elevating the risk to critical infrastructure. Mill Creek Road, on the north side of the park, is a primary transportation and evacuation route connecting nearby residences to inland areas.

Preliminary drawings were prepared and submitted for FEMA’s Building Resilient Infrastructure and Communities (BRIC) funding in 2021 and 2022. The proposed design includes bulkheading the shoreline, adding berms to the interior park areas, and smaller landscaping elements.

Additional funding from DEP is available to further develop the conceptual designs for living shorelines to reduce erosion and mitigate flooding, which will be discussed further in Section 7.

### Location



### Resilience Benefits and Co-Benefits

- Protection of critical infrastructure
- Protection of adjacent properties and stabilization of shared shoreline
- Enhance public spaces, recreation spaces, livability by improving access due to flood mitigation
- Increase biodiversity

### Cost Estimate

- \$\$\$\$

### Potential Funding Sources

- FEMA BRIC
- NFWF Coastal Resilience Fund
- DEP NCS Grant

## Resilient Stafford Action Plan

### Section 6: Resilience and Adaptation Actions



*Project Owner/Sponsor*

- Stafford Township

*Project Partners*

- OCUA

*Timeframe for Implementation*

- Short-term

*Regulatory Requirements*

- USACE standard permit
- [Nationwide Permit 13](#) (Bank stabilization)
- CWA section 401 WQ Certification and/or CZMA per USACE

*Background Information/Sourcing*

- Mill Creek Erosion Control - Proposed Bulkhead Design Plans
- BRIC Application - Mill Creek Park Aerial

## Lagoon Dredging and Beneficial Reuse

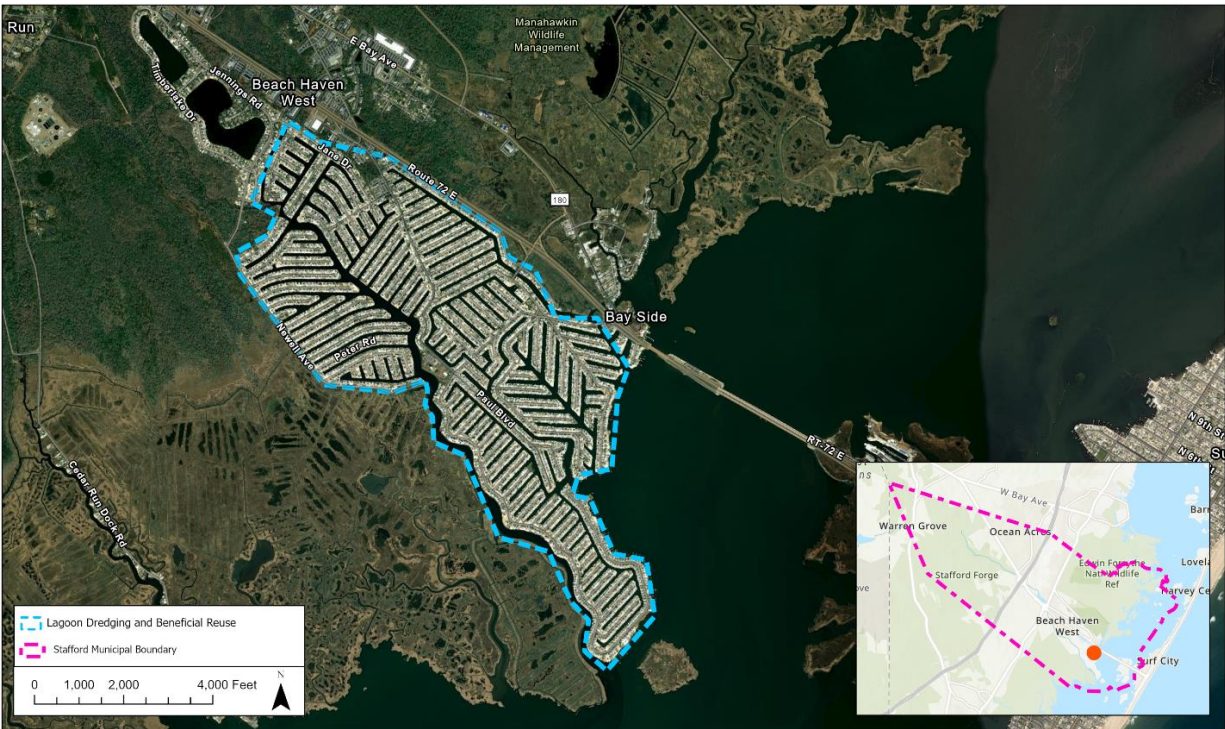
### *Project Description*

Sediment transport and deposition is increasingly occurring in the Back Bay as a result of storm surge, wave action, and tidal influence. Depositions are disrupting marine navigation and boat access and exacerbating sea level rise effects, especially for Stafford homeowners in Beach Haven West, Cedar Bonnet Island, and Mud City.

Dredging lagoons and reusing material for berm construction can help to dissipate storm surge and enhance native ecosystems. Lagoon dredging and beneficial reuse were proposed in the 2021 Stafford Lagoon Study where dredge sites were identified in a bathymetric survey and soil samples tested (ACT Engineers, Inc., 2021). Dredged material may be applied in proposed restoration work at Popular Point, Mud City, and/or Mill Creek Park. Soil tests suggest suitability for shoreline bolstering and wetland expansion when paired with sand material and vegetation.

The Township has submitted a grant application to NOAA to assist in funding this project, which is pending, and will continue to seek additional funding opportunities in 2023.

