RESILIENT

Kitty Hawk

Town of Kitty Hawk Resiliency Plan

Developed for the The North Carolina Resilient Coastal Communities Program

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Program Partners & Funding

The Nature Conservancy
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This plan facilitated by:

STEWART

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Acronyms

AEC	Areas of Environmental Concern
BMP	Best Management Practices
CAMA	Coastal Area Management Act
CAT	Community Action Team
CIP	Capital Improvements Program
CRC	Coastal Resources Commission
DEQ	Department of Environmental Quality
DCM	Division of Coastal Management
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
GIS	Geographic Information Systems
MOU	Memorandum of Understanding
NCCREWS	North Carolina Coastal Region Evaluation of Wetland Significance
NCDOT	North Carolina Department of Transportation
NCEM	North Carolina Emergency Management
NCORR	North Carolina Office of Recovery and Resiliency
NC SMAP	North Carolina Salt Marsh Action Plan
NEPA	National Environmental Policy Act
NHA	Natural Hazard Areas
RCCP	Resilient Coastal Communities Program
SAV	Submerged Aquatic Vegetation
SASMI	South Atlantic Salt Marsh Initiative
SGNA	Significant Natural Heritage Areas
SLOSH	Sea, Lake, and Overland Surges from Hurricanes
WUI	Wildland Urban Interface

Definitions

baseline: A reference condition against which changes or trends are judged—usually a set of conditions that exist at a particular point in time.

benchmark: A concentration or other accepted measure against which environmental conditions are compared.

consider: Think carefully about or evaluate at the board or staff level. This may require evaluating changes to ordinances, standards or policies.

continue: Follow past and present policy and procedure to maintain the desired goal.

ecosystem: The interacting system of a particular biological community and its non-living environmental surroundings, or a class of such systems (e.g., forests or wetlands).

encourage: Foster the desired goal through new or improved Town policies.

enhance: Improve on a current goal through Town policy.

exposure: Human contact with environmental media including air, water, soil, and food through inhalation, ingestion, or direct contact with the skin or eye. Human exposure to environmental contaminants can be measured in the ambient environment (air, water, land), at the point of human contact, or after contaminants have entered the human body through entry portals such as the eyes, skin, stomach, intestines, or lungs.

floodplain: An area of low-lying land adjacent to a watercourse that is subject to flooding or inundation.

future land use: Future Land Use as shown on a Future Land Use Map is illustrative of an intended development pattern that meets community goals. The Future Land Use Map is generally divided into different character areas that describe general uses, intensity and other shared attributes.

greenway or trail: Paved or unpaved trail and associated greenspace that is utilized for recreation and/or transportation.

hazard mitigation: Hazard mitigation is any sustained action taken to reduce or eliminate the risk of property or personal damage from natural or human-caused environmental disasters.

identify: Take inventory of and confirm a resource or desired item(s) through Town staff.

implement: Take actions to accomplish the Plan recommendations

index: A single number, derived from two or more environmental variables, that is intended to simplify complex information. For example, the Multimetric Index (MMI) for benthic macroinvertebrates in rivers and streams combines several metrics of benthic community condition into a single index score.

institutional: A land use type which may include schools, government offices, churches, hospitals and other institutions.

intermittent waters: Water bodies (e.g., streams or wetlands) that contain water for part of each year, due to precipitation events and some ground water contributions. Intermittent streams and wetlands typically contain water for weeks or months, while ephemeral streams and wetlands contain water for briefer periods—but in some cases these terms are used interchangeably (See ephemeral waters).

maintain: Keep the existing conditions of the desired state of affairs through the use of Town policies, actions, and finances, if needed.

point source: A fixed location or facility that discharges pollution—for example, a factory smokestack, a ship, an ore pit, a ditch, or a pipe discharging treated industrial wastewater or treated sewage into a waterway.

pollutant: Any substance introduced into the environment that may adversely affect the usefulness of a resource or the health of humans, animals, or ecosystems. For most environmental media, this term is commonly understood to refer to substances introduced by human activities. In the case of air, the convention is to include substances emitted from natural sources as well (See air pollutant).

prevent: Stop the identified event/practice through the use of appropriate policy, action, and finances.

promote: Advance the desired goal through Town policy, action, and or finances.

protect: Guard the current conditions or desired conditions through Town policy, action, and or finances.

risk factor: A characteristic (e.g., race, sex, age, obesity) or variable (e.g., smoking, occupational exposure level) associated with increased probability of an adverse effect.

rezoning: The action or process of changing land or property to a different zoning district with associated use allowances and restrictions. The rezoning process is a legislative process and requires action and input from the Planning Board and the Town Council.

stressor: A physical, chemical, or biological entity that can induce adverse effects on ecosystems or human health.

stormwater: Runoff generated by rainfall during a storm event.

support: Supply the necessary staff support, policy, and finances.

sustainability: The continued protection of human health and the environment while enhancing economic prosperity and societal well-being.

wadeable stream: A stream, creek, or small river that is shallow enough to be sampled using methods that involve wading into the water. Wadeable streams typically include waters classified as first through fourth order in the Strahler Stream Order classification system.1

wetland: An area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

work: Cooperate and act in a manner through Town staff, policy, and actions to reach the desired goal.

zoning ordinance: A set of regulations that specify approval procedures and requirements related to the subdivision and use of land. Typically used to help direct and manage growth.

Project Overview

1

Chapter Contents

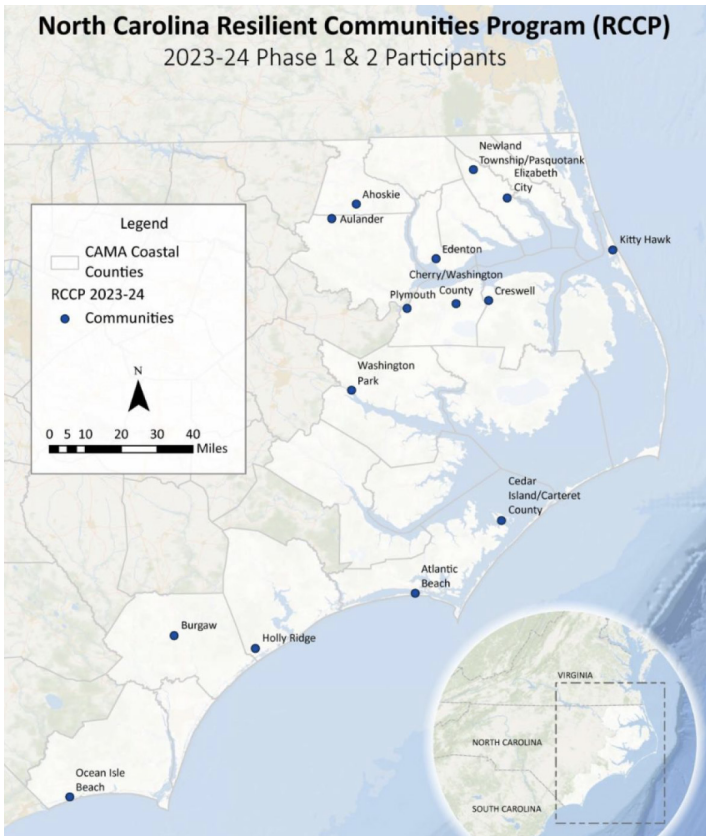
RESILIENT
Kitty Hawk

About the Resilient Coastal Communities Program

North Carolina
RESILIENT COASTAL COMMUNITIES PROGRAM

Coastal and climate hazards like sea level rise, flooding, and storm surge continue to threaten the Town of Kitty Hawk. The Town is considered a frontline community because of its position along the coast and increased susceptibility to the impacts of coastal hazards. Day-to-day life for Kitty Hawk residents can be interrupted by such events, causing long lasting impacts felt throughout Town.

Planning for these hazards, accounting for future conditions, and developing community and science-driven solutions are vital steps to ensuring the well-being and sustainability of the Town. The Town of Kitty Hawk received a grant to participate in the NC Resilient Coastal Communities Program (RCCP). The RCCP is established by the North Carolina Department of Environmental Quality (NCDEQ), and funded through the NC State Legislature and the National Fish and Wildlife Foundation. The RCCP is a four-phase program that establishes a community-driven process for setting goals around coastal resiliency, assessing the local current and future needs for capacity, and identifying and prioritizing projects the end goal of increasing the community's resilience to coastal hazards.



What is "Resilience"?

Resilience refers to the ability of a community or system to withstand or "bounce back" from an impact.[1] The Resilient Kitty Hawk document will include a risk and vulnerability assessment, a planning and project prioritization, and be used to pursue grants for projects to address flooding, mitigate impacts from storms, and aid in response and recovery.

RESILIENCY RECOVERY

1.- Paton D, Millar M, Johnston D. Community resilience to volcanic hazard consequences. Natural Hazards. 2001 2001/09/01;24(2):157-69. English.

Project Objectives

The primary goal of Phases 1 and 2 of the RCCP is to provide local governments with funding and assistance to complete a resiliency planning initiative and:

- Perform a data- and community-driven risk and vulnerability assessment
- Develop a portfolio of well planned and prioritized solutions to address risks
- Create a platform for launching into Phases 3 and 4 (Design and Construction).

Program partners and funders for the North Carolina Resilient Coastal Communities Program Planning Handbook.

Project Phasing

1

Phase 1: Community Engagement and Risk & Vulnerability Assessment

Includes performing a risk & vulnerability assessment, developing a Community Action Team, and engaging with the public.

2

Phase 2: Planning, Project Selection, & Prioritization

Involves a community and data driven process to identify priority actions that can be taken to adapt to short- and long-term hazards.

3

Phase 3: Engineering and Design

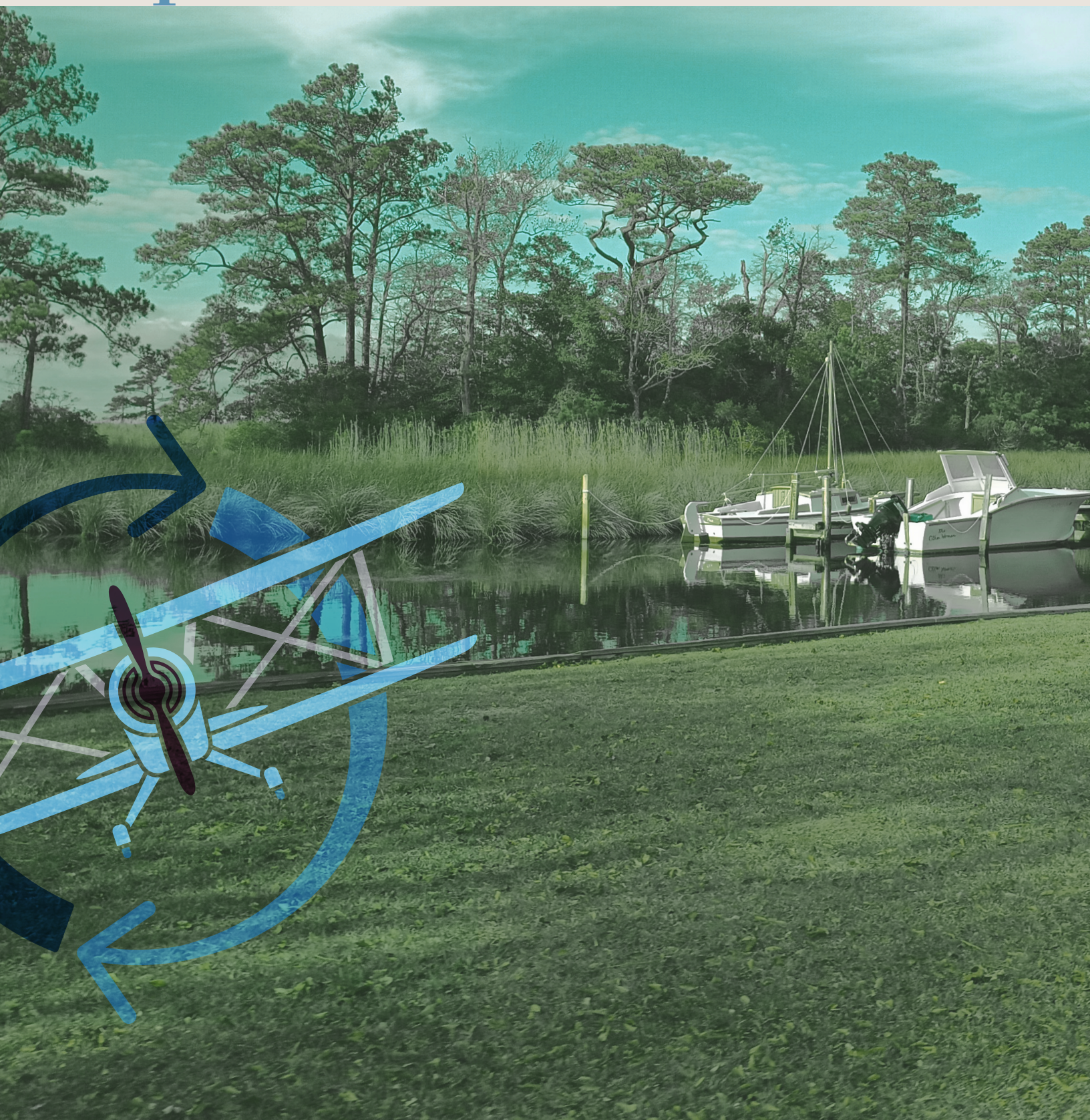
Grants are available for communities that have successfully completed Phase 1 and Phase 2 to develop projects that are shovel-ready.

4

Phase 4: Implementation

Phase 4 grants are available for communities that have successfully completed Phases 1, 2, and 3 for the implementation of shovel-ready projects.

Community Action Team Report



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Community Action Team (CAT)

The Kitty Hawk Community Action Team was developed as a non-appointed steering committee to champion the effort alongside Town staff and consultants (Stewart) during the development of the Resiliency Plan. The Community Action Team consisted of members of the CAMA Land Use and Comprehensive Plan Steering Committee (the Planning Board) and other local stakeholders. Planning Board members were asked to participate in the Resilient Coastal Communities Program because of their expertise and experience during the Imagine Kitty Hawk planning process. Additional members were included to ensure inclusivity and expand the expertise of the Community Action Team. These included a local civil engineer, an engaged female Kitty Hawk citizen, the public works director, deputy fire chief, police lieutenant, town engineer, and two members of the recreation committee.

The main duties of the CAT members included: reviewing data and documents presented by the project team, discussing items presented, assisting and coordinating public outreach, and identifying shovel-ready projects and prioritizing future projects and next steps.

The Community Action Team consisted of the following members: John Delucia, Carlos Gomez, Jimmy Helms, Paul Henriques, Pete Mantz, Craig Merrill, Willie Midgett, David Morton, Mike Talley, Rob Testerman, Mackenzie Todd ***(ex-officio)***, Kasen Wally ***(ex-officio)***, and Amy Wells. The Community Action Team met monthly to discuss the project and provide expertise and local knowledge.

