TOWN OF DUCK, NORTH CAROLINA
RCCP – RESILIENCE STRATEGY
ADDENDUM A – PHASE 2 UPDATE
May 24, 2023

This document is an addendum to the Town of Duck's Resilience Strategy prepared by VHB in June 2022. The original resilience strategy was developed as part of the N.C. Division of Coastal Management's (DCM) Resilient Coastal Communities Program (RCCP). This program is assisting communities with technical and financial assistance to advance coastal resilience efforts.

Following the completion of the initial phases (Phases 1 and 2) for the Town of Duck's Resilience Strategy, the Town and the DCM expressed concerns that the portfolio of projects was not comprehensive with regards to the original intent of the RCCP. The Town hired Coastal Protection Engineering of North Carolina, Inc. (CPE) to update the Phase 2 portion of the Resilience Strategy which deals with planning, project identification, and prioritization. This Addendum is intended to replace the entirety of Section 3 of the Phase 1 & 2 Resilience Strategy previously completed in June 2022.

As stated in the June 2022 Resilience Strategy, the Town has a history of strong community engagement through previous planning endeavors. To ensure that the RCCP captured previous planning efforts and to prevent engagement fatigue, the Town's staff served as the Community Action Team (CAT). The staff for the Town of Duck are multidisciplinary with a wide range of expertise and longstanding knowledge of Town efforts. This Addendum was developed through the engagement with the same Town staff that served on the CAT for the initial efforts in developing the Resilience Strategy.

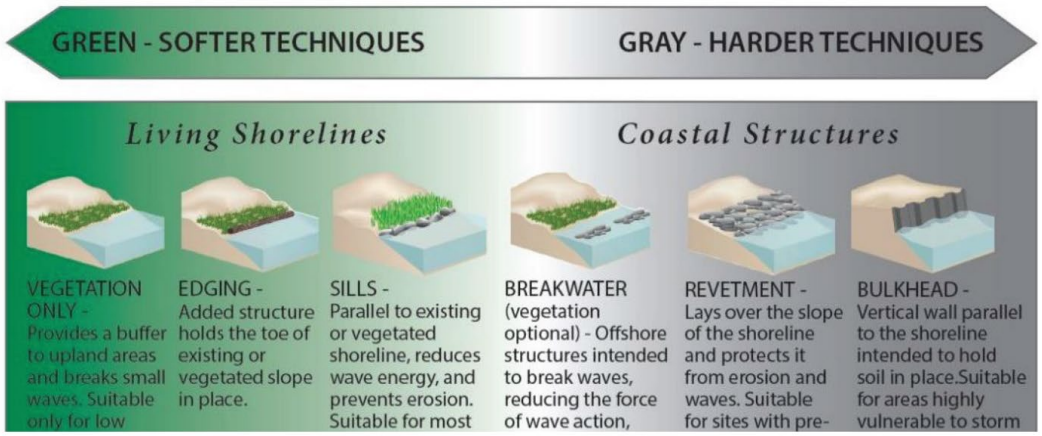
After reviewing the original Resilience Strategy submitted June 2022, a meeting was held on November 11, 2022 between CPE staff and the CAT to ensure scope alignment with the Town's and the RCCP's goals. During the meeting, CPE and the CAT identified several additional concepts to consider as well as additional sources and points of contact with other entities who may be evaluating regional resilience strategies that could complement the Town's goals. A follow up meeting between CPE staff and the CAT convened on December 21, 2022 to review draft concepts anticipated to be included in the list of projects and initiatives to be vetted through public engagement.

Project Criteria

Based on the information provided in the initial Resilience Strategy along with other available information from previous planning efforts and coordination with the CAT, a set of projects was compiled that focus on achieving the vision and goals established in Phase 1. The projects include non-structural and structural techniques that address hazard mitigation and have co-benefits that extend beyond resiliency. The potential projects listed herein are organized under the general categories of "Non-Structural" and "Structural". Each project includes a project description, the hazards addressed, estimate of cost and timeline to complete, and potential funding sources where

applicable. Furthermore, where applicable, each project description includes a location map illustrating the project area.

The structural projects also include information on where each project falls on the spectrum of Natural "Green", Hybrid, and Gray Infrastructure Solutions to Coastal Hazard Protection as adopted by the National Oceanographic and Atmospheric Administration (NOAA). The RCCP program and various state and federal grant programs encourage communities and grant applicants to focus on projects on the "green" side of the spectrum where practicable as they develop resilience strategies.



Once an initial list of projects was compiled, the CAT developed measures to prioritize the projects. These "Prioritization Measures" included cost-benefits, social equity, internal capacity, and co-benefits. The table below shows the various prioritization measures and the relative criteria developed for each. Each project was evaluated by the CAT and values/information were provided for that project.