### *Location*



### *Resilience Benefits and Co-Benefits*

- Storm surge mitigation
- Shoreline stabilization
- Ecosystem restoration/enhancements
- Increase biodiversity (wetland expansion)

### *Cost Estimate*

- \$\$\$\$

### *Potential Funding Sources*

- NOAA Transformational Habitat Restoration and Coastal Resilience Grant
- NJDOT

## Resilient Stafford Action Plan

### **Section 6: Resilience and Adaptation Actions**

*Project Owner/Sponsor*

- USACE

*Project Partners*

- DEP
- NJDOT

*Timeframe for Implementation*

- Mid-term

*Regulatory Requirements*

- USACE permit has been granted
- NJDOT permit has been granted

*Background Information/Sourcing*

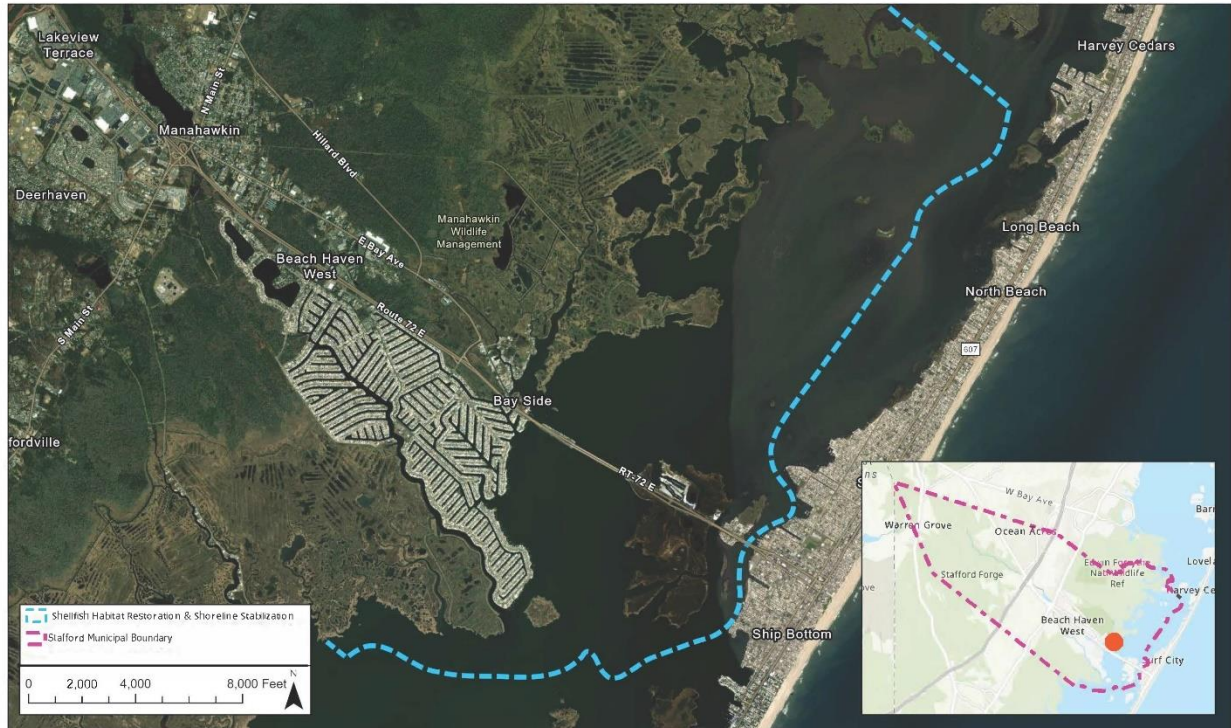
- Stafford Lagoon Study Final Report-8-24-2021
- May\_2021\_Sediment Analysis Report ACT
- USACE Back Bays Study

## Shellfish Habitat Restoration & Shoreline Stabilization

### Project Description

Shellfish habitat restoration has been shown to promote biodiversity and stabilize shorelines in the New Jersey Back Bays. Numerous oyster reef projects are underway in the Manahawkin Bay lead by non-profits like ReClam the Bay and academic institutions like the Stockton University Marine Field Station. Stafford Township has an opportunity to partner with the American Littoral Society to identify additional oyster reef opportunities. Further study is required in order to identify potential locations within Manahawkin Bay that can support shellfish habitat and provide shoreline stabilization and flood mitigation benefits.

### Location\*



\*Approximate location in Stafford. Shellfish restoration extends further to the north and south along Manahawkin Bay.

### Shellfish Resilience Benefits and Co-Benefits:

- Shoreline stabilization
- Increase biodiversity
- Water quality improvements

### Cost Estimate

- \$\$\$\$

### Potential Funding Sources

- NFWF National Coastal Resilience Fund

### Project Owner/Sponsor

- Stafford Township

### Project Partners

- American Littoral Society
- Save Barnegat Bay
- The following parties have ongoing shellfish habitat restoration work at Tuckerton Reef and Mill Creek:

Resilient Stafford Action Plan

## Section 6: Resilience and Adaptation Actions

- Stockton University Marine Field Station
- ReClam the Bay
- DEP
- Jetty Rock Foundation

*Timeframe for Implementation*

- Mid-term

*Regulatory Requirements*

- [DEP General Permit 24](#) (Habitat creation, restoration, enhancement and living shorelines)
- [USACE nationwide permit 27](#) (Aquatic habitat restoration, establish, and enhancement activities)
- [USACE Nationwide Permit 54](#) (Living shorelines)
- USACE standard permit

*Background Information*

- [Barneqat-Bay-Oyster-Restoration-2021.pdf](#)