CAT Champion

One member of the committee was selected to serve as the project champion. This is the person who has knowledge, expertise, and passion to act as a point person with DCM, the project team, and the rest of the CAT. Rob Testerman, the Planning Director for the Town of Kitty Hawk, was chosen to be the CAT Champion.

Community Engagement Strategy

An inclusive community engagement effort led to the development of Kitty Hawk's Resilient Coastal Community Plan (Resilient Kitty Hawk). This Community Engagement Strategy outlines public engagement goals and specific actions by the Town of Kitty Hawk, Stewart, and the Community Action Team (CAT) to collect insightful, accurate public input that reflections the social and cultural values and priorities of the Town during the development of the Plan. This effort takes care to include representation from minority communitios and vulnerable populations. Key targets are the African American community, low income residents, the growing Hispanic population, and the 65 and over age group.

Public Participation Goals

Robust community engagement is essential to creating a plan that reflects and serves the community. Going beyond just informing about the process to meaningfully engage and empower community members is key for fostering trust and more effective and equitable outcomes. The following goals will guide the community engagement strategy for the Kitty Hawk Resiliency Plan:

Equity, Inclusivity, and Diversity: Engagement demographics are monitored and compared to Town demographics according to latest Census data, including racial, income, and age demographics.

Engagement Choices: Community engagement opportunities are varied and equitable so community members can choose the option that works best for them.

Meaningful Dialogue: Community engagement opportunities ask meaningful questions, provide open platforms for discussion, and feature accessible activities within each meeting so community members feel heard and empowered.

Public Participation Methods

To support the Engagement Choices goal, the project team offered a diverse set of engagement methods at various stages of the project. These included:

- Community Workshops/Open Houses
- Digital Public Survey
- Project website: to host materials relevant to the program to encourage public participation

Socially Vulnerable & Historically Under-Represented Groups

Socially vulnerable and historically under-represented groups within the community are often not involved in planning processes and face disproportionate impacts from coastal and climate hazards. Including traditionally underrepresented groups from frontline communities in resilience planning is critical for equitable outcomes. Given that social aspects of the Town contribute to overall community resiliency, having the most inclusive approach possible is key.

The Town of Kitty Hawk has a relatively small population and as a beach community there are limited vulnerable and historically under-represented populations. Public engagement for the Resilient Kitty Hawk Plan was designed to help overcome obstacles in civic engagement in order to capture concerns of all of its residents.

The following digital media was used to promote the project and create general awareness:

- Local newspaper
- Local TV information channel
- Community newsletter
- Email
- Facebook
- Town website

Frontline Communities: People who are both highly exposed to climate risks (because of the places they live and the projected changes expected to occur in those places) and have fewer resources, capacity, safety nets, or political power to respond to those risks (e.g., these people may lack insurance or savings, inflexible jobs, low levels of influence over elected officials, etc.) (Georgetown Climate Center). This includes, but isn't limited to: people of color, low-income, immigrants, those at-risk of displacement, senior citizens, populations experiencing homelessness, outdoor workers / climate-vulnerable labor, incarcerated populations, renters / subsidized housing tenants, unemployed/underemployed, youth, persons with disability, and chronically-ill / hospitalized people.

Community Engagement Timeline

The following is a timeline of community engagement activities during the Resilient Kitty Hawk plan development.

Kitty Hawk Resiliency Plan Engagement Timeline			
Activity	***Description***	***Date***	***Lead Party***
Develop Community Engagement Strategy	Develop Draft Community Engagement Strategy; Include recommendations for 2 public workshops and targeted engagement for underrepresented community members	Late September 2023	Stewart
Develop Community Action Team (CAT)	Ask for participation from Steering Committee; Add additional members to build a multi-disciplinary committee; Identify and include representation from vulnerable populations (i.e. low income, African American, Hispanic and/or 65+ communities); Schedule 3-5 meetings	October 2023	Town, CAT/ Stewart: send RCCP explanation & homework to CAT 1-2 weeks in advance of 1st CAT meeting
Develop Project Webpage	Establish online presence; Set up dedicated Resiliency Plan webpage on Town website and populate with relevant information; Add notice to home page about the Plan and direct visitors to the Plan webpage; Create social media posts for Town and associated official accounts	Mid to Late October 2023	Town, Stewart to assist
CAT Mtg #1	Introduce the RCCP and planning process; Appoint a CAT Champion; Discuss member roles; Assign tasks to members on identifying contacts in vulnerable communities; Schedule next meeting	November 15, 2023	Town, CAT
Demographic Analysis	Mapping and research to identify vulnerable populations	December 2023	Stewart
CAT Mtg #2	Meeting to discuss engagement for targeted outreach, discuss existing plans and efforts, prepare draft goals and vision	December 19, 2023	Town, Stewart, CAT
Project Priorities Field Trip	Field trip with Public Works Director	December 2023 / January 2024	Town, Stewart
Public Open House / Community Workshop #1 & #2	Interactive input from the community on values, preference, and direction; Large community event with breakout groups for public to review existing conditions, survey 1 results, and draft resiliency and environmental goals for the town	January 2024	Town, Stewart, CAT

Kitty Hawk Resiliency Plan Engagement Timeline

Activity	Description	Date	Lead Party
CAT Mtg #3	Community Action Team meeting to review and discuss risk and vulnerability assessment	February 20, 2024	Town, Stewart, CAT
CAT Mtg #4	Community Action Team meeting to discuss development of potential resilience projects	March 20, 2024	Town, Stewart, CAT
CAT Mtg #5	Community Action Team meeting to discuss development of potential resilience projects	April 17, 2024	Town, Stewart, CAT
Public Open House / Community Workshop #2	Interactive input from the community on the draft plan, resiliency and environmental goals; Seek public input on prioritization	June 4, 2024	Town, Stewart, CAT
CAT Mtg #6	Community Action Team meeting to discuss prioritization and draft plan	June 5, 2024	Town, Stewart, CAT
Draft Plan Public Review Period	Draft plan available for public review and comment	August 2024	Town, Stewart, CAT

Ongoing Community Engagement Tasks

Activity	Description	Date	Lead Party
Event Coordination	Coordinate on notices, press releases, and event details and responsibilities	Prior to major events	Town, Stewart to assist
Event Debrief	Go over results and feedback received at previous event	After major events	Stewart, Town
Public notices	Distribute notices via Town staff, email, website and social media prior to events	Prior to major events	Town
Project updates	Project updates and annoucements to elected and appointed boards	Prior to major public events	Town, Stewart to assist
Community survey	Online survey accessed 24/7 during open period	Prior to first public meeting	Stewart, Town
Website, social media	Website updates and information sharing through staff	At milestones and after CAT meetings	Town, Stewart to assist

Community Action Team(CAT) Meetings

The Community Action Team consists of 11 members with various backgrounds (see page 6) and met six times throughout this process. The following sections provide a summary of discussions from each meeting.

Community Action Team (CAT) Meeting #1

The first Community Action Team meeting was held in person on November 15, 2023 at Town Hall with 10 out of 11 CAT members in attendance. The meeting convened from 5:30 - 7:30 PM. The meeting began with introductions followed by a presentation from the consultants. The consultants provided an outline of the Resilient Coastal Communities Program objectives and explained the purpose of Phase I and Phase II of the program. The Community Action Team was introduced to the Resilient Coastal Communities Program handbook and discussed action items for Outer Banks Regional Hazard Mitigation Plan, the Town's Stormwater Management Plan, and Imagine Kitty Hawk 2050. The team strategized ways to involve the community and decided that two public meetings held at various times along with a public survey would be an excellent way to engage with the community.

The consultant introduced the Community Action Team to the Critical Asset map and explained what assets must be identified and how each asset tied into FEMA's community lifelines. There was discussion of flooding on the soundside and how beach nourishment has prevented ocean overwash from occurring on the east side. However, when there is a heavy rain or storm event the town's pumping stations along the east side have served them well. Some fire hydrants along Highway NC 12 have been relocated to the west side but others remain along the east side and are being impacted by salt and sand. Staff stated these hydrants have to be cleared after storm events.

Afterwards, planning director, Rob Testerman was named the CAT champion. Public meetings were scheduled for January 25 from 6:00 PM - 8:00 PM and January 26 from 10:00 AM - 12:00 PM and the next CAT meeting was scheduled for December 19.

Agenda 11/15/23

Item 1. Introduction/Roles	**5 min**
Item 2. Plan Assessments	**20 min**
Item 3. Community Engagement Strategy and Project Schedule	**20 min**
Item 4. Critical Asset Mapping	**40 min**
Item 5. Appoint CAT Champion	**5 min**
Item 6. Schedule First Public Meeting	**15 min**
Item 7. Schedule Next CAT Meeting	**5 min**
Item 8. Next Steps	**10 min**

Community Action Team Meeting #2

The second Community Action Team meeting was held online on December 19, 2023 from 5:30 PM - 8:00 PM and 6 out of 11 CAT members were present. The consultants reviewed Phase I and Phase II of the Resilient Coastal Communities Program and the schedule again with the team. The consultants reviewed the hazards pointed out in the Outer Banks Regional Hazard Mitigation Plan with the team and then had a discussion about which hazards they were most concerned about. The team discussed what has been accomplished in the town's Stormwater Management Plan.

There was more discussion about flooding issues especially along Kitty Hawk Road from wind-driven storm events. The consultant continued to discuss the town's vulnerability including elderly population, children, and the town's built environment. The CAT team was introduced to annual relative sea level rise projections and what has been observed and the scenario being used to evaluate future conditions. The consultants reiterated the importance of this program and its outcomes by providing an explanation of "what is resiliency" and "why it matters."

The team had a work session to discuss vision and goals as part of this process. The two most important goals for the town were to provide educational opportunities to increase public awareness and to enhance and utilize the town's natural resources as a defense mechanism. Advertisements for upcoming public meetings were discussed in depth and how to get people excited about addressing their concerns.

Additions to the Critical Assets map were shown and discussed. Transportation and low-lying areas were discussed and how traffic is sometimes diverted through neighborhoods. The CAT team scheduled their next meeting and ended the meeting at 8:00 PM.

Agenda 12/19/23

Item 1. Introduction	**5 min**
Item 2. Schedule	**5 min**
Item 3. Plan Assessments	**40 min**
Item 4. Vulnerability	**35 min**
Item 5. What is Resiliency?	**10 min**
Item 6. Vision and Goals Work Session	**30 min**
Item 7. Community Engagement	**5 min**
Item 8. Critical Infrastructure	**20 min**

Community Action Team Meeting #3

The third Community Action Team meeting was online on February 20, 2024 from 6:00 PM - 8:00 PM and 10 out of 11 CAT members were present. The consultants began the meeting with an overview of the schedule and process. Public meeting and survey results were then reviewed. The public meeting and survey results indicated general support for the plan's vision and goals but indicated there may be some changes needed to the natural resource/green infrastructure goal. The top hazards the community was most concerned were: soundside flooding, erosion, rainy day flooding, and storms. When asked where flooding occurs in the community, flood prone areas were as follows: Kitty Hawk Landing, Kitty Hawk Rd./Twiford St., on either side of Kitty Hawk Village,, and on the ocean side south of Kitty Hawk Rd. to Tateway Rd. When asked what the most important community assets were the most important were: fire, police, and emergency services, infrastructure, municipal facilities, and businesses.

The consultants reviewed the potential vulnerabilities to be assessed with the CAT team. The first draft of the vulnerability and risk assessment indicated that Town Hall, All Saints Episcopal Church (in Southern Shores), Kitty Hawk United Methodist, Bob Perry Landing, Kitty Hawk Police Department, and the Boat Ramp were all vulnerable to anticipated sea level rise, in the floodplains or in the future floodplains, and storm surge. After discussion, the CAT team and the consultant decided to also factor in wildfires and ocean overwash.

Agenda 02/20/24	
Item 1. Introduction & Schedule	**5 min**
Item 2. Public Meeting Results	**20 min**
Item 3. Survey Results	**20 min**
Item 4. Vulnerability	**20 min**
Item 5. Critical Assets and Natural Infrastructure	**30 min**
Item 6. Risk and Vulnerability Assessment	**25 min**

Community Action Team Meeting #4

The fourth Community Action Team meeting was held online on March 20, 2024 from 5:30 PM - 7:30 PM with 10 out of 11 CAT members present. The consultant began the meeting by reviewing the project schedule and Phase I and II of the Resilient Coastal Communities Program with the group. The consultant provided an update to the vulnerability assessment and the group discussed how adaptive capacity would be assessed. Transportation networks and their exposure and sensitivity to flooding and permanent inundation were reviewed and adaptive capacity of Kitty Hawk Rd, Moor Shore Rd, and Twiford St were discussed.

Next the team discussed barriers to marsh migration and potential locations for wetland restoration or living shorelines. Beach nourishment and dune plantings were discussed as a way to mitigate ocean overwash issues on the ocean side. Since all of Kitty Hawk depends on private septic systems and all power is above ground, these were included as part of the vulnerability assessment.

The second draft of the vulnerable asset map was reviewed. During the last meeting, it was discussed that buildings outside of the town's jurisdiction would be taken out of the overall assessment. The updated map showed Bob Perry Boat Launch, Kitty Hawk United Methodist, Town Hall, Kitty Hawk Police Department, Kitty Hawk Public Works Department, Kitty Hawk Fire Department (new bay being located on Highway 158), and Unitarian Church being the most vulnerable to sea level rise, flooding, storm surge, and wildfires.

Twelve projects were introduced to the CAT members. These include: Lindbergh Ave. swales, Additional pumps and swales, Dune access retrofit, Kitty Hawk Rd. and Twiford Rd., Bob Perry Convenience Center, Town Hall, Passive recreation acquisitions, Police Department reuse, Wetland Restoration, Living Shorelines (Moor Shore Rd. and west side of Kitty Hawk, and Kitty Hawk Methodist Church. The next CAT meeting was set and the presentation was emailed to the CAT members to review and rank projects at the upcoming meeting.

Agenda 03/20/24

Item 1. Introduction & Schedule	**5 min**
Item 2. Critical Facilities, Risk and Vulnerability	**55 min**
Item 3. Policies and Projects	**55 min**
Item 4. Schedule Next CAT Meeting	**5 min**

Community Action Team Meeting #5

The fifth Community Action Team meeting was held online April 17, 2024 from 5:30 PM - 7:30 PM with 8 out of 11 members present. The purpose of this meeting was to review projects that were introduced at the 4th CAT meeting and schedule the last public meeting. At this meeting the CAT team introduced three potential projects, and they are: creek snagging, removal of branches and trees to reduce risks for electrical service, and Ridge Rd. to Colleton Rd. Elevation of private properties were removed from the potential project list. The CAT team scheduled the next public meeting for June 4, 2024 and the last CAT meeting for June 5, 2024. The project list was sent to the CAT team to review to begin prioritization.

Community Action Team Meeting #6

The last Community Action Team meeting was held in person on June 5, 2024 and 5 of the 11 members were present. Town staff and other CAT members held a meeting prior to this to prioritize projects. Projects were discussed and put into categories as follows: Design or Implementation Ready, Other Implementation, and Additional Study needed. The projects were then prioritized.