Prioritization Measures	
Cost-Benefit	**Low** – Benefits exceed cost in the short term (1 to 5 years); however, future sea level rise over the 30-year planning horizon may significantly decrease the project benefits **Medium** – Benefits entirety of the Town **High** – Benefits exceed cost in the short term (1 to 5 years) and continue to provide additional benefits over the 30-year planning horizon.
Social Equity	**Low** – Benefits are limited to location of project **Medium** – Benefits entirety of the Town **High** – Directly benefits vulnerable populations
Internal Capacity	**Low** – Significant outside expertise needed, and current Town staff may not be able to support the effort **Medium** – Considerable outside expertise needed, and existing Town staff are able to support the effort and perform some tasks **High** – Minimal outside expertise needed, and Town staff can support the effort and perform most tasks

Co-Benefits	Other benefits the project may bring that are not directly related to resiliency.

Project Prioritization:

Phase 1 of the Resilience Strategy completed in June 2022, assessed risks and vulnerabilities throughout the Town. Phase 2 of the Resilience Strategy involved planning, identifying basic project concepts, and attempting to prioritize the conceptual projects. This process and the initial prioritized lists of conceptual projects are included in Sections 3.1 and 3.2 of the Resilience Strategy. Public online and in-person surveys were conducted to gauge the public's opinion on the identified hazards and proposed projects.

During the development of the Resilience Strategy, the Town engaged the public via an online survey and in-person engagements to evaluate the types of hazards that concerned people the most, how people would rank various community assets from most important to least, and how they would rank the initial list of conceptual projects. The results of the surveys regarding hazards of concern and importance of community assets are shown in the tables below.

Type of Hazard That Concern You the Most	# of Respondents Concerned	% of Respondents Concerned
Beach or Soundside Erosion	36	85.7%
Sea Level Rise	27	64.3%
Hurricanes and Tropical Storms	25	59.5%
Ocean or Soundside Flooding	23	54.8%
"Rainy Day" Flooding (freshwater/rainwater/stormwater flooding)	18	42.9%
Rising Groundwater Table	8	19.0%
Extreme Heat	4	9.5%
Severe Weather (thunderstorms, lightning, tornadoes)	2	4.8%
Other Hazards (specified by the individual surveyed)	1	2.4%
Wildfires	1	2.4%

Total of 42 Respondents

Rank the following community assets in Duck from MOST IMPORTANT to LEAST IMPORTANT	Ranking
Fire Station/Police Stations/Emergency Medical Services	1
Infrastructure (roads, bridges, stormwater conveyance [ditches])	2
Small Businesses	3
Parks & Town Recreation Sites/Facilities	4
Town Municipal Facilities	5
Food Markets	6
Gas Stations	7
Cultural Landmarks	8 - Tied
Pharmacy	8 - Tied

Total of 41 Respondents

As the Town proceeded with its proactive approach to resilience planning, a significant amount of additional information was compiled and developed, which allowed for the updating and refining of the list of resilience initiatives under consideration. The CAT worked with the Town's consultant, CPE, to update and refine the list and to assign prioritization measures for each of the various initiatives. As mentioned above, these initiatives have been divided into "Non-Structural" and "Structural" projects. Non-Structural projects are planning, educational, and policy initiatives aimed at bolstering coastal resilience. Structural projects are those that entail implementing specific physical improvements such as flood protection, erosion mitigation, and water quality improvement projects designed to enhance coastal resilience.

In order to prioritize the refined list of resilience initiatives, a Resilience Open House was held in Duck on April 12, 2023 to present the updated projects and facilitate the opportunity for engagement between the public, the CAT, and CPE. In an attempt to maximize participation, the Town actively used social media, websites, and web-meetings to promote the Resilience Open House and subsequently shared the information and video recording of the event with the public. An online survey was provided to the public on April 12, 2023 immediately following the Resilience Open House.

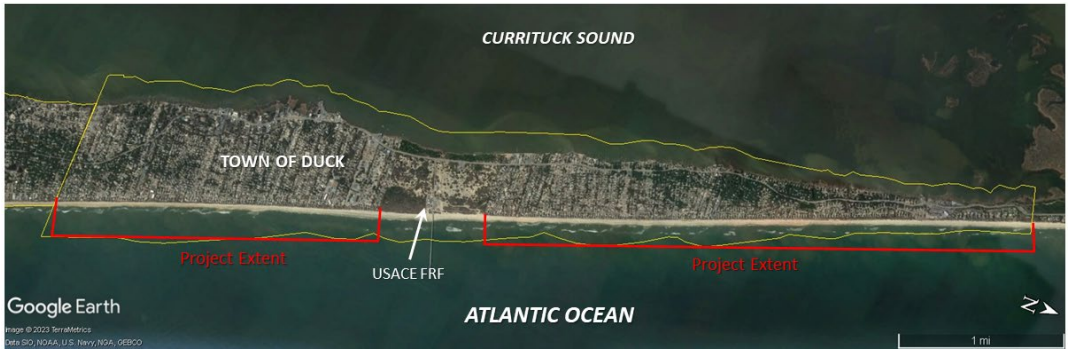
Thirty-three (33) responses were received through the online survey between April 12 and May 21, 2023. The results of the online survey are provided in Appendix A1. These results were used by the CAT, along with the prioritization measures previously described, to rank the various resilience initiatives in terms of Non-Structural and Structural Projects. The following sections list each of the Non-Structural and Structural projects in order of their ranking of priority.