## Water Quality Testing and Improvement

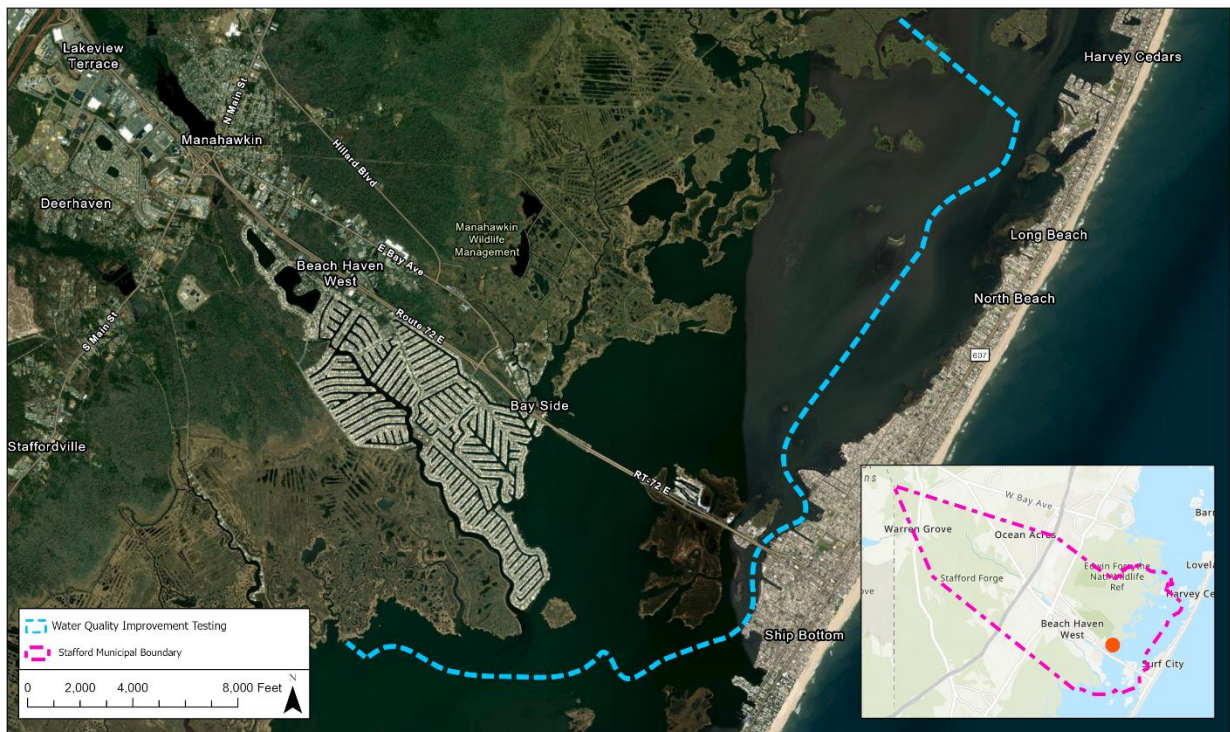
### Project Description

The Barnegat Bay Partnership (BBP) released a Water Quality Network Annual Report in March, 2022 that indicates water quality issues and the need for additional testing in Manahawkin Bay. The water quality monitoring effort included the collection of near real-time data collected in 15-minute intervals during the 2019 sampling year at three monitoring stations in Barnegat Bay, the closest of which was located at the Beach Haven Yacht Club. BBP tested for various water quality indicators including, salinity, temperature, dissolved oxygen, water depth, turbidity and pH. The study, which accounted for seasonal variations, found the following water quality issues (Petersen & Vasslides, 2022):

- Summer seasonal averages remained below NJ Surface Water Quality Standards for saline waters of estuaries.
- Turbidity in Manahawkin Bay exceeded DEP standards, which can contribute to eelgrass loss, death of phytoplankton, and decreased dissolved oxygen.
- pH values exceeded upper limit of 8.5 at Seaside monitoring station due to unknown causes.

Based on these results, additional water quality testing and validation is recommended in Manahawkin Bay to provide testing closer to Stafford, particularly as water quality issues have been observed stemming from human activity, including boat fuel leaks and illegal dumping. The availability of water quality data provides environmental managers and researchers with a valuable tool for understanding estuarine processes and identifying the impacts of different stressors on water quality. Testing programs should be in partnership with local technical universities.

### Location



### Resilience Benefits and Co-Benefits

- Improved water quality in the Bay
- Habitat restoration and welfare
- Enhanced public awareness

### Cost Estimate

- \$\$

### Resilient Stafford Action Plan

## Section 6: Resilience and Adaptation Actions

*Potential Funding Sources*

- Stafford Township
- Barnegat Bay Partnership
- Academic Institutions

*Project Owner/Sponsor*

- Stafford Township

*Project Partners*

- Save Barnegat Bay
- BBP
- DEP

*Regional Connections*

- DEP Watershed Management Areas

*Timeframe for Implementation*

- Short-term

*Regulatory Requirements*

- Township permit to test surface water

*Background Information/Sourcing*

- [2019 Barnegat Bay Water Quality Network Annual Report](#)

### 6.3 Goal 2: Resilient Infrastructure Design

Enhance critical infrastructure design to ensure continued service (mobility, stormwater management, utility) to all communities in the face of intensifying storms and sea level rise.

#### Feasibility Study to Protect Roadways in At-Risk Neighborhoods in Stafford

##### *Project description*

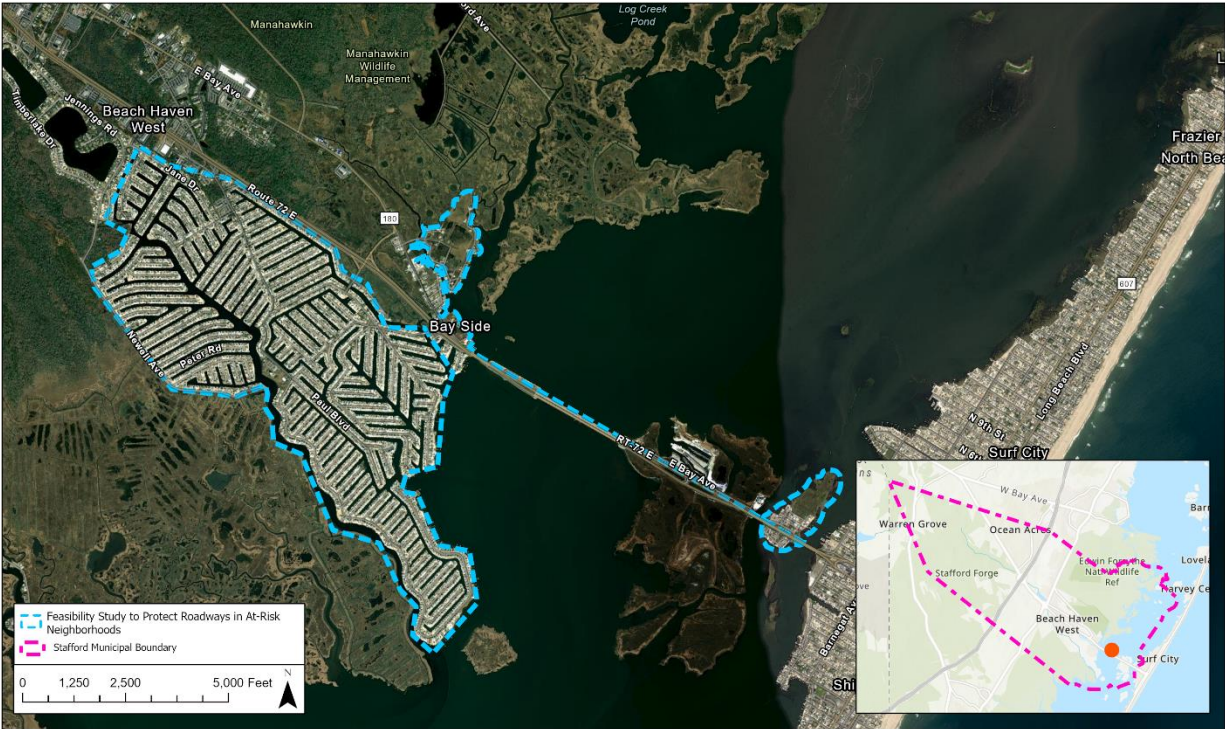
The 2050 flood modeling demonstrates that sections of some roadways will be flooded up to three feet from the mainland at Mallard Island Yacht Club to the Garden State Parkway. The proposed project is to conduct a feasibility study examining the probability, potential causes, and predicted extent of the future inundation of roadways in Beach Haven West, Mud City, and Cedar Bonnet Island and other at-risk neighborhoods, with the purpose of suggesting solutions and determining the cost of flood prevention. Critically, measures to elevate roadways must be coordinated with ongoing efforts to elevate homes in at-risk areas within Stafford Township. Elevated roadways could exacerbate flooding impacts for properties that are not elevated; therefore, home elevation must be completed before roadway elevation.