Agenda 04/17/24

Item 1. Schedule	**5 min**
Item 2. Project Discussion	**100 min**
Item 3. Schedule Public Meeting	**10 min**

Agenda 06/05/24

Item 1. Review Projects	**60 min**
Item 2. Project Prioritization	**60 min**

Community Vision, and Goals

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RESILIENT
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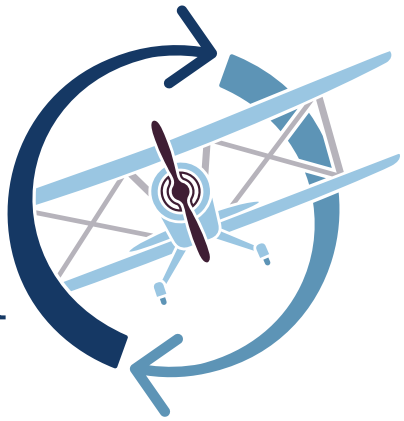
Community Engagement

The community was kept abreast on items discussed on Community Action Team meetings with updates to the project website throughout the process.

Resiliency Vision

The Town of Kitty Hawk is a thriving, Outer Banks village, focused on improving its long-term viability by prioritizing the enhancement and protection of its natural resources, preparing infrastructure assets, and providing effective response and recovery to residents and visitors.

RESILIENT
Kitty Hawk



Project Goals

The focus of this resiliency planning effort is on identifying ways that the Town can reduce the negative impacts of climatic change and coastal hazards on the community in order to minimize disruptions to daily life and increase safety and prosperity.

Goal 1: **Protect and improve public infrastructure, key facilities, and utilities to increase resilience against natural hazards.**

Goal 2: **Maintain and improve the effectiveness and resiliency of public safety response.**

Goal 3: **Maintain transportation access for soundside communities and improve options for evacuation.**

Goal 4: **Provide educational opportunities to increase public awareness and understanding of coastal risks.**

Goal 5: **Safeguard the Town's natural resources including existing tree canopy, wetlands, beaches, dunes, and shorelines, and encourage green stormwater infrastructure and low impact development techniques in new development.**

Goal 6: **Provide guidance for future investment, planning, and regulatory changes to manage stormwater, and limit future property impacts.**

Public Engagement Summary

During this process, the town held 3 public meetings, invited community members to take a public survey, and kept the community engaged with updated information on the town's website.

Public Meeting #1 & #2

The Town of Kitty Hawk held back-to-back drop-in public meetings on January 25 and 26th, 2024 to receive feedback regarding flooding and storm protection. The first meeting was held from 6:00-8:00 pm on Thursday evening. The second meeting was held on Friday morning from 10:00 am-12:00 pm. The open-house style meetings allowed attendees to comment on informational boards.

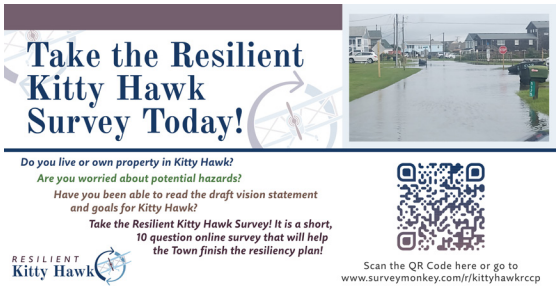
At each meeting attendees reviewed draft vision and goals for this document, existing and future conditions, and were asked to participate in four activities. The first activity was a where do you live activity. This activity asked community members to place a number on the map indicating where they live or spend their most time and were asked to fill out a demographics form so the consulting and CAT team would have a better understanding where vulnerable populations lived. The second activity asked community members to indicate where flooding occurs within the town limits. The third activity asked community members to indicate the types of hazards they are most concerned with. The fourth activity was based off of the critical asset map and asked community members to rank 1-5 the most important community assets.

The full results from these meetings can be viewed in the plan Appendix.

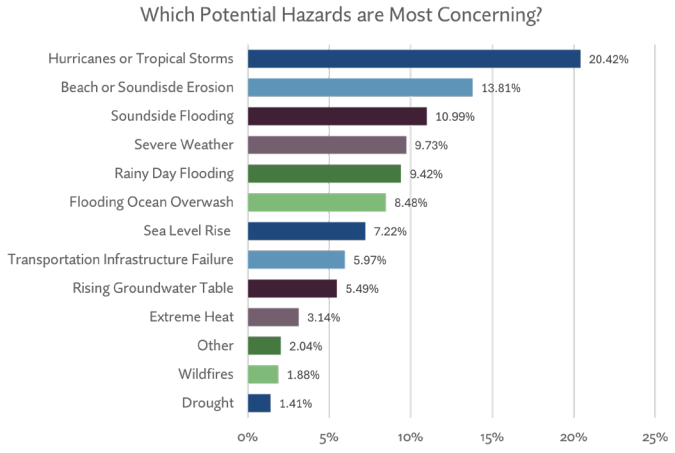
Attendees at the January 25, 2024 meeting

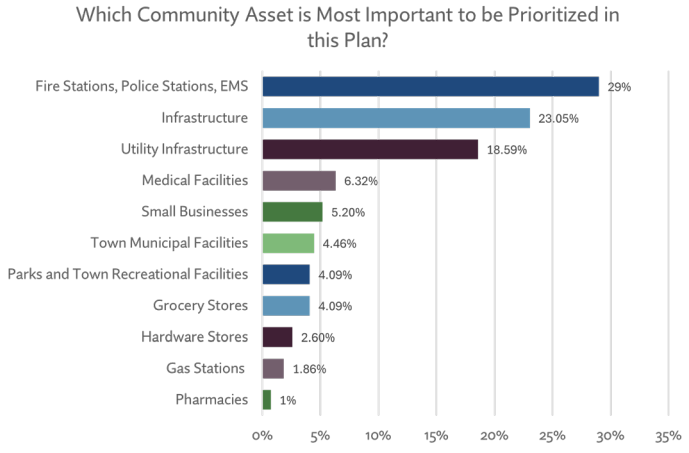
Attendees at the January 26, 2024 meeting

Community Survey



A community survey was sent out to Kitty Hawk residents asking them about the potential hazards that concern them the most, what community assets they feel should be prioritized in this plan, and which of the draft goals reflected their hopes for recovery in Kitty Hawk. With a total of 162 responses, the survey brought to light that the most concerning hazard to respondents are hurricanes or tropical storms, followed by beach or soundside erosion, and soundside flooding. It also highlighted that the most valued community assets include emergency service stations, infrastructure (including roads, bridges, etc.), and utility infrastructure. The survey helped to guide the draft goals into the final goals that are discussed further in the plan. The full results from the survey can be viewed in the plan Appendix.





Public Meeting #3

The Town of Kitty Hawk held their third and final public meeting on June 4th, 2024 to gain feedback and comments on specific projects that the Town could prioritize for future funding and implementation efforts. Attendees reviewed conceptual ideas for resiliency based projects throughout Kitty Hawk which address a number of the problems and vulnerabilities previously identified by residents, Town staff, and members of the Community Action Team. Ultimately, attendees voted on which projects they thought were the most important to them by placing dots on voting sections of the display boards.

The full results from this meeting can be viewed in the plan Appendix.

Attendees at the June 4, 2024 meeting

Review of Existing Local & Regional Plans

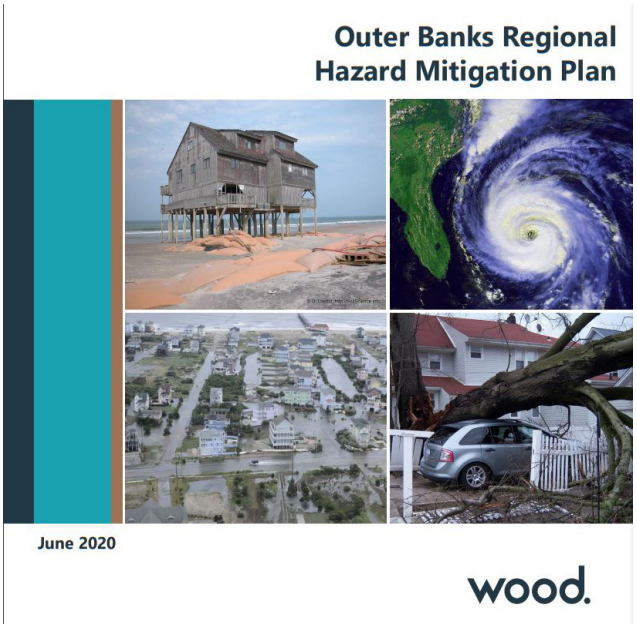
4

Chapter Contents

RESILIENT Kitty Hawk

Existing Plans

Previous planning efforts were researched to help form the foundation of knowledge for this planning process. This Plan will function alongside these existing plans until they are superseded by updated documents. Details about each of these consulted plans are as follows.



OBX Regional Hazard Mitigation Plan

The Outer Banks Regional Hazard Mitigation Plan was developed in June 2020. The counties and municipalities that make up the Outer Banks came together to create an overarching hazard mitigation plan. This plan highlights each community and provides an individualized assessment of risk factors along with action item to address certain hazards. Kitty Hawk has several priority-rated action items that are dedicated to reducing the risks associated with Hurricanes and Tropical Storms, Nor-easters, Floods, and Thunderstorms. These actions include but are not limited to increasing the required freeboard in AE zones, clean out and maintain stormwater infrastructure and waterways to relive standing water, establish long term funding and implementation options for beach renourishment, create a living shoreline along vulnerable areas of the sound, and update and improve protocols, procedures, and communication leading up to a storm to increase the citizen awareness of upcoming natural events. There are also action items that are geared to an overall risk reduction such as establishing a town wide plan that focuses on hazard mitigation and recovery and provides information on disaster recovery. This overarching Hazard Mitigation Plan points Kitty Hawk in the right direction leading into the efforts being made through the RCCP project.

The 8 Goals:

- Reduce the risk of loss of life and personal injury from natural hazards.
- Reduce the risk and impact of future natural hazards by regulating development in known high hazard areas.
- Maintain critical facilities in functional order.
- Protect infrastructure from damage.
- Ensure that hazard mitigation is considered when redevelopment occurs after a natural disaster.
- Provide education to citizens that empowers them to protect themselves and their families from natural hazards.
- Fulfill Federal and State requirements for receipt of future disaster recovery and hazard mitigation assistance.
- Improve interjurisdictional cooperation and coordination, especially regarding the reduction of natural hazard impacts.

Mitigation Action Items

- Establish town plans for mitigation and recovery through information on disaster planning recovery and reconstruction.
  - 2020 Implementation Status Comments state Kitty Hawk should establish a separate migration plan, or add on to Emergency Preparedness, Response and Recovery Plan

- Revise Town's Flood Damage Prevention Ordinance in conjunction with new maps to increase the required freeboard in AE zones and regulate elevation requirements in Shaded X zones.
- Clean out culverts, ditches, and waterways to relieve standing water and facilitate the stormwater drainage.
- Establish long-term plan for funding and implementation of beach renourishment.
- Expedite permitting for the relocation of repetitive loss situations.
- Construct and maintain living shoreline projects in most vulnerable soundside areas.
- Encourage open space preservation/conservation.
- Implement stormwater drainage improvements per the studies/plan.
  - Partially complete.
- Update and improve protocols and procedures (local, county, and state) by which citizens in KH are made aware of impending storm events and expected impacts.
  - Status update states this has been partially completed. There has been some discussion of a town alert, in addition to the existing county one.
- Work w/ Dare Co. to improve the communication systems between all public safety departments within the towns, county, and state so that in the event of a disaster, all entities will be able to communicate with one another.
- Review vulnerabilities of all critical facilities as a component of annual review of Emergency Preparedness, Response and Recovery Plan.
- Maintain post-disaster debris management contract with qualified provider.
- Increase awareness of availability of flood insurance through various methods (mailings, flyers, etc.).
- Provide information on flood damage protection techniques to citizens and property owners.
- Initiate outreach projects to inform the public on Town and County initiatives that will reduce hazard related losses of property and life.

Kitty Hawk Stormwater Management Plan

The Town conducted a stormwater management study to evaluate the need for drainage improvements, permanent and temporary pumping stations, and other best practices to safely manage and remove stormwater. The following ten locations were identified as problem areas:

- Area 1: Byrd St. & Lindbergh Ave.
- Area 2: Lindbergh Ave. & Fonck St.
- Area 3: Lindbergh Ave. & Bennett St.
- Area 4: Lindbergh Ave. & between Bleriot St. and Hawks St.
- Area 5: Lindbergh Ave. between Historic St. and Starfish Ct.
- Area 6 & 7: East Kitty Hawk Road and Hurdle St.
- Area 8: US 158 in the vicinity of Beacon Drive
- Area 9: Poseidon St. and Goosander St.
- Area 10: Tateway Road and the Rabbit Hollow Area

Following the study, the Town has installed a system of stand pipes and outfalls to collect stormwater from ocean overwash into collection basins and pump stormwater back into the ocean when a storm subsides. During heavy rainfall, the Town has seven pumps to remove water from its roadways. Systems are in place to deal with stormwater issues at Area 1, Area 2, Area 4, Area 5, Area 6, Area 9 and Area 10.

In the future additional swales, collection basins, piping or pumps may be necessary to augment drainage due to overwash or other stormwater issues.

Dune Protection and Improvement Plan

The Town of Kitty Hawk has taken it upon themselves to provide their own recommendations for its residents so that they can do their part to preserve the dunes and beaches in terms of erosion. These simple steps range from accessing the beach through designated public beach crossovers, telling people about how important dunes are to the longevity of the beach, to property owners constructing sand fences and wooden walkways in accordance with CAMA regulations.

Major Recommendations

- Plant dune vegetation types based on the time of year to combat erosion.
- Erect sand fences in accordance with CAMA regulations.
- Utilize designated public beach crossovers.
- Utilize roll out wooden walkways or construct an elevated walkway according to CAMA regulations.
- Have conversations and educate others on the importance of sand dunes to the community.

Imagine Kitty Hawk 2050: CAMA Land Use Plan

The Town of Kitty Hawk adopted their CAMA Land Use Plan in September of 2023. This plan established goals and recommendations specific to public access, land use compatibility, infrastructure carrying capacity, natural hazard areas, water quality, and local concerns. Through public input with community members, a vision was established which highlights the "community-focused, family-oriented, low-key, Outer Banks village" that Kitty Hawk has been and strives to be. The plan had an increased focus on the future land use of Kitty Hawk and how it coincides with the existing and future infrastructure, current patterns and trends, and the natural hazards associated with being a coastal community.