Non-Structural Projects:

The following non-structural projects were assembled to identify and reduce hazards in the Town of Duck. These non-structural projects include studies, programs, planning efforts, and other interventions that do not involve physical construction, although they may lead to future construction or other structural interventions. Each project includes a detailed project description, a list of hazards addressed, the type of solution the project represents, an estimated cost, an estimated timeline, potential funding sources, and a map or basic description of the project area. Prioritization measures and final ranking are also provided for each project.

Ranking	Non-Structural Project Description
1	Townwide Beach Management Program
2	Townwide Stormwater Management Study
3	Soundside Shoreline Management Study
4	Sea Level Rise Analysis and Climate Adaptation Plan
5	Septic System and Drain Field Planning
6	Dune Maintenance Education Program
7	Post-Hazard Event Assessment
8	Establishment of Resilience Review Team

Townwide Beach Management Program

Project Description	In 2013, the Town completed an Erosion and Shoreline Management Feasibility Study. The Study led the town to initiate a Beach Management Program aimed at maintaining its oceanfront beach and dune to a configuration that 1) provides a reasonable level of storm damage reduction to public and private development; 2) mitigates long-term erosion that could threaten public and private development, recreational opportunities, and biological resources, and 3) maintains a healthy beach that supports valuable shorebirds and sea turtle nesting habitat. Design parameters have been established to maintain the Town's oceanfront beach and dune to a configuration that achieves these stated goals. The Townwide Beach Management Program requires continued monitoring and evaluation of volumetric changes and storm vulnerability to determine where beach nourishment or other shoreline management strategies are warranted. The continued monitoring and evaluations will also include evaluation of sea level rise and sand resources on the long-term sustainability of the project. This directly aligns with the Town's stated policy and implementation tool (Comprehensive and CAMA Land Use Plan) to "Evaluate the impacts of sea level rise and shoreline erosion on the oceanfront… to improve the long-term resiliency of the community" (7.7). 
Hazard(s) Addressed	Oceanfront erosion, Storm surge flooding, and Sea level rise flooding
Type of Solution	Planning Document
Estimated Cost	<$100,000
Estimated Timeline	Ongoing
Potential Funding Sources	Town, County, and NC Division of Water Resources
Map/Location	Townwide

Prioritization Measures

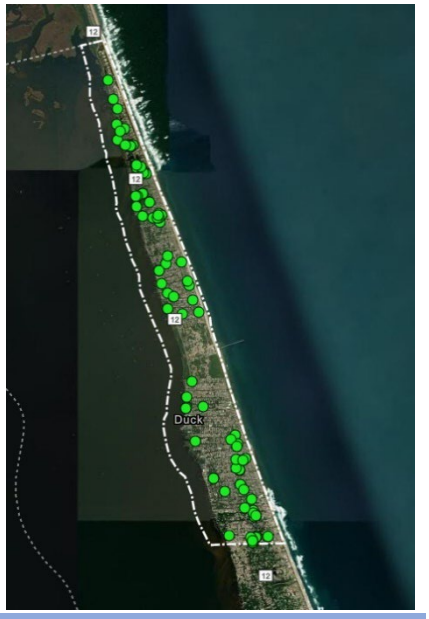
Cost-Benefit	Medium
Social Equity	Medium
Internal Capacity	Medium
Co-Benefits	Provides extensive recreational opportunities, provides shorebird and nesting sea turtle habitat
Prioritization Ranking	1

Townwide Stormwater Management Study

Project Description

The Town of Duck has been working on a Neighborhood Stormwater Management Study to investigate the causes of flooding and to evaluate potential solutions within five (5) specific neighborhoods. These areas were identified by Staff based on repetitive losses and stormwater discharge actions taken in the past. As part of Phase III of the RCCP, the Town received funding to investigate causes of flooding in these areas. These actions included geotechnical analysis, a GIS drainage shed analysis, public engagement, and the development of a menu of solutions including cost estimates for each. This study directly aligned with the Town's stated policy and implementation tool established in the Town of Duck Comprehensive and CAMA Land Use Plan which aims to "Study areas of habitual flooding in neighborhoods and roadways to identify solutions to flooding issues" by the year 2025 (7.6).

Through public engagement efforts associated with the Neighborhood Project, the Town received feedback from property owners and residents throughout the Town regarding other stormwater areas of concern which are depicted in the included map. To comprehensively address stormwater issues throughout the Town, the Town will expand the initial Neighborhood study to evaluate causes of flooding and develop an expanded menu of solutions and estimated costs for the areas beyond the original Neighborhood study area.