Based on flood modeling, the feasibility study would evaluate which roadways are at risk of flooding, identify which roadways are highest priority to improve, and assess possible flood mitigation solutions. Multiple solutions should be examined once the cause of the flooding is identified and better understood.

A cost-benefit analysis should accompany any proposed solutions. Further, this study should incorporate and coordinate with the work on the NJDOT Route 72 Manahawkin Bay Bridges Project, which involved the construction of a new, elevated roadway parallel to and south of the existing Manahawkin Bay Bridge, rehabilitation of the existing Manahawkin Bay Bridge, and the rehabilitation of three trestle bridges over Hilliards Thorofare, East Thorofare, and West Thorofare as well as pedestrian and bicycle accommodations, improvements to the intersection of Route 72 and Marsha Drive, drainage improvements near the base of the bridge in Ship Bottom Borough and numerous environmental mitigations. The construction activity on the bridges is complete, however, the drainage improvements along 8<sup>th</sup> and 9<sup>th</sup> Streets in Ship Bottom and the intersection improvements at Marsha Drive are ongoing with an anticipated completion date of December 2024. This project should be evaluated as part of the feasibility study to determine whether further resiliency measures will be required on Route 72 based on future sea-level rise.



*Location*



*Resilience Benefits and Co-Benefits*

- Future flood risk mitigation
- Protection for critical infrastructure
- Protection of adjacent properties and stabilization of shared shoreline

*Cost Estimate*

- Feasibility Study: \$\$\$
- Implementation: \$\$\$\$\$

*Potential Funding Sources*

- FEMA FMA Grant

*Project Owner/Sponsor*

- Stafford Township
- NJDOT

*Timeframe for Implementation*

- Long-term
- The flood modeling analysis should occur in the next few years, however, mitigation actions such as road elevation, if deemed effective, will not occur for another 10+ years as homes need to first be elevated

*Background Information*

- [Route 72 Project Information](#)

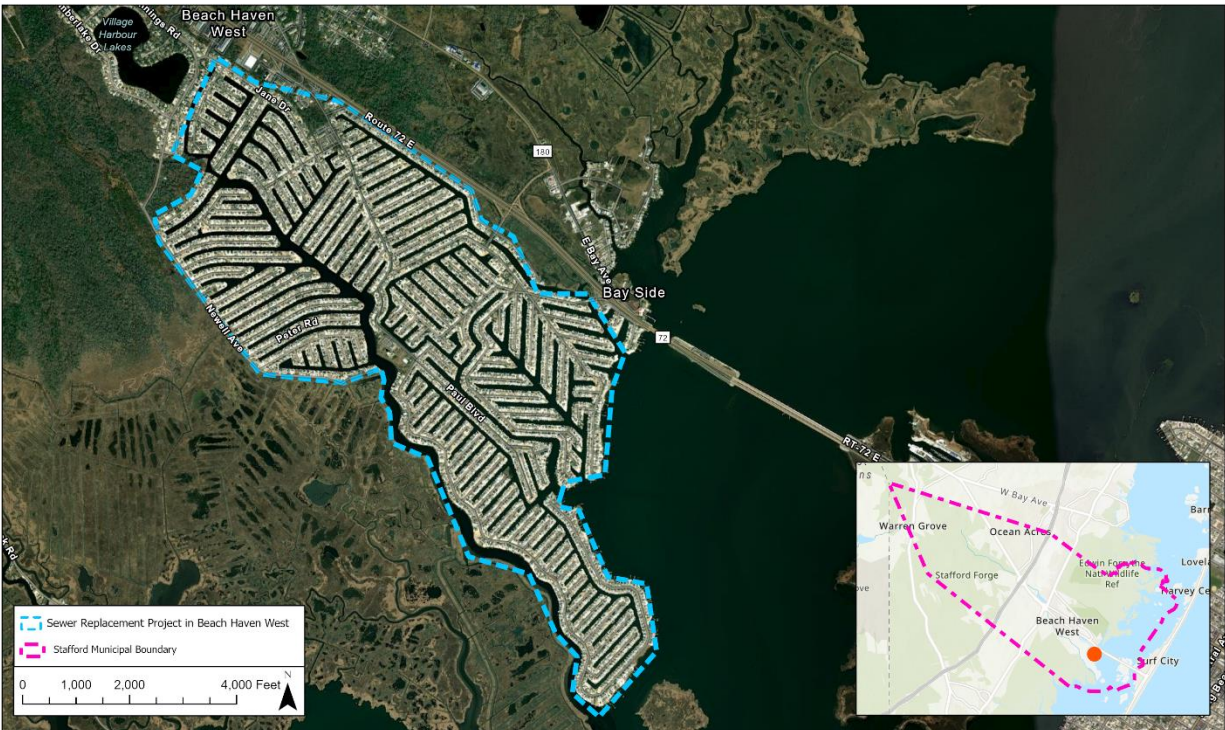
## Sewer Replacement Project in Beach Haven West

### *Project description*

An existing, outdated sewer collection system is being replaced in the Beach Haven West section of Stafford Township to remove and replace deteriorated pipes. This project provides preventative maintenance and strengthens the Township’s existing infrastructure through necessary upgrades to vulnerable systems. The project scope includes the replacement of drainage catch basins, drainage pipe milling, and repaving roadways.