The main themes of this plan include the following:

- Public Access
- Natural and cultural resources
- Character
- Resiliency
- Public Infrastructure
- Water Quality
- Multi-modal transportation
- Recreation

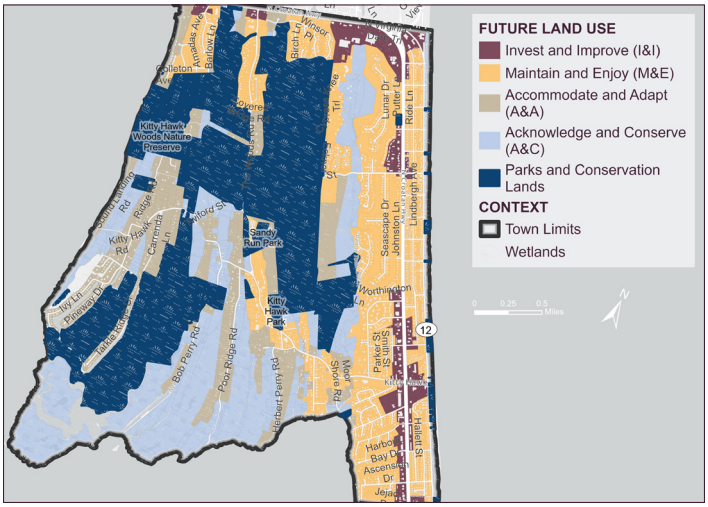
The CAMA Land Use Plan included several goals and recommendations related to resiliency. Key goals and recommendations include:

- Maintain and improve sound side access points. (Policy 1.6)
- Update, enforce and amend ordinances and procedures to protect the Atlantic Ocean Shoreline and associated sand dunes. (Policy 2.1)
- Support cooperative efforts to acquire unbuildable oceanfront lots as appropriate. (Policy 2.2)
- Restore coastal buffers to protect inland areas. (Policy 7.1)
- Discourage new development that relies on septic

tanks in areas that will be inundated with a 2' rise in sea level. (Policy 2.3)

- Establish a program for identifying and addressing impaired septic systems. (Policy 2.3)
- Require stormwater management systems in new development that mimic predevelopment runoff conditions and consider additional incentives for green stormwater infrastructure and Low Impact Development (LID). (Policy 2.4, 9.1)
- Encourage the preservation of maritime forest, floodplains, marshes and wetlands through development regulations and land protection initiatives. (Policy 4.1)
- Continue to require additional freeboard for buildings located in the floodplain. (Policy 4.1)
- Enhance tree cover in the Town of Kitty Hawk. (Policy 4.3)
- Utilize the future land use map, storm surge maps, flood exposure maps, wetlands assessments, and projected sea level rise and flood vulnerability data when considering rezoning and development requests. (Policy 5.1)
- Maintain and provide ocean rescue services, emergency services and fire and police protection. (Policy 6.1)
- Continue stormwater upgrades and implement and update the Stormwater Management Study (2012). (Policy 6.4)
- Maintain and enhance the stormwater removal system in place that clears flooding on streets to allow for emergency vehicle access. (Policy 6.5)

Future Land Use Map



- Evaluate areas of flooding and options for low-lying neighborhoods and roadways. (Policy 6.6)
- Pursue and utilize state and federal grants to study areas of persistent flooding and potential solutions. (Policy 6.7)
- Study infrastructure exposure including roads and other key assets in vulnerable areas. (Policy 8.1)

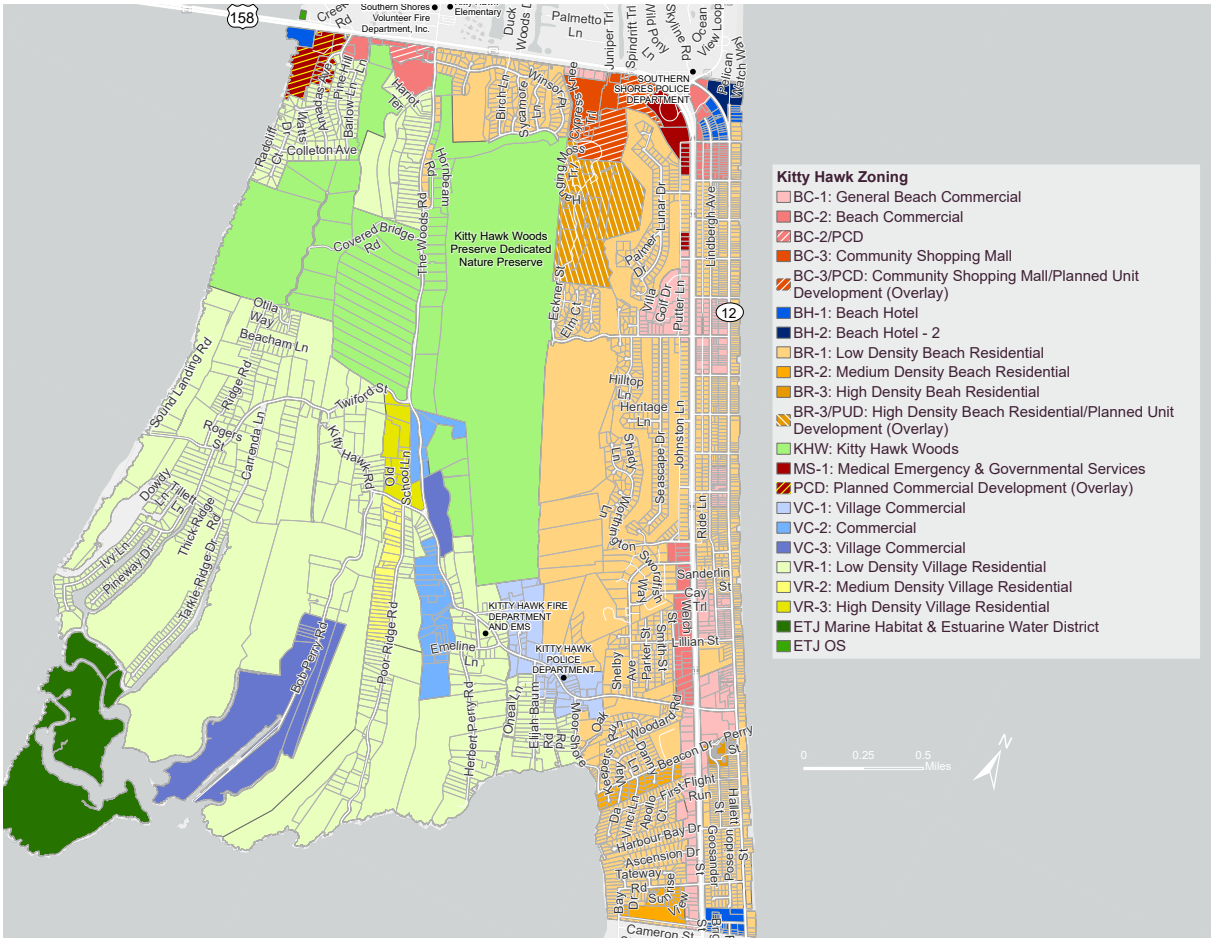
2023-2024 FY Budget Capital Improvement Plan

The 2023-2024 Budget includes funds for new vehicles for Ocean Rescue and the Police Department, vehicle equipment and radios, new public works personnel, and funds for town infrastructure and facilities including street resurfacing, the Highway 158 sidewalk project, Town parks, boardwalk and dock repairs and upgrades to the Public Works Building. Funds related to beach nourishment are also included in the budget. A major resiliency related budget item is the purchase of the former Regional Medical Center at 5200 N. Croatan Highway. The Town is currently in the process of completing designs for the building to meet the needs of the Police Department.

Zoning Ordinance

Chapter 42 of the Town's Code of Ordinances is the Zoning Ordinance. Kitty Hawk enforces zoning, to protect property values, separate incompatible uses, protect the environment, provide for adequate infrastructure, and provide for orderly development of land while keeping the best interests of its citizens in mind. The zoning districts are divided into 3 different geographic areas of the Town each with its own unique character; Kitty Hawk Woods, Kitty Hawk Beach, and Kitty Hawk Village. The Kitty Hawk Woods district was created to protect environmentally sensitive land; this district allows for limited uses such as watershed conservation area, and wildlife ecological preserves, and low-density single-family detached homes with at least 80,000 square feet lots not including wetland area. In the Kitty Hawk Beach area, there are three residential districts, two commercial districts, one shopping center district, and two beach hotel districts located along Highway 158 and Highway 12.Density is generally higher and more uses are permitted in these districts due to their location. Uses that are permitted include detached single-family homes, attached multifamily homes, churches, fire stations, offices, retail stores, service establishments, schools, and hotels depending on the zoning district. The third character area in Kitty Hawk is the Kitty Hawk Village. This area contains some environmentally sensitive lands but it also includes some residential and small-scale commercial uses. In the residential districts, detached single-family homes, duplexes, attached multifamily homes, manufactured homes, churches, fire stations, are permitted

Town of Kitty Hawk Zoning Map



depending on the residential district. There are three village commercial districts that allow small-scale offices, retail stores, service establishments, schools, marinas and docks, craft production, and some residential uses depending on the zoning district. Wetlands are not allowed to be counted towards the minimum lot size requirements for residential uses in Kitty Hawk Village. In addition to dimensional requirements there are also lot coverage requirements for residential and nonresidential uses.

Erosion and Sedimentation Control

Chapter 32 of the Town Code requires that any land-disturbing activity of 5,500 square feet or more of land is required to have an erosion and sedimentation control plan reviewed and approved by the Town of Kitty Hawk. The plan requires a Financial Responsibility/Ownership (FRO) form to be notarized to ensure there is consent for allowing activities on the property. Other requirements include a site location map, a narrative that covers proposed land disturbance activity, existing conditions and proposed control measures, a site plan and design calculations.

Stormwater Management & Flood Damage Prevention Ordinance

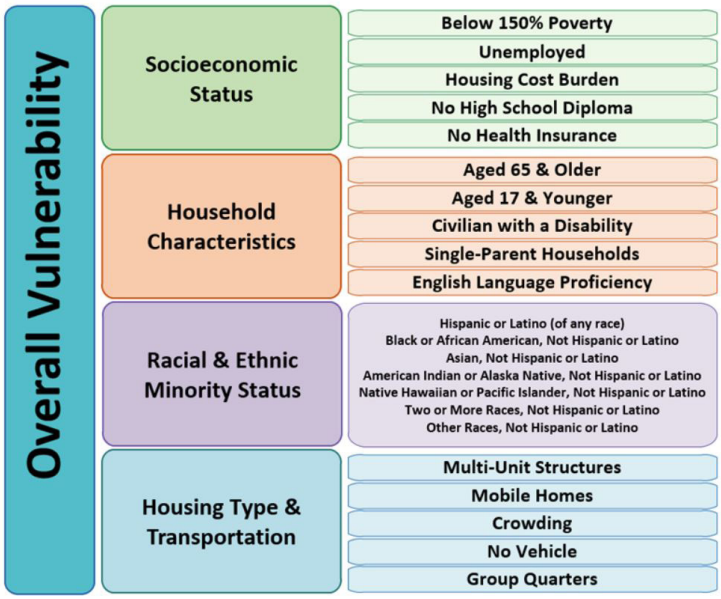
Chapter 14 of the Town's Code of Ordinances is the Flood Damage Prevention Ordinance. In an effort to minimize flood dangers and property damage the Town of Kitty Hawk requires buildings to be elevated eight feet above the regulatory floodplain for structures located in the VE flood zone (high hazard areas) and an additional one foot for structures located in the AH and AO zones. In A, AE, AH, A99, Shaded X and X zones the Town allows for floodproofing measures in lieu of elevation above the regulatory floodplain. All elevation requirements are applicable to the building and building components such as HVAC equipment, water softener units, ductwork, bath/kitchen fixtures, electric/gas meter panels/boxes, utility/cable boxes, water heaters, and electric outlets/switches.

Beach Maintenance Plan

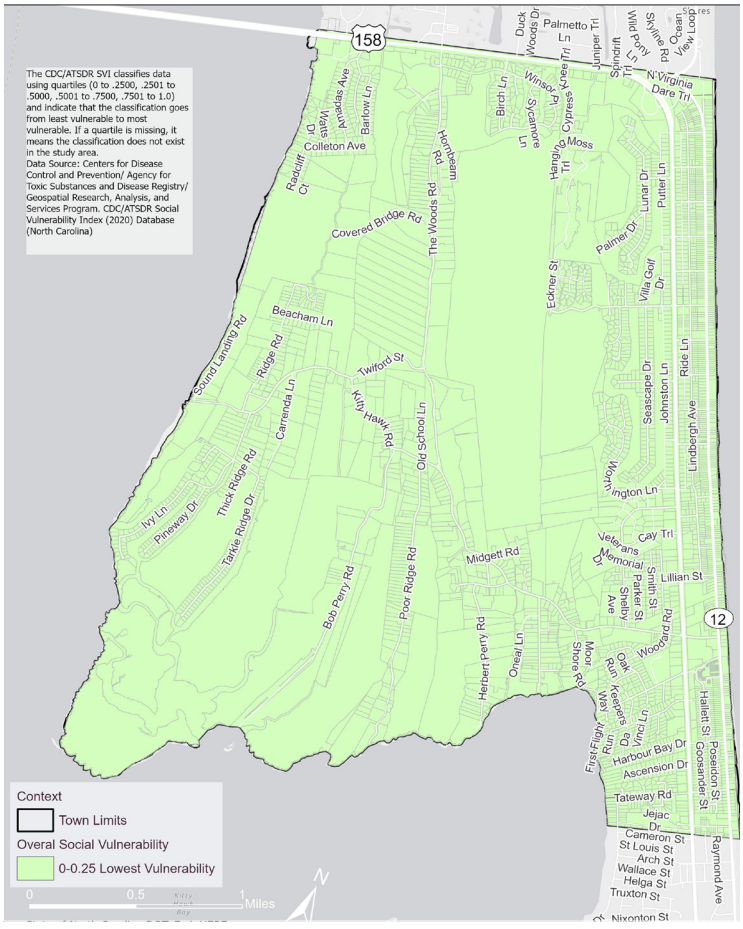
The Town of Kitty Hawk has implemented a shore protection project aimed at: 1) reducing the vulnerability of public infrastructure including NC 12, town roads between NC 12 and U.S. Highway 158, and utilities to storm-induced erosion; 2) reducing flooding in many non-oceanfront areas throughout the Town during ocean overwash conditions, including portions of NC 12 and U.S. Highway 158; and 3) reducing the vulnerability of homes within the Town that front the Atlantic Ocean and are exposed to wave events during nor'easters and other large storm events. In order to accomplish these goals, the Town is taking steps to maintain its oceanfront beach and dune to a configuration that: 1) provides a reasonable level of storm damage reduction; 2) provides a reasonable level of flood reduction; and 3) mitigates long term erosion that could threaten public infrastructure and private property as well as recreational opportunities and biological resources. A key aspect to the long term success of the project is the implementation of a maintenance program to document construction achievements and project performance. The maintenance plan meets the criteria established for 44 CFR 206.22(j)(2). Beach fill and sand fencing was completed in October 2017. Beach renourishment was completed in fall of 2022 and is expected to occur on a 5-year cycle.

Social Vulnerability

The U.S. Centers for Disease Control (CDC) has created a Social Vulnerability Index using Census data trying to estimate social vulnerability using a number of different factors. These include many factors that are compiled into four categories: Socioeconomic vulnerability, household vulnerability, language vulnerability, and transportation vulnerability. This index was consulted and shared with the Community Action Team and the general public when discussing the social vulnerabilities of the Town. The map on the right shows the composite social vulnerability scores by Census Block Group.