Hazard(s) Addressed	Rainfall flooding, sea level rise flooding, contaminated surface waters
Type of Solution	Planning Document
Estimated Cost	<$100,000
Estimated Timeline	1 Year
Potential Funding Sources	Town and NC Department of Environmental Quality
Map/Location	Townwide

Prioritization Measures

Cost-Benefit	High
Social Equity	Medium
Internal Capacity	Medium
Co-Benefits	Public education, and improved water quality
Prioritization Ranking	2

Soundside Shoreline Management Study

Project Description	This planning study will focus on developing a comprehensive strategy to reduce soundside erosion and flooding along the Town's soundside shoreline especially in areas where critical assets are present. The study will evaluate and provide information regarding risks to the soundside shoreline from sea level rise and storm events, which directly aligns with the Town's stated policy and implementation tool established in the Town of Duck Comprehensive and CAMA Land Use Plan. The Land Use Plan specifically aims to "Evaluate the impacts of sea level rise and shoreline erosion on the soundfront… to improve the long-term resiliency of the community" (7.7). The study will also focus on aligning strategies with the Town's goal of prioritization of living and nature-based shoreline management projects where appropriate. The study's goals will also directly align with the Vision and Goals established in Section 2.2 of the Town's Resilience Strategy specifically to protect critical natural resources and coastal ecosystems and to plan for orderly and sustainable growth and redevelopment. The study will result in a number of tangible strategies to manage the soundside shoreline in accordance with established soundside management goals.

Hazard(s) Addressed	Soundside Erosion and Flooding
Type of Solution	Planning Document
Estimated Cost	$100,000 - $500,000
Estimated Timeline	1 year
Potential Funding Sources	Town, National Fish & Wildlife Foundation, National Coastal Resilience Fund, and NC Department of Environmental Quality
Map/Location	Town-wide along the sound

Prioritization Measures

Cost-Benefit	High
Social Equity	Medium
Internal Capacity	Medium
Co-Benefits	Educated/informed public and staff, and will serve as a resource for the Currituck Sound Coalition
Prioritization Ranking	3

Sea Level Rise Analysis and Climate Adaptation Plan	
Project Description	The Town's Comprehensive and CAMA Land Use Plan established the goal of "Improving the community's resiliency to rising seas and changing climates". Under this goal, which is listed as Item 7 in Chapter 2: Tools for Management Development, several policies and steps required for implementation were established to specifically deal with sea level rise (See Items 7.3, 7.4, 7.5.1 through 7.5.3, and 7.7). The Sea Level Rise Analysis and Adaptation Plan will aim to 1) Research and adopt anticipated water levels based on the anticipated rates of sea level rise and how it may impact projects of various time horizons; 2) implement higher standards and work with local utilities to improve the resilience of public infrastructure; and 3) provide guidance and recommendations on policies, plans, and ordinances that should be updated or developed to address anticipated sea level rise over various temporal horizons. The sea level rise analysis portion of the work will engage various federal (US Army Corps of Engineers and NOAA) and State (Division of Coastal Management) agencies as well as stakeholder groups (Currituck Sound Coalition, Audubon Society, the Nature Conservancy, etc.) to pool data and studies previously conducted on sea level rise. The analysis will also establish regular intervals for updating the assessment as new data becomes available and technologies for predicting sea level rise improve.
Hazard(s) Addressed	Oceanfront and storm surge flooding and sea level rise flooding
Type of Solution	Planning Document
Estimated Cost	<$100,000
Estimated Timeline	1 year
Potential Funding Sources	Town, NOAA Resilience Grants, FEMA, NC Department of Environmental Quality, USACE, and NGOs
Map/Location	Townwide
Prioritization Measures	
Cost-Benefit	High
Social Equity	Medium
Internal Capacity	Low
Co-Benefits	Public health and safety, will serve as a resource for the Currituck Sound Coalition and scientific community, Climate Adaptation Plan will serve as a model for other coastal communities in the State
Prioritization Ranking	4