This project is already underway with sewer line work now taking place under Phase 5. Once completed, the effected roadways will be repaved beginning in spring 2023 with a tentative target completion date of fall 2023. Phase V is set to be bid and awarded during summer 2023 with a start date in fall of this year.

### *Location*



### *Resilience Benefits and Co-benefits*

- Flood risk mitigation
- Protection of critical infrastructure
- Protection of property

### *Cost Estimate*

- Implementation: \$\$\$\$\$
- \$1.75M has been issued in principle forgiveness funds

### *Potential Funding Sources*

- Stafford Township
- NJ Infrastructure Bank (NJIB)

### *Project Owner/Sponsor*

- Stafford Township

*Project Partners*

- DEP
- NJDOT
- Save Barnegat Bay
- New Jersey Natural Gas

*Timeframe for Implementation*

- Mid-term: This project is in progress

*Regulatory Requirements*

- DEP Division of Water Quality [Treatment Works Approvals Permit](#)

*Background Information*

- [Risk Factor Beach Haven West Information](#)
- [Stafford Township Beach Haven West Sanitary Sewer Replacement Bulletin \(3/5/2021\)](#)

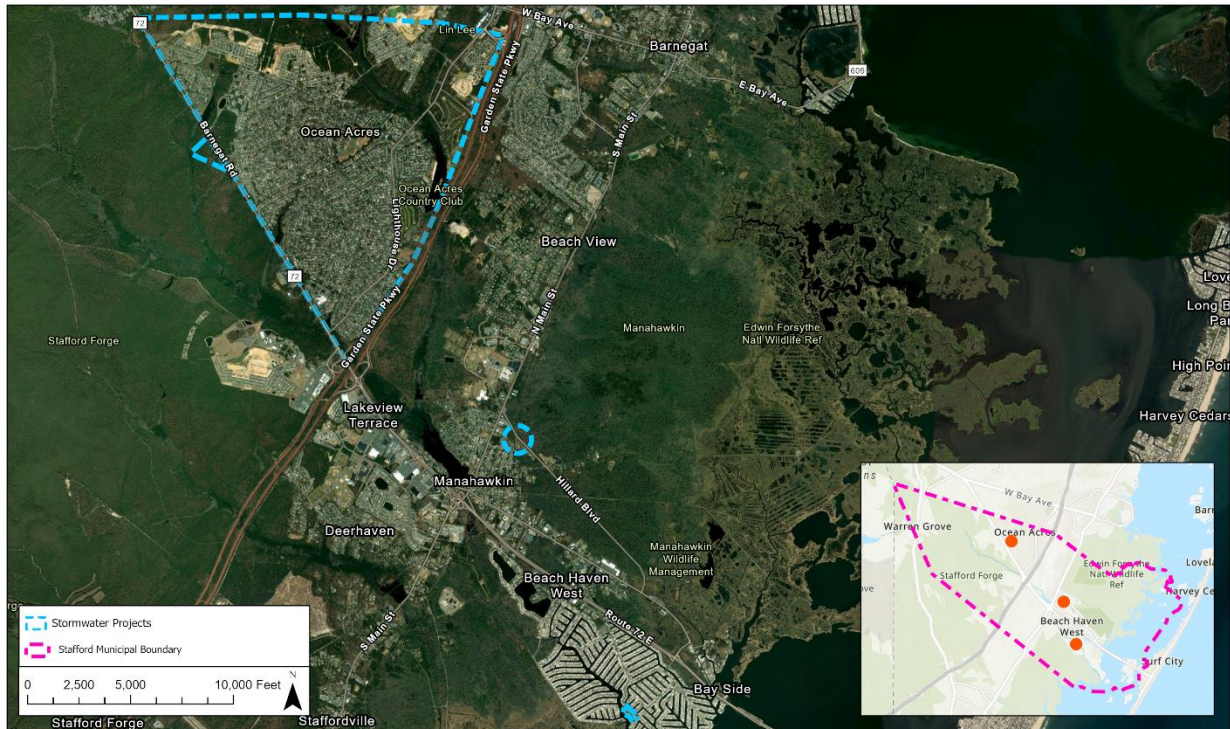
## Watershed-scale Stormwater Projects

### *Project description*

This project would build upon Stafford Township’s Neptune Basin Expansion project, which involves the construction of an additional 7.2 acres stormwater drainage runoff area parallel to the existing one on Neptune Drive. The Township plans to construct a pipe under Route 72 to convey water to the additional basin to mitigate flooding. A \$3.3 million dollar grant from FEMA’s Hazard Mitigation Unit has been obtained for the project to be implemented.

In addition, stormwater projects have been planned with Rutgers University and NJIT for implementation of bioswales at Hilliard Boulevard and Parker Streets, Pine Street Recreation Building, and Mill Creek Park.

### *Location*



### *Resilience Benefits and Co-Benefits*

- Stormwater flooding mitigation
- Water quality improvements
- Enhanced biodiversity (e.g. native & adaptive vegetation, pollinator rain gardens)

### *Cost Estimate*

- \$\$\$\$

### *Potential Funding Sources*

- FEMA Hazard Mitigation Unit
- State of New Jersey

### *Project Owner/Sponsor*

- Stafford Township

### *Project Partners*

- Barnegat Township
- Public

Resilient Stafford Action Plan

## **Section 6: Resilience and Adaptation Actions**

- NJDOT

*Timeframe for Implementation*

- Short-term

*Regulatory Requirements*

- Pinelands Comprehensive Management Plan
- DEP Division of Land Resource Protection [General Permit 11](#)

*Background Information*

- [Consulting & Municipal Engineers Ocean Acres Stormwater Management Investigation Project](#)
- [Neptune Drainage Basin Background Information](#)