Composite Social Vulnerability Index



Since majority of the town is within one Census block group the dataset was not very useful to assess social vulnerability.

The OBX Regional HMP identified at risk populations for the Town of Kitty Hawk. According to the HMP, there are approximately 1,082 total population at risk, 165 elderly population at risk, and 59 children at risk. The consulting team wanted to build upon the information from the CDC and the HMP to help identify where the at risk population lived, if they lived in Kitty Hawk Village or in Kitty Hawk Beach.

Prior to the public meetings, the o built upon this information, the consultants asked residents demographics questions pertaining to age, race, and income at the public meetings on January 25 and 26. Out of the 30 people who participated in filling out their demographic information the findings coincided with the Dare County parcel dataset indicating where owner-occupied housing is located. This data shows that most full-time residents reside in Kitty Hawk Village, very few full-time residents live in Kitty Hawk Beach.

At Risk Populations

Total Population At Risk:

1,082 out of 3,270 (33.1%)

Elderly Population At Risk(65 & older):

165 out of 498 (33.1%)

Children At Risk:

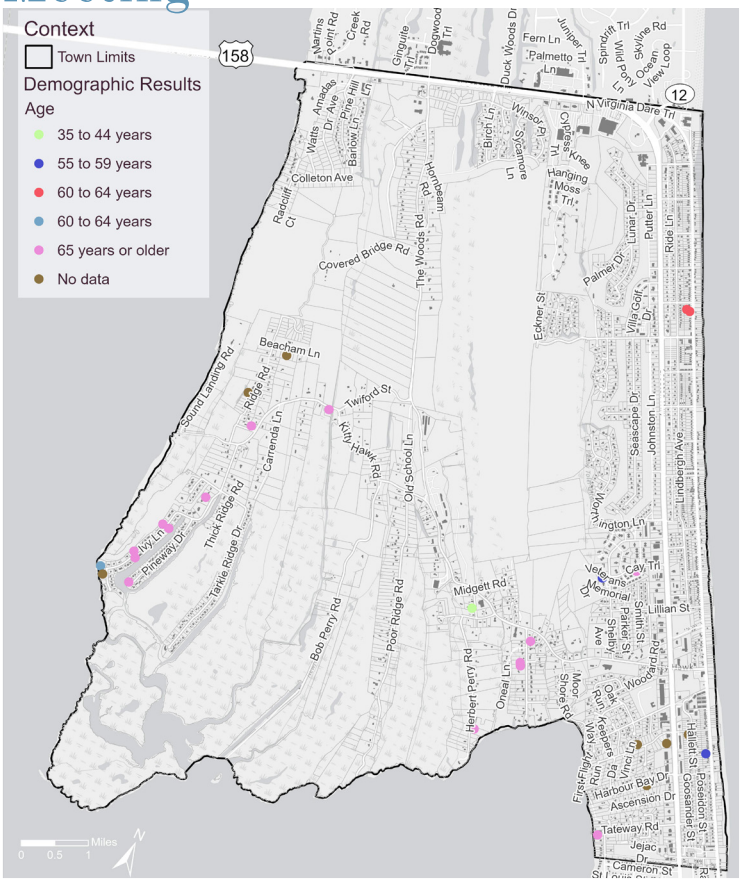
59 out of 177 (33.3%)

(Source: Outer Banks Regional Hazard Mitigation Plan, June 2020)

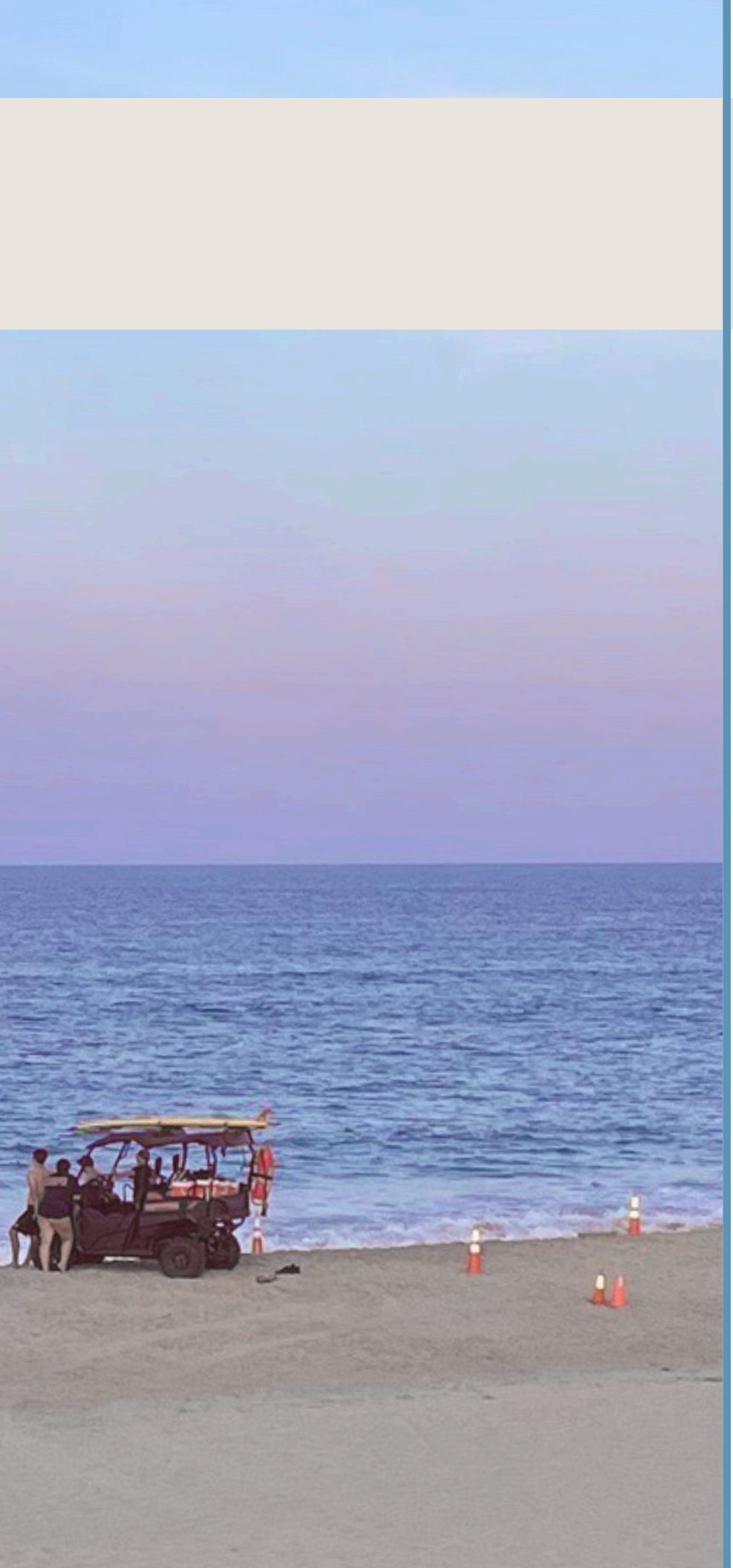
The data collected regarding race and income did not add much value, however the age data collected allowed the consultants to identify where people lived. This information coincides with the Using the collected data, the consultants were able to identify Kitty Hawk Landing as a neighborhood with a large number of elderly population (65 & older).

Owner-Occupied Housing

Age Results from Public Meeting



Inventory of Hazards and Assets



5

Chapter Contents

RESILIENT
Kitty Hawk

Hazard Identification

The Town of Kitty Hawk's coastal location makes it vulnerable to a number of hazards. The Resilient Coastal Communities Program stipulates that local hazard mitigation planning should serve as the primary basis for the risk and vulnerability assessment. This chapter of the plan builds on previous work, including the OBX Regional Hazard Mitigation Plan (2020), and identifies hazards that threaten different areas and assets in Kitty Hawk.

Identified Hazards for the Vulnerability Assessment

The RCCP Handbook identifies minimum hazards and stressors to include in the risk and vulnerability assessment. These include flooding (rainfall, tidal, riverine), storm surge, and 30-year sea level rise projections. The *Outer Banks Regional Hazard Mitigation Plan (HMP),* reviewed on page 24, identifies these and other hazards that have the potential to impact the Town of Kitty Hawk and its neighboring communities. In the HMP hazards are assigned values between 1-4 (*the highest possible value is 4*) based on probability (*the likelihood of a hazard event occurring*), impact (*injuries, damage, or death, minor, limited, critical, or catastrophic impacts*), spatial extent (*how large of an area that could be impacted by the hazardous event*), warning time (*lead time or warning measures*), and duration (*how long the event usually lasts*). The hazards identified in the HMP can be seen in the image on this page and are rank from high to low priority.

The following pages provide a brief description of the hazards used for the risk and vulnerability assessment. Hazards included in the assessment were:

- Flooding
- Storm Surge
- Hurricanes and Tropical Storms
- Sea Level Rise
- Wildfire

Probability of Hazards Identified in the OBX Regional Hazard Mitigation Plan

H	• Flooding (storm surge, heavy rainfall, high tide, etc.) • Hurricanes and Tropical Storms • Extreme Heat • Sea Level Rise • Severe Weather (Thunderstorms, Winds, Lightning, & Hail) • Severe Winter Storm • Erosion • Tornados • Wildfire
M	• Drought • Earthquake
L	• Cyber Attacks • Transportation Infrastructure Failure

Hazards are assigned values between 1-4 with the highest value being 4. These values are based on probability, impact, spatial extent, warning time, and duration. The above hazards are ranked from high to low priority based on the plan's risk assessment.

Flooding

Flooding in the Town of Kitty Hawk is a reoccurring hazard, whether it be wind driven, from high tides, heavy rainfall, hurricanes, or tropical storms. Elevation in Kitty Hawk varies significantly. Dunes on the west side of US 158 rise to heights of 50 feet or more and the western part of the Town is made up of a series of ridges and creeks running north to south. Many ridges rise to 15-20 feet in elevation,

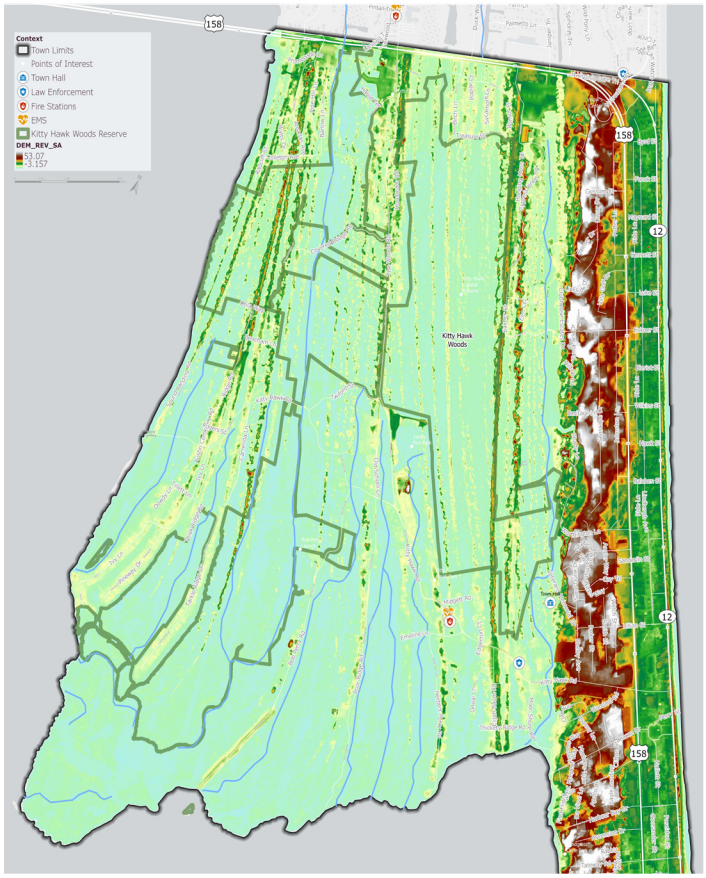
where as land beside creeks and in between ridges is only 1-2 feet in elevation.

A significant amount of the town is located in the 100 year floodplain. Reoccurring flooding has been an ongoing issue due to the fact that there are many low-lying areas. For this reason, the Town requires buildings in high flood hazard areas to elevate the building and mechanical equipment 8 feet above the regulatory floodplain in the VE flood zone and an additional one foot for structures located in zones AH and AO.

Land adjacent to creeks along Kitty Hawk Road is low in elevation

Floodplain Map

Elevation Map



Heavy Rainfall, Ocean Overwash and Localized Flooding

According to NOAA, there is no single definition for extreme or heavy rainfall but a good benchmark is a month's worth of rain falling in one day. Heavy rainfall can cause dangerous driving conditions, especially in low-lying areas on the ocean and sound sides of Kitty Hawk. Average annual rainfall in Kitty Hawk is 49 inches. August is the wettest month with an average of 6 inches. October through May are the driest months out of the year with an average between 3.1 inches to 4.1 inches of rain per month. June through August are the wettest months out of the year for the town with an average of 3.8 inches to 6 inches of rain per month.

Ocean overwash has occurred east of US 158. The town has sump pumps that pump the water out of the roadways and into the Atlantic Ocean. The Town maintains a system consists of 7 pumps that remove standing water on streets to assist in emergency vehicle response. Currently pumps are located at Byrd St., Fonck St, Bennett St., Hawks St., Starfish Ln., Hallet St., and Tateway Ave. There are no pumping stations located on the soundside due to discharge limitations in the Albemarle Sound.

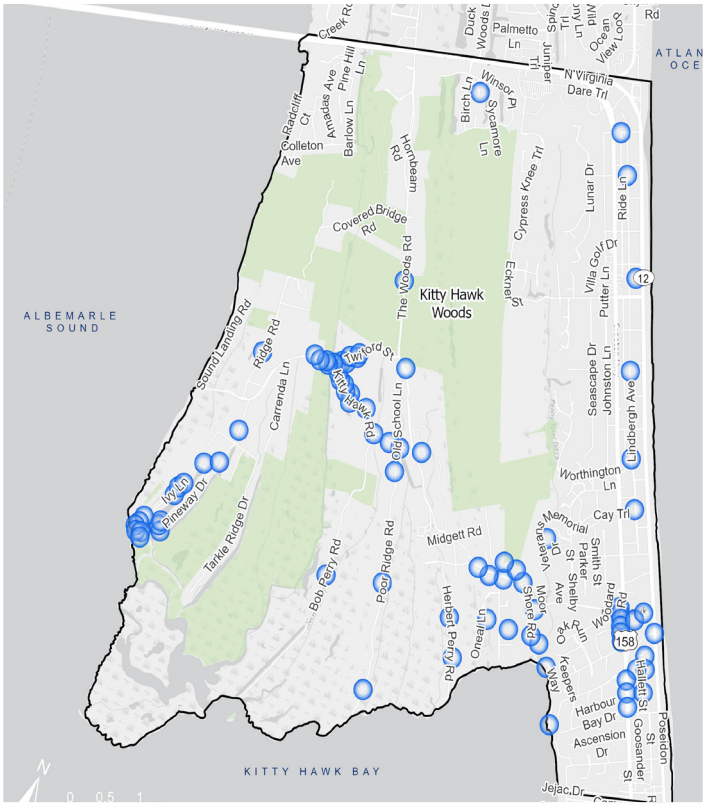
Utilizing data from several sources and from community input, the project team was able to identify critical facilities, transportation routes, utilities, and natural resources that are prone to flooding.