Septic System and Drain Field Planning

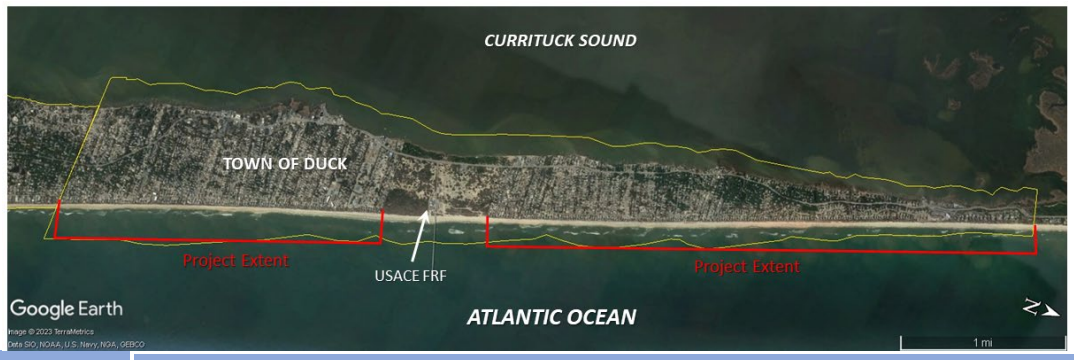
Project Description	This planning effort will include coordination with Dare County to explore the implementation of community-wide septic system and drain field monitoring, remediation, and continuity of operations planning. This directly aligns with Item 7.4 in Chapter 2: Tools for Management Development in the Town's Comprehensive and CAMA Land Use Plan. This effort will focus on establishing an inter-governmental team representing the County and various municipalities within the region to conduct groundwater sampling, map groundwater deposits, evaluate and develop continuity of operations planning procedures, and evaluate opportunities to assist private owners with maintaining their systems. This may include the evaluation of ways to provide government assistance for septic retrofits, inspecting current septic systems, and assisting homeowners in maintaining their septic systems. The team will also evaluate the feasibility of transitioning to an incentivized mandatory septic inspection program, routine ground water and drain field monitoring, and remediation.
Hazard(s) Addressed	Septic System and Drain Field Hazards
Type of Solution	Planning Document
Estimated Cost	<$100,000
Estimated Timeline	1 year
Potential Funding Sources	Town, Division of Water Resources, NC Department of Environmental Quality, and Coastal Studies Institute
Map/Location	Townwide

Prioritization Measures

Cost-Benefit	Medium
Social Equity	Medium
Internal Capacity	Medium
Co-Benefits	Homeowner education, health, water quality
Prioritization Ranking	5

Dune Maintenance Education Program

Project Description	Dunes play a major part in reducing damage and flooding along the oceanfront that can occur during storms. The Town of Duck has taken extraordinary measures to construct (through beach nourishment), vegetate (through dune planting), and grow (through sand fence installation) the protective dunes along its oceanfront. In order to preserve, protect, and enhance these valuable features, a Dune Maintenance Education Program will be developed. The Program will focus on educating the public on dune maintenance and provide guidance for maintaining dunes within the Town to align with the Town's overall Beach Management Program. Having the public adopt dune maintenance practices and strategies will help the Town continue and improve their efforts designed to protect the dune and the beach ecosystem.



Hazard(s) Addressed	Oceanfront Storm Surge Flooding / Sea Level Rise Flooding / Oceanfront Erosion
Type of Solution	Education Program
Estimated Cost	<$10,000
Estimated Timeline	Ongoing
Potential Funding Sources	Town and Dare County
Map/Location	Townwide along the oceanfront

Prioritization Measures

Cost-Benefit	High
Social Equity	Medium
Internal Capacity	High
Co-Benefits	Educated/informed public
Prioritization Ranking	6

Post-Hazard Event Assessments	
Project Description	Planning and preparing is a vital part of enhancing coastal resilience. However, natural hazard events such as tropical storms, nor'easters, torrential rain showers, and even king tides test a community's planning and preparedness. These events offer an opportunity to learn and adapt. A standardized protocol for conducting Post-Hazard Event Assessments will be established and implemented to collect standardized information. The protocol will focus on collecting or obtaining data that helps determine what worked well and did not work well and to help determine what sorts of vulnerabilities were exposed. The development of the protocol will include drafting an assessment template to be completed after each hazard event. The protocol will identify specific data to obtain such as rainfall, water levels/tides, wind records, wave heights, etc. The protocol will also establish information to be obtained at site specific locations such as ground shots, drone shots, flood level markings, scarping, etc. The protocol may also include a list of interviews to conduct following each event which are designed to obtain additional information by those most affected.
Hazard(s) Addressed	ALL
Type of Solution	Planning Document
Estimated Cost	<$10,000
Estimated Timeline	Continuous in response to natural hazard events
Potential Funding Sources	Town and FEMA
Map/Location	Townwide
Prioritization Measures	
Cost-Benefit	High
Social Equity	Medium
Internal Capacity	High
Co-Benefits	Provides internal accountability
Prioritization Ranking	7

Establishment of Resilience Review Team	
Project Description	This effort will focus on establishing a Resilience Review team to conduct periodic and systematic reviews of various plans such as the Hazard Mitigation Plan, the Comprehensive and CAMA Land Use Plan, the Resilience Strategy, and others. This periodic and systematic review will evaluate accomplishments, re-establish milestones, and re-prioritize the various initiatives. This periodic systematic review will seek to identify efficiencies to reduce duplication and streamline resilience planning. The review team will also incorporate ongoing and future plans as they are completed such as the Soundside Shoreline Management Study, the Neighborhood Stormwater Management Study, and the Sea Level Rise Analysis and Climate Adaptation Plan.
Hazard(s) Addressed	ALL
Type of Solution	Planning
Estimated Cost	<$10,000
Estimated Timeline	Continuous
Potential Funding Sources	Town
Map/Location	Townwide
Prioritization Measures	
Cost-Benefit	Medium
Social Equity	Medium
Internal Capacity	High
Co-Benefits	Provides internal accountability
Prioritization Ranking	8