**6.4 Goal 3: Civic Empowerment and Preparedness**

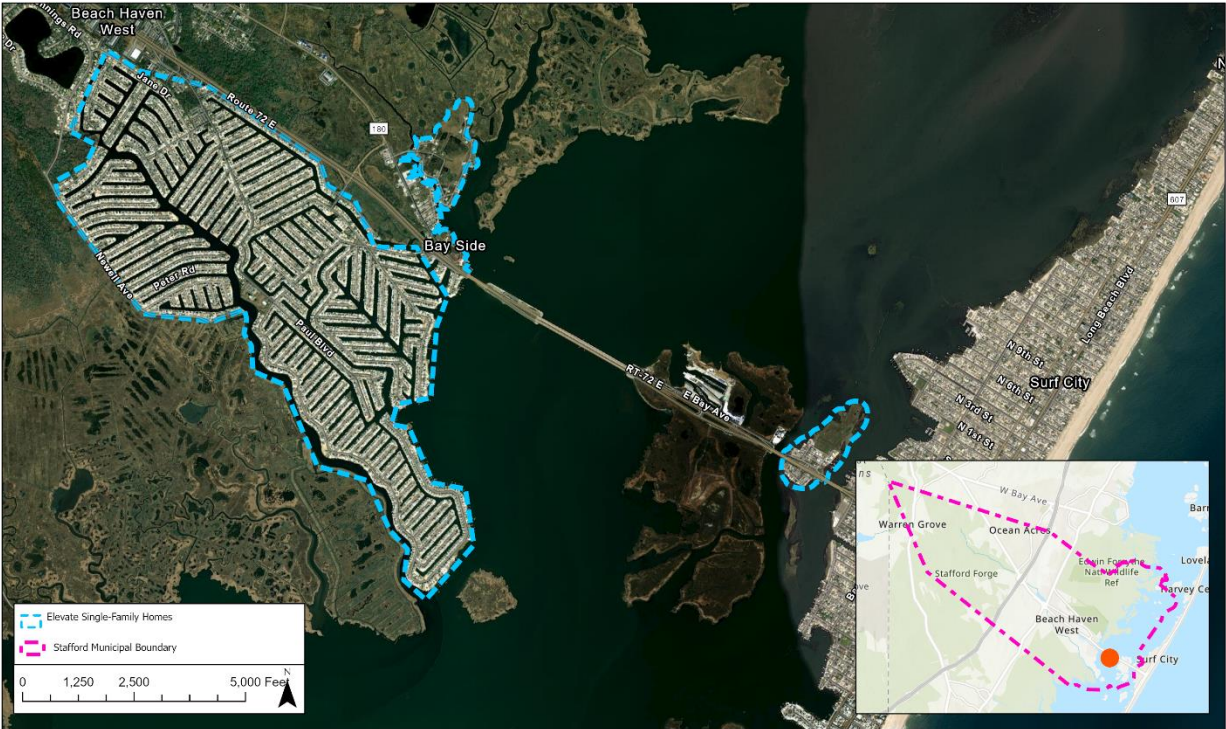
Empower community members to provide input on Township projects and make informed decisions for their own properties. Ensure resilience strategies are equitable for all communities to minimize vulnerability and avoid displacement.

Elevate Single-Family Homes

*Project Description*

The proposed project would allow for the continuation of elevating homes in substantially damaged, repetitive loss and severe repetitive loss areas in Stafford Township, especially those within the SFHA. Beach Haven West has been identified as the neighborhood with the highest concentration of residential properties at risk and therefore is a primary focus for home elevation projects. Stafford Township has prioritized this form of flood risk reduction, and has already successfully elevated 500 homes, with 850 more identified as candidates to be elevated. In 2022, Stafford Township applied for a FEMA FMA grant to elevate 10 homes, all in the FEMA 1 percent annual chance flood zone, in the SFHA. This project reduces flood risk for individual property owners and will allow first responders to focus efforts on critical infrastructure during a major flooding related event. The focus of the proposed project should remain on prioritizing substantially damaged, repetitive loss and severe repetitive loss properties in the SFHA.

*Location*



*Resilience Benefits & Co-Benefits*

- Flood Risk Reduction
- Property loss avoidance

*Cost Estimate*

- \$\$\$\$\$

*Potential Funding Sources*

- FEMAGO – FMA 2022 was submitted in late 2022, to be determined in 2023
- FEMA Pre-Disaster Mitigation (PDM) grant



*Project Owner/Sponsor*

- Stafford Township
- Private property owners

*Timeframe for Implementation*

- Mid-term: This project is ongoing but will take years to complete

*Regulatory Requirements*

- Zoning Permit Application (Township Zoning Department)
- Construction Permit

*Background Information*

- NJIT Repetitive Loss Study

## Continue Activities of the Program for Public Information (PPI)

### *Project Description*

The proposed project will be a continuation of the work completed this year by the Stafford PPI Committee. In early 2022, Stafford Township created the PPI advisory committee in order to specifically address flooding related needs for Stafford residents. Improving awareness of flood risk and risk reduction opportunities is vital, as roughly 4,000 acres, or 11%, of Stafford Township lies within the SFHA. In their first year, the PPI committee set objectives to improve the Township's FEMA CRS score and set the target audience for flood awareness and mitigation related outreach. The committee's objectives include:

- Inventory the Township's and region's flood hazard and flood response efforts
- Determine flood insurance coverage within the Township
- Examine gaps and opportunities in community awareness about flood hazard
- Develop outreach activities about flooding for members of the community
- Maintain flood protection outreach efforts in perpetuity and update these efforts as issues arise
- Maximize participation in the National Flood Insurance Program (NFIP) and the CRS program to provide flood insurance premium discounts to policyholders within the Township, and
- Publicize the Township's services about flooding

The resulting recommendations pertaining to public outreach are as follows:

- Focus outreach efforts on uninsured residents in substantially damaged, repetitive loss and severe repetitive loss areas
- More aggressively market flood insurance to those in areas of moderate flood risk
- Publicize building elevation and floodproofing grants and programs to minimize loss
- Promote flood insurance for renters
- Make seasonal residents better aware of flood insurance benefits
- Continue to host flood mitigation workshops annually and invite local insurance agents and lenders to attend
- Distribute flood preparedness information with municipal tax bills on an annual basis

Continuing this work by expanding flood insurance availability and home elevation outreach to residents in flood prone will aid in reducing flood risk and improve overall preparedness for flood related disasters.