King or Exceptionally High Tides

Tide levels impact the ocean side of Kitty Hawk and the soundside. According to NOAA, a king tide or an exceptionally high tide typically occurs during a new or full moon phase and are caused by the interactions among the gravitational fields of Earth, the sun, and the moon. Along North Carolina's coast, the associated rise and fall of the water level yields two high and low tides per day. The difference in

Flooding on the 4200 block of Lindbergh Avenue from a heavy rainfall.

Localized Flooding Map



high and low tides is largely determined by the adjacent continental shelf. The Mean Lower Low Water (average height of the lowest tide) to Mean Higher High Water (average height of the highest tide) is 3.7 feet in Duck. (*NC Climate Science Report, 2020*) The strongest interannual tides along the North Carolina coast has a 4.4–year cycle and will cause high tides to vary by approximately 5% over this period (*Haigh et al 2011, Ray and Merrifield, 2019).* During this period, king tides can contribute to rises in sea level and enhanced coastal flood risk (*Eliot, 2010*).

The table on the previous page shows 2023 published high tides. In 2023, the highest high tides occurred in late summer to early fall months, typically during a new moon phase. In the vulnerability and risk assessment, king or exceptionally high tides were considered with analyzing adaptive capacity. Kitty Hawk and Dare County currently requires for buildings in high-risk flood areas to be elevated by 8 feet.

Storm Surge

Storm surge is an abnormal water level rise generated by a storm (*NOAA, 2024*). Storm surge is primarily caused by strong onshore winds of a hurricane or tropical storm. The wind circulation around the eye of a hurricane causes a vertical circulation in the ocean. When this vertical circulation is interrupted by the ocean bottom in shallow water, it begins to move upward and inland, resulting in storm surge.

The amount of storm surge depends on several factors, including storm intensity, forward speed, size (radius of maximum winds), angle of approach, and the shape and characteristics of the coastline. The Town of Kitty Hawk has many complex features, it is located on a barrier island with the Atlantic Ocean on the east side, the Albemarle Sound on the west side, and Kitty Hawk Bay to the south. Due to its physical features, storm surge impacts both

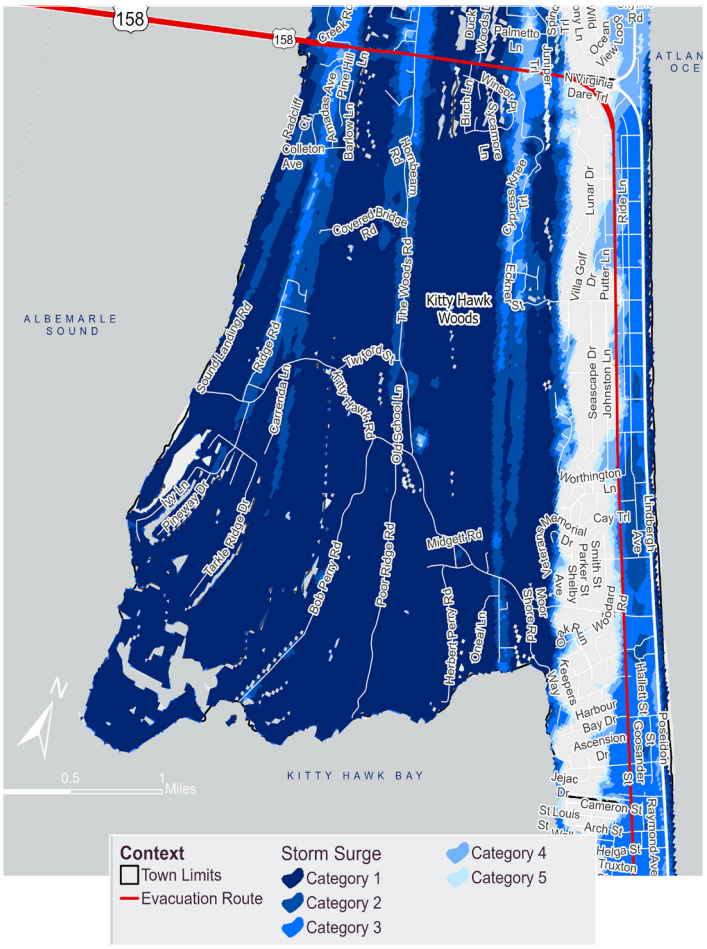
NOAA Annual Published Tides (2023)

Duck Station 8651370

Highest Tide Levels in 2023

1.	Jan 21	4.1 feet	6:40 AM	●
2.	Feb 20	4.0 feet	7:17 AM	●
3.	March 21	3.8 feet	7:59 AM	●
4.	April 12	3.6 feet	12:24 AM	○
5.	May 18	4.1 feet	7:38 PM	◐
6.	June 5	4.2 feet	9:22 PM	○
7.	July 1	4.1 feet	6:32 PM	◐
8.	August 1	4.5 feet	8:02 PM	○
9.	Sept 29	4.5 feet	7:53 AM	○
10.	Oct 3	4.4 feet	9:28 PM	○
11.	Nov 14	4.2 feet	7:33 AM	●
12.	Dec 13	4.1 feet	7:13 AM	●

Storm Surge Map



the west and east sides of town depending on the direction of wind and approach angle of the storm.

In a Category 1 hurricane event, approximately 41% of the land area is impacted by storm surge and 7 critical facilities are impacted. In a Category 2 hurricane event, approximately 54% of the land area. The dunes west of US 158 are the only areas not impacted by large storm surges.

Hurricanes and Tropical Storms

Hurricanes and tropical storms are classified as tropical cyclones which form over tropical or subtropical waters. A tropical cyclone is a rotating low-pressure system that has organized thunderstorms but no fronts (a boundary separating two air masses of different densities) (*National Hurricane Center*). These cyclones are classified by maximum sustained winds; a tropical depression has maximum sustained surface winds of less than 39 miles per hour (mph) and a tropical storm has maximum sustained winds of 39 mph or higher. When a storm's maximum sustained winds reach 74 mph it is called a hurricane. The Saffir-Simpson Hurricane Wind Scale includes a 1 to 5 rating based on maximum sustained wind speed and estimates potential property damage (See tables on pages 39 and 40) Major hurricanes are those rated Category 3 and higher.

All hurricane categories produce life-threatening winds and are often accompanied by deadly storm surge (see "Storm Surge Map" on page 37 and "Storm Surge" section on page 37), rain-induced flooding, and tornadoes. Such hazards require people to take protective action, such as evacuating the Town. The most destructive hurricanes in North Carolina history have struck in September and October. Property owners should begin preparation for potential hurricanes early each year and should know where available shelter spaces are, have protective measures in place to minimize damage to personal property, familiarize themselves with evacuation routes, use the Town's website for local disaster recovery resources, and download the FEMA mobile application for weather alerts, disaster resources, and safety tips.

Fallen tree from Hurricane Matthew in October 2016

Flooding from Hurricane Irene in 2011

According to NOAA, the intensity and frequency of hurricanes will increase over the future. NOAA scientists have observed steadily increasing ocean surface water temperatures and warmer surface waters typically indicates increased hurricane activity. Due to its coastal location, hurricanes, tropical storms, and nor'easters have impacted the Town of Kitty Hawk. Wind impacts usually affect the Town uniformly, while storm surge affect the Atlantic Ocean side and the Albemarle Sound side of the Town differently, depending on tide and height of the surge (page 37).

Dune erosion from Hurricane Dorian in 2019

Saffir-Simpson Scale			
Hurricane Category	**Wind Speed(mph)**	**Storm Surge (feet above normal)**	**North Carolina Example(that made landfall in North Carolina)**
1	74-95	4-5	Hurricane Bertha (1996) Hurricane Ernesto (2006) Hurricane Charley (2004) Hurricane Sandy (2012) Hurricane Matthew (2016) Hurricane Florence (2018) Hurricane Dorian (2019)
2	96-110	6-8	Hurricane Isabel (2003) Hurricane Arthur (2014)
3	111-130	9-12	Hurricane Irene (2011) Hurricane Fran (1996)
4	131-155	13-18	Hurricane Floyd (1999) Hurricane Hazel (1954)
5	>155	>18	

Flooding from heavy rainfall and storm surge is not the only impact from hurricanes. The Town also deals with property damage from fallen trees and other debris, beach erosion, damage to the dunes, and soundside shoreline erosion. Some of the most damaging hurricanes according to Dare County storm damage reports were Hurricane Irene, Hurricane Matthew, Hurricane Sandy, and Tropical Storm Michael.

For the risk and vulnerability assessment, data from Sea, Lake, Overland Surge from Hurricanes (*SLOSH*) was used to determine potential flooding impacts for critical facilities from wind or storm driven storm surge. The consultants used data from the Category 1 or Category 2 storm events since these categories inundate 41%-54% of land area in the Town of Kitty Hawk. The consultants utilized the Coastal Roadway Inundation Simulator (CRIS) to developed by North Carolin Department of Transportation (NCDOT) and North Carolina Emergency Management (NCEM) to assess transportation routes.

Similar to hurricanes, nor'easters are ocean storms that are capable of doing substantial damage due to their strong winds and heavy surf.

Damage from Hurricanes

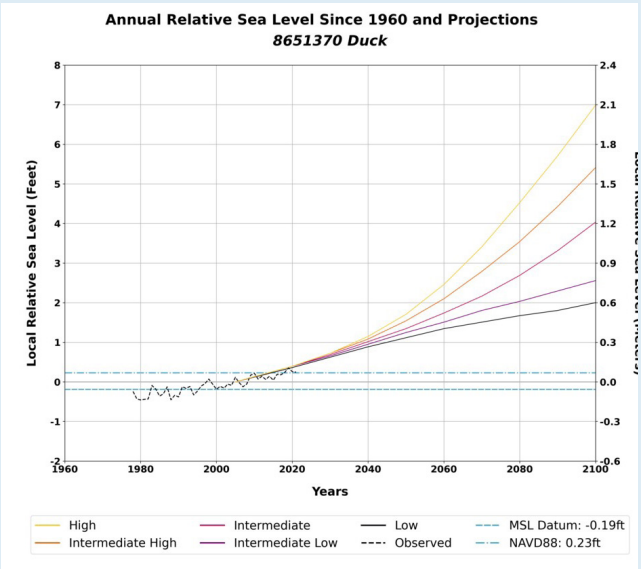
Hurricane Category	*Expected Damage*
1	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months

Source: Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model, NOAA

Sea Level Rise

Rates of sea level rise can vary significantly from the globally average rate and is manifested as relative sea level rise. Tide gauge are used to collect and observe sea level changes and are located at stations along the coast. The closest station to Kitty Hawk is located in Duck (Station ID number 8651370). This station analyzes sea level trends measured by tide gauges to represent local relative sea level trends.

Observation-based extrapolations using tide-gauge data collected from 1978 to 2023 are shown in the chart below. Five scenarios show extrapolations extended out to 2100, with near-term estimates from 2020-2060 ranging from 0.4 to 0.75 meters and long-term estimates from 2050-2100 ranging from 0.6 to 2.1 meters. The projections for these five sea level rise scenarios are expected to assist local decision makers in responding to local relative sea level rise.



The figure shows the station's annual mean sea level rise since 1960 and five sea level rise scenarios plotted relative to a 1996-2014 baseline period, with the year 2005 as the 'zero' for the figure. The relative Mean Sea Level (MSL) datum established by CO-OPS is also shown. The relative position of th geodetic datum NAVD88, which is the 'zero' used for land elevations. Source: NOAA Station ID 8651370

NOAA Tide Gauge Data

Sea Level Rise Trends:

4.88 mm/year

Relative Sea Level Trend

.56 mm/yr

Monthly Sea Level Data observed from 1978 to 2023

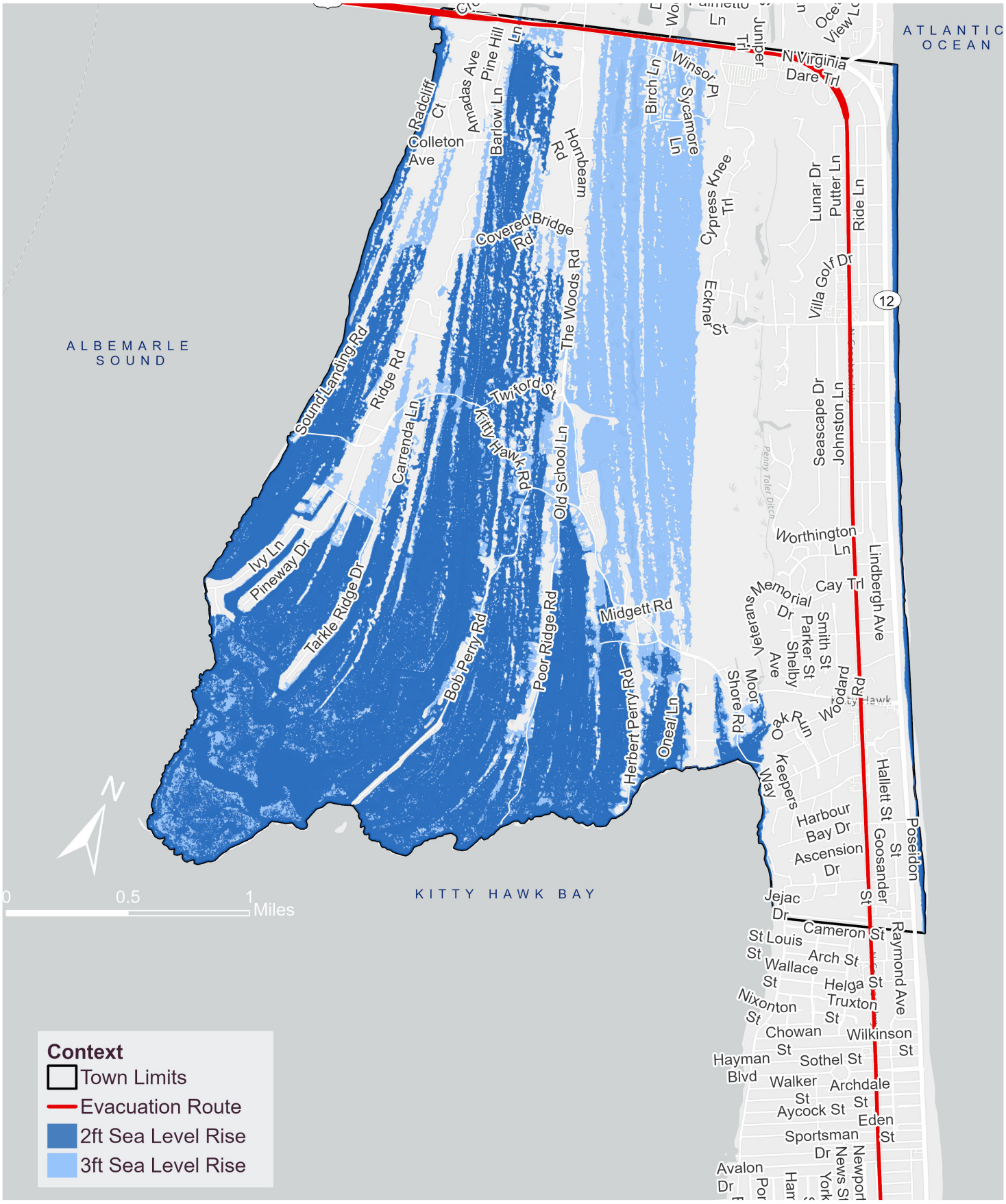
The observed data is equivalent to a change of 1.60 feet in 100 years.