Structural Projects:

The following structural projects were assembled to identify and reduce hazards in the Town of Duck. These structural projects include physical construction projects and retrofitting. These projects may require additional planning, design, and cost estimation prior to construction. Each project includes a detailed project description, a list of hazards addressed, the type of solution the project represents, an estimated cost, an estimated timeline, potential funding sources, and a map or basic description of the project area. Prioritization measures and final ranking are also provided for each project.

Ranking	Structural Project Description
1	Flooding and Stormwater Management Along Duck Road
2	Central Reach Beach Nourishment Program
3	NC-12 Coastal Resiliency Project
4	Soundside Erosion Mitigation and Storm Damage Reduction Projects
5	Town Park Shoreline Protection Project
6	Stormwater Outfall/Pond Retrofits
7	Acquire Oceanfront Property to Support Future Beach Maintenance

Flooding and Stormwater Management Along Duck Road

Project Description

The risk vulnerability assessment included in the Town's Resilience Strategy found that roads, bridges, and stormwater conveyance (e.g., ditches), had the highest overall vulnerability of the assets assessed. Furthermore, Duck Road (NC 12) is the primary transportation corridor into and out of the Town. The Town will develop solutions to flooding and stormwater management along Duck Road and throughout the town to ensure safe public access as stated in its Comprehensive and CAMA Land Use Plan in Item 6.1 in Chapter 2: Tools for Management Development. In 2020, the Program for the Study of Developed Shorelines at Western Carolina University completed the Duck Infrastructure Vulnerability Assessment. The assessment identified four specific segments of Duck Road as having "High" or "High-Moderate" vulnerability. The Town will focus on these particular areas as priorities. Those specific areas are:

- From the northern Town Boundary to Station Bay Dr.
- From Cook Rd. to Marlin Rd.
- From Marlin Rd. to Schooner Ridge.

Hazard(s) Addressed	
Type of Solution	Grey Infrastructure, Grey Infrastructure Retrofit
Estimated Cost	$100,000 - $500,000
Estimated Timeline	2 - 3 years
Potential Funding Sources	Town, FEMA BRIC, NC DOT, and NC DPS
Map/Location	Site-specific

Prioritization Measures

Cost-Benefit	Low
Social Equity	Medium
Internal Capacity	Low
Co-Benefits	Water quality and traffic continuity
Prioritization Ranking	1

Central Reach Beach Nourishment Program

Project Description	The Town of Duck has taken steps to maintain its oceanfront beach and dune to a configuration that 1) provides a reasonable level of storm damage reduction to public and private development; 2) mitigates long-term erosion that could threaten public and private development, recreational opportunities, and biological resources, and 3) maintains a healthy beach that supports valuable shorebirds and sea turtle nesting habitat. In 2017, the Town of Duck constructed a beach nourishment project along 1.6 miles of the central portion of the Town between the northern boundary of the US Army Corps of Engineers Field Research Facility and 128 Skimmer Way. The Town will continue to monitor and maintain the beach nourishment project along this area (the Central Reach). Monitoring includes annual beach profile surveys used to evaluate the performance of the project and to determine when maintenance is required. Maintenance of the project involves the replacement of advanced fill and any material lost from the design template on an as needed basis.

Hazard(s) Addressed	Oceanfront erosion, Storm surge flooding, and Sea level rise flooding
Type of Solution	Nature-Based/Green Infrastructure
Estimated Cost	>$5 Million
Estimated Timeline	Every 5-7 years
Potential Funding Sources	Town, NC Division of Water Resources, Dare County, and FEMA
Map/Location	Include a Map for this project.

Prioritization Measures

Cost-Benefit	High
Social Equity	Medium
Internal Capacity	High
Co-Benefits	Provides extensive recreational opportunities, provides shorebird and nesting sea turtle habitat
Prioritization Ranking	2

NC-12 Coastal Resiliency Project

Project Description	The Town has begun taking steps to address the most critically vulnerable section of Duck Road between Old Duck Road and Barrier Island Station. A project is scheduled to commence in summer 2023 that includes 1) the construction of a subsurface stormwater chamber system to address inland flooding, 2) elevating North Carolina Highway 12 (NC 12) to address storm surge and flooding, and 3) reestablishing a shoreline embankment and constructing a living shoreline using native vegetation and breakwater sills to minimize affects from storm surge and wave action erosion. The Town should monitor and maintain the project in a way that sustains the protection provided and that gains valuable information to help design and implement future projects aimed at addressing flooding and stormwater management along Duck Road and throughout the Town to ensure safe public access.