### *Location*

- Townwide

### *Resilience Benefits & Co-Benefits*

- Flood Risk Reduction
- Increasing community awareness/engagement

### *Cost Estimate*

- \$

### *Potential Funding Sources*

- Sustainable Jersey Grant Program

### *Project Owner/Sponsor*

- Stafford Township PPI Committee

### *Timeframe for Implementation*

- Ongoing



## Educational Program to Mitigate Erosion Caused by Boat Wakes

### *Project Description*

Wave action caused by recreational, high-speed boats' wake contributes to accelerating erosion within Stafford's shoreline. Easily affected landforms that are vulnerable to boat wake erosion include areas where natural wave energy tends to be low, such as estuaries, inlets, and lagoons. The Township of Stafford should create a program of educational outreach to homeowners, tourists, and recreational boaters within Stafford to enforce maritime speed limits, educate the public on the erosion potential of boat wakes, and reinforce boating safety in general. This program could include three components:

- Educational outreach, such as informative pamphlets, to homeowners, vacation rental property owners, and boating rental companies to promote recreational boater education
- Seek grant funding for a marine police unit to enforce maritime speed limits
- Signage program on Township property

### *Location*

- Townwide

### *Resilience Benefits & Co-Benefits*

- Flood Risk Reduction
- Increasing community awareness/engagement
- Improve safety

### *Cost Estimate*

- \$

### *Potential Funding Sources*

- Stafford Township

### *Project Owner/Sponsor*

- Stafford Township

### *Project Partners*

- Stafford Police Department
- Residential homeowners

### *Timeframe for Implementation*

- Near-term

Implement the U.S. Army Corps of Engineers New Jersey Back Bays Study

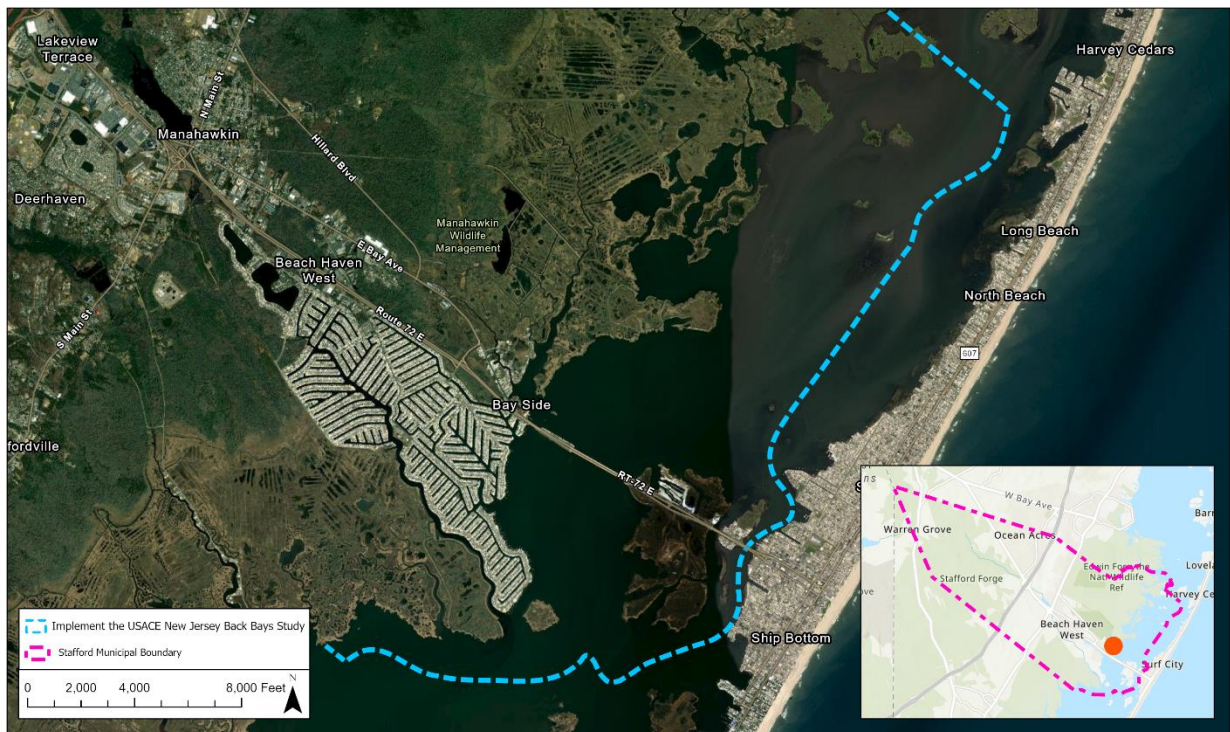
*Project Description*

Stafford Township is open to relevant recommendations within the USACE Back Bays Study, as it pertains to flood prone structures. The tentatively selected plan from the Back Bay Study includes a recommendation to focus on elevating and floodproofing structures that would not see reduced flood elevations from other recommendations within the plan and that lie within the 5% annual exceedance probability (AEP) floodplain. One of the neighborhoods highlighted is Beach Haven West in Stafford Township. Stafford has already initiated the elevation of properties in areas of high flood risk and has successfully elevated 500 flood prone properties. This work is ongoing, with the Beach Haven West neighborhood as the primary focus, among others.

The Tentatively Selected Plan from the 2021 Back Bay Study includes (USACE, 2021):

- Storm surge barriers at Manasquan Inlet, Barnegat Inlet, and Great Egg Harbor Inlet
- Cross-bay barriers or interior bay closures at Absecon Boulevard, and Southern Ocean City
- Elevation and floodproofing of 18,800 structures. These solutions are considered for 11 percent of the study area and are concentrated in the vicinity of the Shark River Inlet, and in Southern Ocean County specifically along the mainland shoreline south of Beach Haven West and on Long Beach Island. These solutions are also concentrated in northern Atlantic County on the mainland shoreline and on Brigantine, and in large portions of Cape May County
- Perimeter measures such as floodwalls, levees and seawalls which tie storm surge barriers and cross bay barriers into adjacent higher ground

*Location*



*Resilience Benefits & Co-Benefits*

- Flood Risk Reduction

*Cost Estimate*

- \$\$\$\$\$

Resilient Stafford Action Plan

**Section 6: Resilience and Adaptation Actions**

*Potential Funding Sources*

- Disaster Relief Appropriations (P.L. 113-2)

*Project Owner/Sponsor*

- USACE

*Regional Connections*

- North Atlantic Coast Comprehensive Study (NACCS)

*Timeline for Implementation*

- Ongoing/Long-term
- Elevating structures is already underway and the other measures included in the plan, such as floodwalls, levees, seawalls, cross-bay barriers, and storm surge barriers, will take between 10 – 20 years to implement

*Background Information*

- USACE Back Bays Study
- Water Resources Development Act (WRDA)

**6.5 Goal 4: Economic Development Initiatives**

Create a sustainable local economy with emphasis on workforce development opportunities, new revenue/funding streams, and mitigation of property value loss.