(Duck Station 8651370)

According to the 2022 Sea Level Rise Technical Report, the southeastern region of the United States has been are tracking between the Intermediate and Intermediate High scenarios. The observed data at Duck has been tracking along the Intermediate to Intermediate High scenario. Meaning that the sea level rise in the Town of Kitty Hawk is anticipated to see between 1.80 feet (Intermediate) and 2.17 feet (Intermediate High) by 2060. By 2080, the town is anticipated to see an increase in sea level up to 2.76 feet (Intermediate) or 3.61 feet. Changes in sea level are directly linked to atmospheric and oceanic processes. These changes include increasing temperatures, hydrologic cycles, melting glaciers and ice sheets, and increased frequency and intensity of storms.

Planning for future conditions and more frequent and intense storms is imperative. Especially since 3,689 ***(2020 Decennial Census)*** people are at risk in the Town of Kitty Hawk with 22% of its population being 65 and older and 5% considered minority.

Sea level rise will affect current and future development in Kitty Hawk. As sea levels rise, the


ATLANTIC OCEAN
ALBEMARLE SOUND
KITTY HAWK BAY
Colleton Ave
Radcliff Ct
Amadas Ave
Pine Hill Ln
Barlow Ln
Hornbeam Rd
Birch Ln
Sycamore Ln
Winsor Pl
Juniper Trl
Virginia Dare Trl
Cypress Knee Trl
Lunar Dr
Putter Ln
Ride Ln
Villa Golf Dr
Eckner St
Covered Bridge Rd
The Woods Rd
Sound Landing Rd
Ridge Rd
Twiford St
Kitty Hawk Rd
Old School Ln
Carrenda Ln
Ivy Ln
Pineway Dr
Tarkle Ridge Dr
Bob Perry Rd
Poor Ridge Rd
Midgett Rd
Herbert Perry Rd
Oneal Ln
Seascape Dr
Johnston Ln
Worthington Ln
Cay Trl
Lindbergh Ave
Memorial Dr
Veterans Ave
Parker St
Smith St
Shelby Ave
Moor Shore Rd
Oak Run
Woodard Rd
Keepers Way
Harbour Bay Dr
Ascension Dr
Hallett St
Goosander St
Poseidon St
Jejac Dr
Cameron St
Raymond Ave
St Louis St
Arch St
Wallace St
Helga St
Truxton St
Nixonton St
Chowan St
Wilkinson St
Hayman Blvd
Sothel St
Walker St
Archdale St
Aycock St
Eden St
Sportsman Dr
Newport News St
Avalon Dr
12
0
0.5
1
Miles
Context
Town Limits
Evacuation Route
2ft Sea Level Rise
3ft Sea Level Rise

land's capacity to absorb rainfall will be reduced, making its residents more vulnerable to storms. Storm surge from a hurricane or nor'easter will build upon a high base water level, resulting in larger areas of inundation.

Using the high scenario, two feet of sea level rise is anticipated as early as 2057. The intermediate high scenario predicts two feet of sea level rise as early as 2059. The intermediate scenario predicts two feet of sea level rise as early as 2065.

Most homes today are built to last approximately 50 years, whereas larger buildings or infrastructure (i.e.,schools, churches, fire, police, emergency services) are built to last 100 years and beyond. Why is this important? For projects involving larger life spans where a loss may be catastrophic the higher sea level rise scenario should be considered. For projects with a shorter lifespan or projects that are designed to flood (ie., parks, bike paths, golf courses) lower sea level rise scenarios may be more appropriate.

When considering investment and land use in the future, it is imperative to consider factors such as; is the asset critical, is it vulnerable to flooding, how quickly it can be repaired, and how many people will be affected by a disruption in service from the asset. Critical assets should be sited and designed using the high scenario when planning for the future conditions of Kitty Hawk.

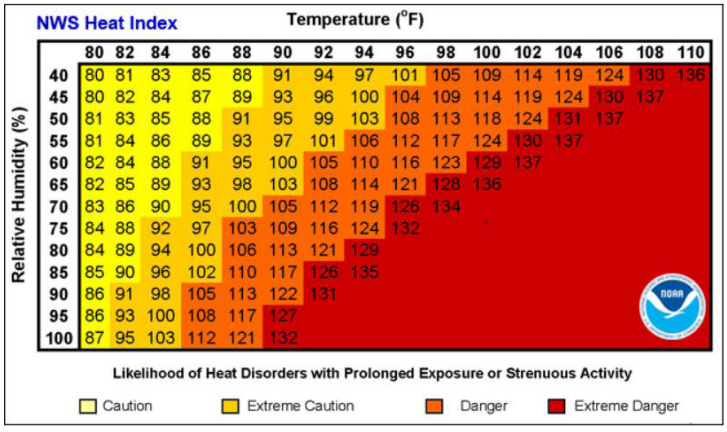
Out of all of the critical assets shown on the Critical Assets with Current and Future Flooding Map on page 59 three privately owned structures are impacted by future sea level rise and one publicly owned structure (this one is designed to flood). There are over 3,500 buildings and structures in the Town of Kitty Hawk, there are only 105 buildings impacted by 2 feet sea level rise. Majority of the buildings that are impacted by future sea level rise are not primary buildings or structures.

Extreme Heat

According to FEMA, extreme heat is defined as a long period (2 to 3 days) of high heat and humidity with temperatures above 90 degrees. The effects of excessive heat on the human body can be devastating, especially for older adults, children, and sick or overweight individuals. The human body works extra hard to maintain a normal temperature, which can lead to death. (*FEMA, 2024*) Extreme heat is responsible for the highest number of annual deaths among all weather-related hazards. According to the National Weather Service, in 2022 extreme heat fatalities resulted in 148 deaths.

During extreme heat events, outdoor activities should be reduced or eliminated, eat light easy-to-digest foods and drink plenty of water, use portable fans or spend time in air-conditioned locations, and make sure to check on others, especially older adults, people with children or infants, people taking certain medications, pregnant women, people with limited mobility or living alone. On extreme heat days, the Town of Kitty Hawk should work with private organizations to help spread the word about cooling locations.

Heat index is used to determine how warm the outside temperature feels when relative humidity is factored in. The Heat Index chart on the below uses both temperature and relative humidity to produce



Source: National Weather Service

a guide using degrees Farenheit. For instance, the red area on the chart without numbers indicates extreme danger. The National Weather Service will initiate alert procedures in the from of advisories or warnings when the Heat Index is expected to exceed 105°–110°F.

The North Carolina Climate Office collects data from stations that indicate the number of hours in a given year where the heat index reached or exceeded 100°F. The closet station is located in Kill Devil Hills at the First Flight Airport (KFFA). Data collection ranges from 2005–2023. In 2016, there were a total of 281 hours where temperatures exceeded 100°F. Since 2016, the number of hours of extreme heat have decreased. However, long term projections from the Fourth National Climate Assessment indicate the number of days over 95°F are expected to increase between by between 20 and 30 days annually in the Kitty Hawk Area (OBX Regional Hazard Mitigation Plan, 2020).

Humidity increases the feeling of heat as measured by a heat index.

Wildfires

Kitty Hawk is home to the Kitty Hawk Woods Preserve which is a 1,450 acre preserve that consists of maritime forest, salt brackish marsh,

Heat Index Counts* for First Flight Airport (KFFA)

2005 to 2024

Year	100-104	105-109	110-114	≥115	Total
2005	31	19	3	0	53
2006	86	47	18	9	160
2007	35	14	7	6	62
2008	34	10	2	0	46
2009	17	0	0	0	17
2010	65	31	13	0	109
2011	7	5	0	0	12
2012	22	1	0	0	23
2013	2	0	0	0	2
2014	13	0	0	0	13
2015	53	35	6	0	94
2016	117	95	40	29	281
2017	30	4	0	0	34
2018	4	0	0	0	4
2019	28	5	0	0	33
2020	38	2	0	0	40
2021	7	0	0	0	7
2022	20	0	0	0	20
2023	14	2	0	0	16
Sum	623	270	89	44	1026
Average	31	14	4	2	51

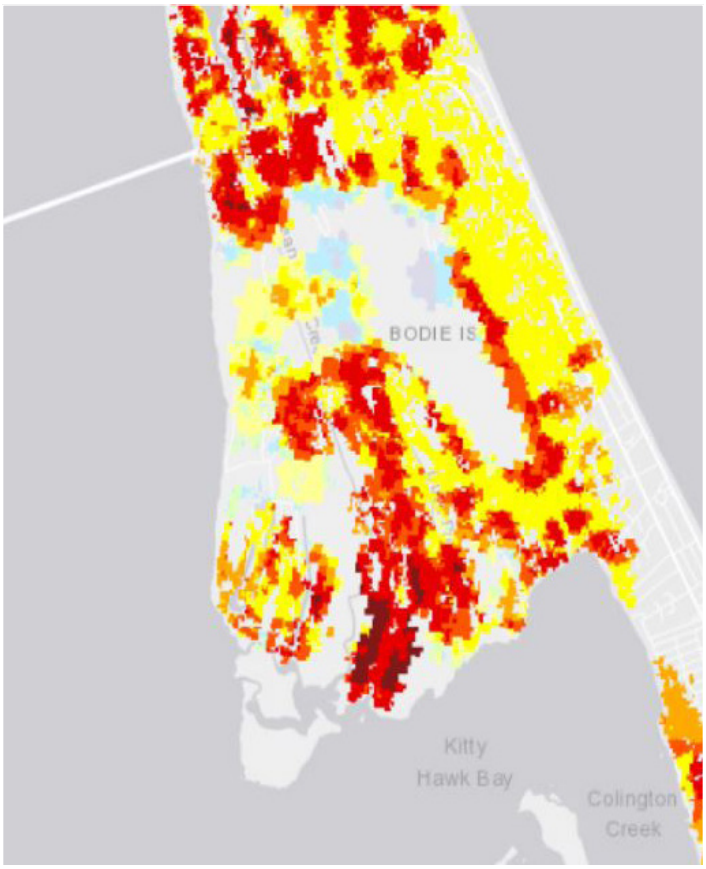
*Counts are defined as the number of hours in a given year where the heat index reached or exceeded 100 degrees Fahrenheit.

Source: North Carolina Climate Office, Kill Devil Hills First Flight Airport, 2005-2023

estuarine shrub/scrub, and managed pineland. It is located south and west of US 158. Residential areas including neighborhoods just west of US 158 and along Kitty Hawk Road are located in what is known as the Wildland Urban Interface (WUI). The WUI is described as, "the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels, and thus demarcates the spatial extent of wildfire risk (OBX Regional Hazard Mitigation Plan, 2020)." The location of existing residential areas, many exceeding 3 homes per acre, in close proximity to the large blocks of maritime forest lead to increased risk of wildfire, especially in times of prolonged drought.

Residential development in the Wildland Urban Interface near Kitty Hawk Woods Preserve

Wildland Urban Interface



Source: Southern Group of State Foresters Risk Assessment Portal, Wildland Urban Interface Map

Inventory of Assets

What are Community Lifelines?

FEMA Community Lifelines are used to identify assets that provide fundamental services for the community. These integrated network of integrated assets, services, and capabilities provide key services used to support reoccurring needs of the community. When disrupted, rapid re-establishment or employment of contingency response solutions are required.

Critical Assets

FEMA's Community Lifelines are a good starting point for providing a framework for which of the Town's critical assets should be included in the risk and vulnerability assessment. In addition to structural assets, the Town has natural "green" infrastructure that reduces risk of and exposure to flooding, heat, and wind.

The Resilient Coastal Communities Program requires certain critical assets and natural infrastructure to be included in the risk and vulnerability assessment. Critical assets that were included in the risk and vulnerability and its associated community lifeline can be seen in the list on the right of this page. The Town's critical assets and natural infrastructure are discussed and mapped in the following section.

Kitty Hawk Fire Department, Kitty Hawk Police Department, Kitty Hawk Public Works, Town Hall, Southern Shores Fire Station #12, Southern Shores Police Department, Suction Basins/standpipes, & Dare County Highway Patrol

Food Lion, Walmart, Harris Teeter, Unitarian Universalist Congregation of the Outer Banks, Holy Redeemer Catholic Church, Lighthouse Christian Fellowship,& Kitty Hawk Baptist Church

Therapy Center, Urgent Care, Primary Care, & Pharmacy

Dare County Water Department & Private Septic Systems

Mobil, Citgo, BP, Shell, 7-Eleven Northern and Southern Kitty Hawk, Dominion Energy, & Dominion Substation

United States Postal Service

NC 158, NC 12, Moor Shore Rd., W. Kitty Hawk Rd., & Twiford St.

Waste and Recycling Center and Boat Launch

Critical assets include community lifeline components and built infrastructure that provides benefits to the community. Critical assets are those that enable the continuous operation of critical government and business functions and are essential to human health and safety.