Hazard(s) Addressed	Flooding, Storm Surge
Type of Solution	Grey Infrastructure, Nature-Based/Green Infrastructure
Estimated Cost	$1 Million - $5 Million
Estimated Timeline	2 years
Potential Funding Sources	Town, FEMA, NC DPS, NFWF, and CCAP
Map/Location	Barrier Island Station to Dune Road

Prioritization Measures

Cost-Benefit	High
Social Equity	Low
Internal Capacity	Low
Co-Benefits	Habitat restoration, water quality, traffic continuity, serves as model for other coastal communities in the State.
Prioritization Ranking	3

Soundside Erosion Mitigation and Storm Damage Reduction Projects

Project Description	Following the completion of the Soundside Shoreline Management Study recommended under Non-Structural Projects, the Town will pursue recommended efforts to restore eroded portions on the coastline of the Currituck Sound to enhance buffering of storm and wind-driven waves, reduce erosive forces, increase stormwater runoff filtration, improve water quality, and otherwise enhance coastal habitat, which aligns directly with Item 2.1.1 in the Comprehensive and CAMA Land Use Plan (Chapter 2: Tools for Management Development).

Hazard(s) Addressed	Erosion, Storm Surge, Storm Damage
Type of Solution	Grey Infrastructure, Grey Infrastructure Retrofit
Estimated Cost	TBD
Estimated Timeline	5 – 10 years
Potential Funding Sources	Town
Map/Location	Site-specific

Prioritization Measures

Cost-Benefit	Medium
Social Equity	Medium
Internal Capacity	Low
Co-Benefits	Implement goals of the Currituck Sound Coalition
Prioritization Ranking	4

Town Park Shoreline Protection Project

Project Description	The Town Park Shoreline Protection project is intended to enhance the resilience of the Duck Town Park/Town Hall property by protecting a significant stretch of coastal marshlands along Currituck Sound. These marshes serve as a natural buffer to the Town's property by reducing the potential for erosion and storm damage along the shoreline. The proposed sills will reduce wave energy thereby reducing erosion and will allow for the native marsh grasses to reestablish in the protected areas. The project will also serve as an educational tool for property owners and the general public demonstrating nature-based shoreline stabilization. Specifically, the project will entail the construction of 17 near-shore vertical wooden sills totaling 1,046 feet in length. These sills are intended to dissipate the wave energy that has damaged and eroded the coastal wetlands located along the Currituck Sound shoreline. Behind four of the sills in an area that has experienced significant erosion, the plans call for the addition of 215 cubic yards of fill to be added and vegetated with native species of marsh grasses. This small area of marsh restoration is intended to stabilize the eroded shoreline and restore some of the natural marsh habitat. Additionally, 500 tons of stone will be used to construct 120 linear feet of a stone revetment to stabilize the shoreline at the southern end of the project. 
Hazard(s) Addressed	
Type of Solution	Low-Impact Development
Estimated Cost	$100,000 - $500,000
Estimated Timeline	2 years
Potential Funding Sources	Town, NC Department of Environmental Quality, FEMA, and NC DPS
Map/Location	Currituck Sounds shoreline along the Town Park

Prioritization Measures

Cost-Benefit	High
Social Equity	Medium
Internal Capacity	High
Co-Benefits	Educated and informed public/staff, habitat conservation, supports efforts of the Currituck Sound Coalition
Prioritization Ranking	5

Stormwater Outfall/Pond Retrofits

Project Description	This project will include coordination with owners and operators of stormwater outfalls and stormwater ponds to 1) evaluate existing stormwater outfalls and connections to the Towns stormwater system, 2) evaluate existing stormwater ponds for functionality, and 3) provide recommendations for improvements/ retrofits of stormwater outfalls and stormwater ponds. This may include the purchase and installation of backflow prevention devices for priority stormwater outfalls in Duck and or the removal of sediment from the ponds. The initial assessment will focus on whether such actions at specific locations will be effective at preventing flooding. An assessment of any cracks or damage to outfalls will be conducted and estimates for repairs of such issues will be provided. The project will also include the development of a routine maintenance plan for stormwater outfalls and stormwater ponds.
Hazard(s) Addressed	Tidal flooding, saltwater intrusion/sea level rise
Type of Solution	Grey Infrastructure Retrofit / Nature-Based/Green Infrastructure
Estimated Cost	$100,000 - $500,000
Estimated Timeline	2-5 years
Potential Funding Sources	Town, NC DEQ / EPA Section 319 Watershed Restoration Fund, Golden Leaf Flood Mitigation Program, neighborhood Associations, NC DOT, and NC DWR
Map/Location	Site-specific