Resilience and Redevelopment Study for Cedar Bonnet Island

*Project Description*

Cedar Bonnet Island is a collection of islands and wetlands along the Causeway between Long Beach Island and mainland Township of Stafford. The majority of the land area of these islands is made up of wetlands, which should remain unchanged. The remaining land uses include a mix of water-dependent uses (e.g., Causeway Marina), commercial businesses (e.g., a restaurant and wedding venue), and single-family homes. Due to the low-lying elevations on Bonnet Island, these single-family homes are at high risk for future flooding and repetitive damages. Some of these homes have been elevated, but many have not.

A redevelopment study for the Cedar Bonnet Islands is necessary in order to determine the potential for future land use changes on the islands to ensure the safety of residents and businesses, while also maintaining the Township’s tax base and preserving natural resources and wetland habitat. The Township has submitted a planning application to the New Jersey Department of Community Affairs (DCA) for this redevelopment study, which has been approved. The study will focus on the north end of Cedar Bonnet Island, which is a SFHA that contains multiple substantially damaged properties. The redevelopment study would examine the feasibility and impact of rezoning the north end of Cedar Bonnet Island, allowing for pre-existing non-conformities, with the potential of transforming the area into a commercial corridor with elevated properties. This study should be led by the Township and the DCA and should include substantial outreach and engagement of property owners, residents, business owners, and workers on the island, should a redevelopment move forward.

The objective of this study is to identify potential land use and development changes on Cedar Bonnet Island, in recognition of the high level of flood risk facing residential properties on the island. The study would consider appropriate future land uses that balance both future flood risk, as well as economic development opportunities.

*Location*





*Resilience Benefits and Co-Benefits*

- Flood risk reduction
- Economic development

*Cost Estimate*

- Planning Study: \$\$

*Potential Funding Sources*

- New Jersey Department of Community Affairs (DCA) Post Sandy Planning Assistance Grant

*Project Owner/Sponsor*

- Stafford Township

*Timeframe for Implementation*

- Short-term

## Avoid Long-Term Property Value Loss and Community Disinvestment from Repeat Flood Events

### *Project Description*

Stafford has been working for several years with FEMA and local property owners to elevate homes to reduce repetitive loss and maintain property values. This effort is being supported by a study that NJIT is conducting to review detailed building information on Repetitive Loss (RL) and Severe Repetitive Loss (SRL) properties and adjacent properties to determine an exact cause of the repetitive loss. Once complete, a mitigation plan will be prepared for areas that have or are expected to experience repeated losses from flooding. Ultimately, the study aims to understand distributed climate impacts on communities and will be leveraged by the Township to identify at-risk buildings to target for elevation.

In addition, the Township should continue to provide options for RL and SRL property owners and continue coordinating with FEMA to provide assistance through available grants to elevate homes.

### *Location*

- Townwide

### *Resilience Benefits and Co-Benefits*

- Flood risk reduction
- Property damage avoidance
- Community disinvestment avoidance

### *Cost Estimate*

- \$

### *Potential Funding Sources*

- The NJIT study is underway
- The Township may need to fund additional community outreach efforts

### *Project Owner/Sponsor*

- Stafford Township

### *Project Partners*

- FEMA
- NJIT

### *Background Information/Sourcing*

- NJIT Repetitive Loss Study

### *Timeframe for Implementation*

- Ongoing/mid-term
- The NJIT Repetitive Loss Study is underway and should be completed by Fall 2023. Once complete, the Township should begin work on the mitigation plan and should continue conducting outreach to inform homeowners of financial assistance options. The task of elevating at-risk homes is already underway and will take another 5 – 10 years to complete

## **7. Mud City Ecological Restoration and Resiliency Conceptual Plan**

## 8. Next Steps

Costs associated with implementing long-term engineering and infrastructure resiliency projects can be significant, particularly when the projects are designed to prepare a municipality or region for future climate conditions, which take years and, in some cases, decades to complete. Up to this point, Stafford has been successful in seeking funding from FEMA and DEP to conduct resiliency projects, including assisting homeowners in securing funding for home elevations. Going forward, the Township should continue to leverage federal funding sources, while also seeking out additional grant funds to support resiliency work.

Over the last decade or so, as the frequency and intensity of extreme weather events and coastal storm impacts have increased, climate resilience has garnered attention on both the state and federal level as a topic of interest. Most recently, this increased interest is demonstrated through the signing of the Inflation Reduction Act (IRA) in August of 2022, which includes approximately \$400 billion in funding for climate programs nationwide. There are numerous other climate resilience-related funding opportunities that are available to Stafford to fund this work that the Township should explore further as it seeks to implement the mitigation measures provided in this Resilience Action Plan. Below is a non-exhaustive list of State and Federal resilience-related grant programs and funding opportunities:

### Federal

- FEMA’s Hazard Mitigation Assistance Program
  - BRIC Grant
  - FMA Grant
  - PDM Grant
- NFWF
  - National Coastal Resilience Fund
- EPA
  - State Revolving Fund
- NOAA
  - Transformational Habitat Restoration and Coastal Resilience Program
- Infrastructure Investment and Jobs Act

### State

- Sustainable Jersey
- DEP
  - Resilient NJ Program
  - NCS Grant

### County

- Ocean County’s Natural Lands Trust Program

In addition to these grant programs, Stafford should continue to seek out partnerships in collaboration with local and state universities, such as Rutgers University and NJIT, to conduct studies and analyses in an academic setting. These unique partnerships provide master and doctorate students with the opportunity to conduct studies that have real-world impacts, while providing the Township with valuable research to better inform the mitigation actions.

Finally, and critically, as Stafford works to select and implement resilience projects in preparation for both present-day and future flood risks, the Township should continue to engage with the community. Many of the projects discussed in this Action Plan address current flooding issues and should be implemented in the next several years to prepare for the next large storm event. Several other projects, however, are proposed with an eye on the future. These mid- to long-term projects are significant in both scope and scale, taking more of a community-level approach to resilience with the intent of helping the Township and the region adapt to future climate conditions. Working together, the Township, its residents, and neighboring municipalities should continue to strengthen their existing partnerships to work hand-in-hand towards a more resilient future.



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