Prioritization Measures

Cost-Benefit	Low
Social Equity	Medium
Internal Capacity	Medium
Co-Benefits	Water quality and traffic continuity
Prioritization Ranking	6

Acquire Oceanfront Property to Support Future Beach Maintenance

Project Description	The construction of beach nourishment projects requires a significant amount of heavy equipment and pipes on the beach to receive and shape the sand that is pumped to the beach by dredges. Access for equipment and materials to the project area on the beach is required. The Town of Duck had no such access along it's oceanfront during the 2017 initial construction and the 2022/2023 renourishment of the Central Reach project. This lack of convenient construction access added to the cost of these projects. Furthermore, resource agencies raised concerns about the potential adverse impacts threatened and endangered species of shorebirds and sea turtles due to the extended mobilization along portions of the beach not included in the construction project and specifically advised the Town to look for future ways to minimize these potential adverse impacts. The Town recently acquired a property within the Central Reach Beach Nourishment project area to provide future construction access. The Town will continue to evaluate access options and investigate ways to acquire sufficient oceanfront access to support future beach maintenance throughout the entirety of the Town.
Hazard(s) Addressed	Erosion, Tidal Flooding, Sea Level Rise, Storm Surge
Type of Solution	Low-Impact Development
Estimated Cost	$1,000,000 to $5,000,000
Estimated Timeline	2 years
Potential Funding Sources	Town
Map/Location	Townwide

Prioritization Measures

Cost-Benefit	Medium
Social Equity	Medium
Internal Capacity	Medium
Co-Benefits	Ocean Rescue access
Prioritization Ranking	7

Appendix A-1

Results of public survey for the prioritization of the Non-Structural Projects

Shoreline Management Study	Town-wide Stormwater Management Study	Sea Level Rise Analysis and Climate Adaptation Plan	Septic System and Drain Field Planning	Dune Maintenance Education Program	Post- Hazard Event Assessments	Town-wide Beach Management Program	Establishment of Resilience Review Team
1	2	3	4	5	6	7	8
1	2	5	6	4	8	3	7
1	5	3	8	7	4	2	6
3	4	1	5	8	6	2	7
5	1	4	3	6	8	2	7
1	5	8	4	3	6	2	7
7	6	8	5	2	4	1	3
6	1	5	2	8	3	4	7
3	2	8	4	1	5	6	7
7	1	2	4	6	8	3	5
5	1	2	3	6	7	4	8
2	5	3	7	1	8	6	4
6	2	7	1	8	4	3	5
5	6	3	1	4	7	2	8
1	2	4	8	5	7	3	6
3	1	6	2	4	8	5	7
1	2	3	7	4	8	5	6
3	1	8	7	4	5	2	6
5	2	7	1	6	8	4	3
4	6	3	7	1	8	2	5
6	2	3	4	5	8	1	7
4	3	2	1	6	7	5	8
4	2	1	3	7	8	5	6
7	1	6	2	5	3	8	4
6	4	1	2	5	8	3	7
6	4	5	2	3	8	1	7
3	2	4	5	7	8	1	6
4	5	2	8	3	7	1	6
3	4	6	1	2	7	5	8
1	7	3	6	8	5	2	4
1	2	6	3	5	7	4	8
3	6	4	5	1	8	2	7
8	3	1	2	5	6	4	7

Total of 33 Respondents

Appendix A-1

Results of public survey for the prioritization of the Structural Projects

NC-12 Coastal Resiliency Project	Flooding and Stormwater Management Along Duck Road	Town Park Shoreline Protection Project	Acquire Oceanfront Property to Support Future Beach Maintenance	Central Reach Beach Nourishment Program	Soundside Erosion Mitigation and Storm Damage Reduction Projects	Stormwater Outfall/ Pond Retrofits
1	2	3	4	5	6	7
2	1	4	7	5	3	6
2	5	4	7	1	3	6
2	4	3	6	1	5	7
5	1	3	7	6	2	4
6	2	4	7	1	3	5
4	2	5	7	1	3	6
4	2	3	7	6	5	1
5	2	4	7	1	3	6
3	7	6	4	5	2	1
3	1	4	7	6	5	2
2	4	1	3	5	6	7
7	2	5	3	4	1	6
6	1	5	7	3	2	4
2	4	3	7	1	5	6
5	1	4	7	6	3	2
3	4	5	7	1	2	6
6	2	1	7	3	5	4
6	1	4	7	5	3	2
3	7	2	4	1	5	6
1	4	6	7	2	3	5
3	1	4	5	6	7	2
5	2	6	7	4	1	3
2	5	3	7	6	4	1
7	4	5	1	2	3	6
7	2	1	6	5	4	3
3	4	2	7	1	5	6
2	4	5	7	3	1	6
4	3	5	7	1	2	6
2	4	6	7	1	5	3
5	1	6	3	4	2	7
2	4	6	5	1	7	3
6	4	2	7	1	3	5

Total of 33 Respondents