These maps are mapped and categorized by asset type. The Critical Assets map (page 48) identifies the location of each asset and includes the following:

- Building Supplies
- Electric
- Emergency Services (Police, Fire, EMS)
- Gas and Fueling Stations
- Government Services
- Grocery Stores
- Medical Offices and Supplies
- Religious Buildings
- School (in Southern Shores)
- Water Access

Required Critical Assets

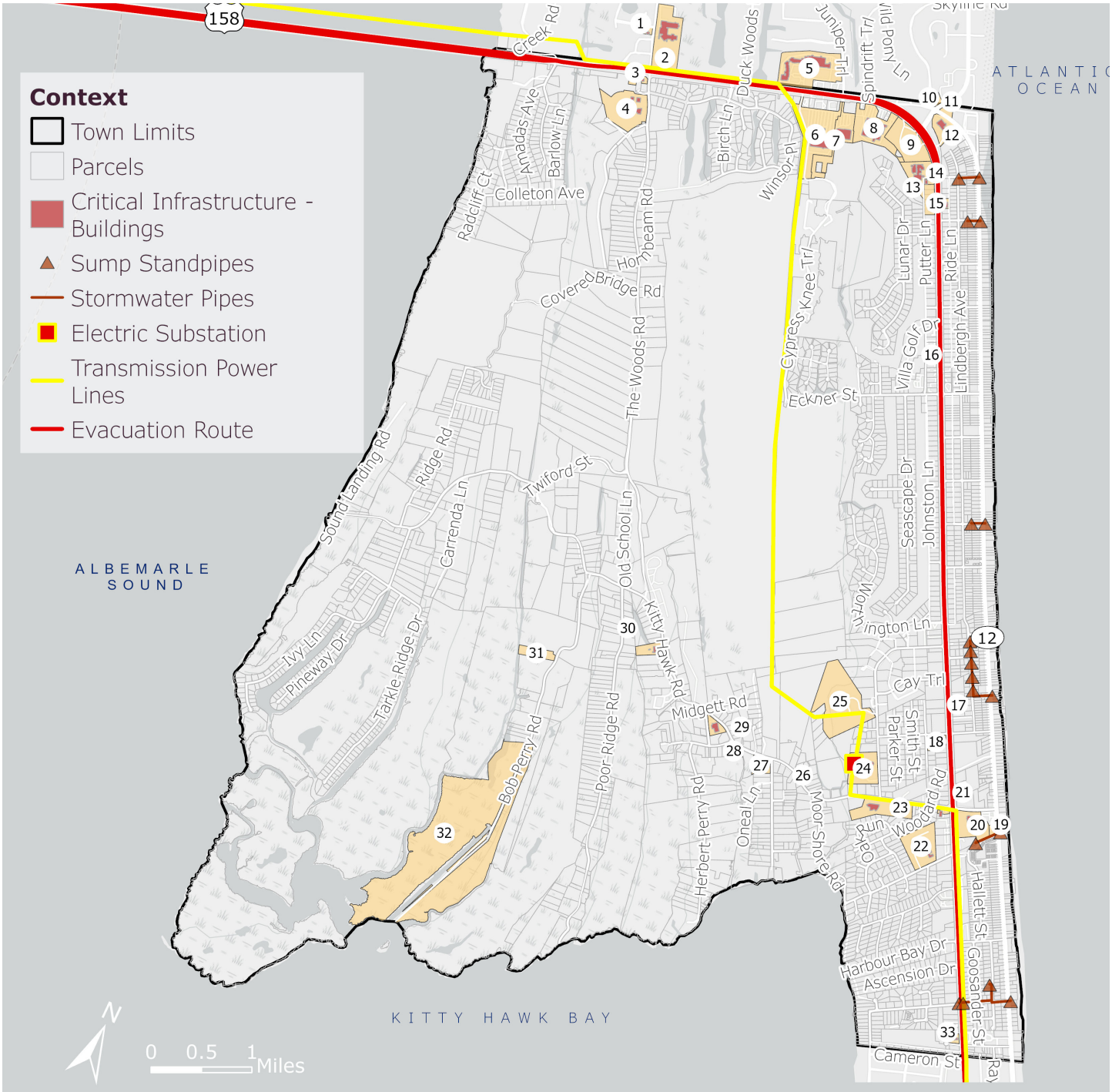
Building Infrastructure Summary

The tables below provide a summary of asset by type, estimated value, and ownership.

Summary of Asset Ownership and Value	
Asset Ownership	**Estimated Value**
Private	$115,170,620
Public	$57,818,982
Total	**$172,989,602**

Summary of Asset Type and Value	
Asset Type	**Estimated Value**
Building Supplies	$11,868,000
Electric	$30,778,673
Emergency Services	$8,748,616
Fuel	$7,705,021
Government	$11,320,385
Grocery	$35,537,300
Medical	$15,545,900
Religious	$18,607,033
School	$31,061,800
Water Access	$1,816,874
Total	**$172,989,602**

Critical Infrastructure



1 - Emergency Services - Fire/EMS
2 - Kitty Hawk Elementary
3 - Gas Station (7-Eleven)
4 - Dominion Energy Office
5 - Food Lion
6 - Walmart
7 - Harris Teeter
8 - Home Depot
9 - Outer Banks Visitor's Center
10 - Emergency Services - Police
11 - Gas Station (BP)
12 - Walgreens
13 - Beach Medical, Bear Drugs, Future PD
14 - Medical Office - Therapy Center
15 - Medical Office - Urgent Care, Primary Care
16 - Gas Station (Shell)
17 - Gas Station (Mobil)
18 - Religious - Kitty Hawk Baptist Church
19 - Lifeguard Station
20 - USPS
21 - Gas Station (7-Eleven)
22 - Religious - Lighthouse Christian Fellowship
23 - Religious - Holy Redeemer Catholic Church
24 - Dominion Substation
25 - Town Hall
26 - Emergency Services - Police
27 - Religious - Kitty Hawk Methodist Church
28 - Religious - Unitarian Universalist Congregation of the Outer Banks
29 - Emergency Services - Fire
30 - Public Works
31 - Waste and Recycling Center, Bob Perry Boat Launch
32 - Vulcan Materials
33 - Gas Station (Citgo)
34 - Emergency Services - State Highway

Natural Infrastructure

Kitty Hawk has a variety of natural assets, including public trust waters, coastal and non-coastal wetlands, dunes, Natural Heritage Areas, maritime forests, and other areas of high biodiversity. The Town of Kitty Hawk has two distinct areas; Kitty Hawk beach is where the tourists and retirees stay and Kitty Hawk Village, where year-round residents live. Each area is unique in its characteristics. Kitty Hawk beach is the typical coastal resort town, with a mixture of land uses including short-term rentals, hotels, restaurants, and retail businesses with the east side consisting of public beach access areas, dunes, and the beach. In contrast, Kitty Hawk Village this low-lying area consists of dune ridges, large live oak trees, wetlands with a small village area and some residential neighborhoods along some high ridges.

Coastal and Non-Coastal Wetlands

Coastal wetlands include the existing salt/brackish marshes (approximately 1,508 acres using NCCREWS data) along the Kitty Hawk Bay and Albemarle Sound shorelines. Non-coastal wetlands include managed pinelands, estuarine shrub/scrub, pine flats, freshwater marches, and human impacted wetlands. Whether considered coastal or non-coastal, wetlands are usually covered with plants known as hydrophytes because they can live in water.

The soils in wetland areas are known as hydric soils because they were formed under water-logged conditions. Hydric soils have distinct color, texture and sometimes odor. The presence of hydric soils indicated the area was once a wetland, but that does not mean the area still functions as a wetland.

Wetlands perform various functions, including acting as efficient and cost-effective filtration systems by trapping sediment and removing nutrients and harmful components before water

enters creeks and the sound. In addition, wetlands have the ability to store large amounts of water to slow and prevent rapid runoff from stormwater into brackish estuaries.

Vegetation in wetland areas is often very dense, offering protection by absorbing energy and reducing wave action during storm events. The dense vegetation traps sediment and encourages sediment deposition helping stabilize shorelines.

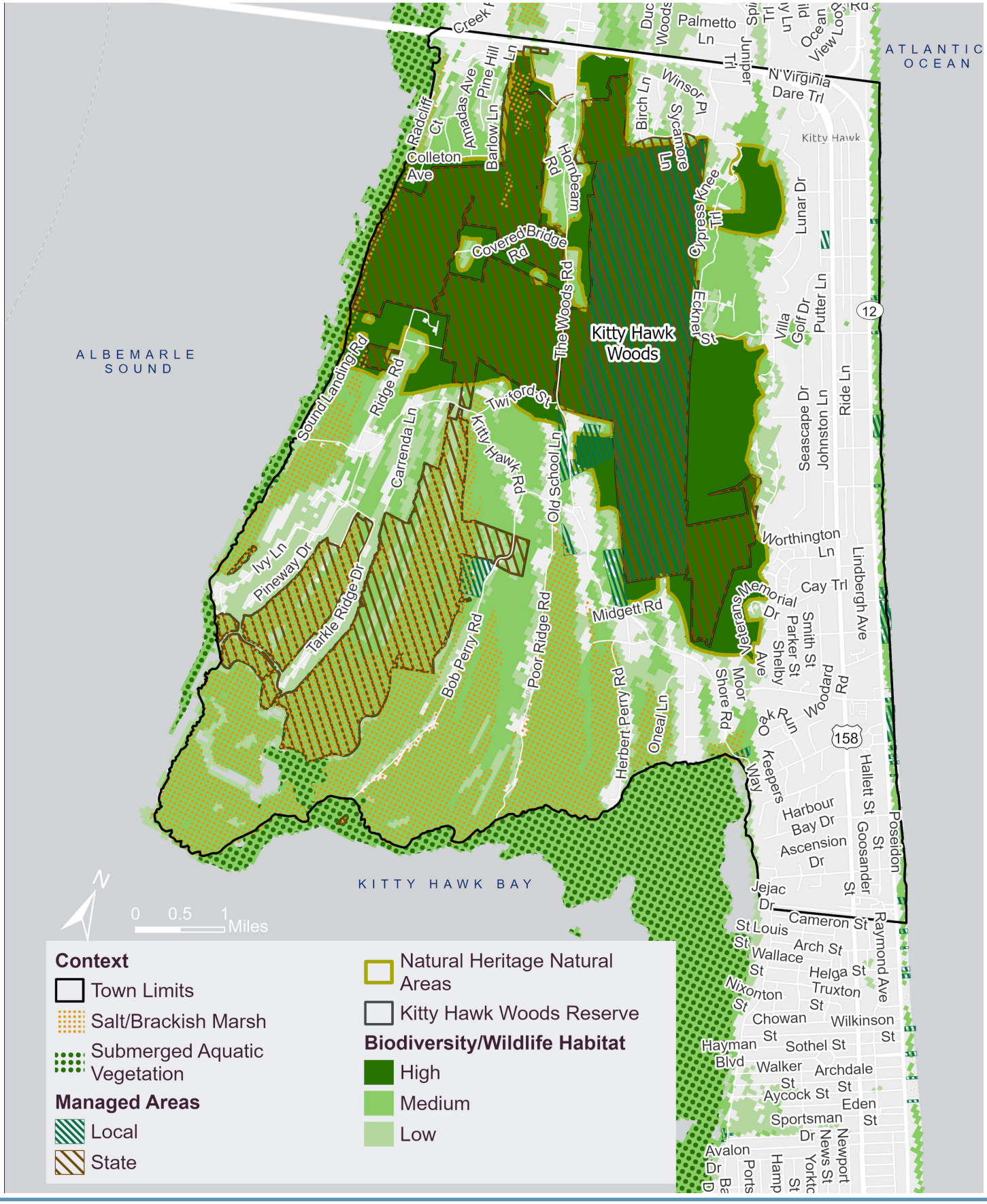
Coastal wetlands (salt marsh) provide nursery areas for finfish and shellfish and are some of the most productive natural systems in the world. Salt marshes are under threat from incompatible land and water uses, boats wakes, more intense and wetter storms, and sea level rise. These threats require urgent action. In May 2024, the NC Coastal Federation with support from the South Atlantic Initiative (SASMI) produced the North Carolina Salt Marsh Action Plan (NC SMAP). This plan outlines a five-year strategy to protect, restore, and allow for the migration of slam marshes in coastal North Carolina to minimize the loss and degradation of their existing ecological, economic, and cultural functions.

As part of the risk and vulnerability assessment coastal marsh migration and wetland restoration potential was assessed.

Other Natural Resources

With its unique characteristics, Kitty Hawk's natural resources differ from the beach side to the village side. On the beach side, areas of biodiversity are along the dune line that protects local businesses and residences from ocean overwash. Whereas, Kitty Hawk Village has areas of biodiversity ranging from low-to-high. The areas with highest biodiversity include the Significant Natural Heritage Area, Kitty Hawk Woods. Kitty Hawk Woods is the most extensive and diverse example of a Maritime Deciduous Forest and Maritime Swamp Forest occurring together. Kitty Hawk Woods has been known to host avian species including warblers, woodpeckers, hawks, wren, and other various songbirds. The deeper swales are home to wood ducks. Within the marsh area, there are herons, egrets, geese, ducks, swans, gulls, and rails. These areas also are inhabited by mammals such as muskrats and river otters. The swales and ponds support a high density and variety of amphibians and reptiles, such as, green tree frog, southern leopard frog, eastern mud turtle, snapping turtle, northern water snake, and brown water snakes. Upland areas are home to mammals such as opossums, raccoons, rabbits, gray foxes, eastern gray squirrels, and white-tailed deer. This area is owned and management responsibility is shared by the Town of Kitty Hawk and the North Carolina Coastal Reserve Program. Kitty Hawk Woods is part of the Coastal Reserve Program, a program of the NC DCM, a division of the NC DEQ. Existing conservation easements in Kitty Hawk Woods are based on the Coastal Reserve Program regulations and policies.

Town-owned and managed areas consist of approximately 533 acres that include parks, public beach access, and open space. Some of these town owned areas are prone to flooding and provide both economic and cultural benefits to the town's residents and visitors.


ATLANTIC OCEAN
ALBEMARLE SOUND
KITTY HAWK BAY
Kitty Hawk Woods
Kitty Hawk
N Virginia Dare Trl
Colleton Ave
Radcliff Ct
Amadas Ave
Pine Hill Ln
Barlow Ln
Hornbeam Rd
Birch Ln
Winsor Pl
Sycamore Ln
Cypress Knee Trl
Lunar Dr
Covered Bridge Rd
The Woods Rd
Eckner St
Villa Golf Dr
Putter Ln
Ride Ln
Johnston Ln
Seascape Dr
Sound Landing Rd
Ridge Rd
Twiford St
Kitty Hawk Rd
Old School Ln
Carrenda Ln
Ivy Ln
Pineway Dr
Tarkle Ridge Dr
Bob Perry Rd
Poor Ridge Rd
Herbert Perry Rd
Oneal Ln
Midgett Rd
Worthington Ln
Cay Trl
Lindbergh Ave
Veterans Memorial Dr
Parker St
Smith St
Shelby Ave
Moor Shore Rd
Woodard Rd
Keepers Way
Harbour Bay Dr
Ascension Dr
Hallett St
Goosander St
Poseidon
Jejac Dr
Cameron St
Raymond Ave
St Louis St
Arch St
Wallace St
Helga St
Truxton St
Nixonton St
Chowan St
Wilkinson St
Hayman Blvd
Sothel St
Walker St
Archdale St
Aycock St
Eden St
Sportsman Dr
Avalon Dr
Newport News St
12
158
0 0.5 1 Miles
Context
Town Limits
Salt/Brackish Marsh
Submerged Aquatic Vegetation
Managed Areas
Local
State
Natural Heritage Natural Areas
Kitty Hawk Woods Reserve
Biodiversity/Wildlife Habitat
High
Medium
Low

Utility and Transportation Infrastructure

Public Drinking Water

The Dare County Water Department provides water service to the community. The town's potable water is provided by both the Skyco Water Plant and the North Reverse Osmosis Plant. The Kitty Hawk water system includes one water tower located in Southern Shores, 2 ground storage tanks, a pumping station in Kitty Hawk, and 16" transmission lines fed by four pumps. If there are issues with the Southern Shores tower, water service can come from the water tower in Duck.

Private Septic Systems

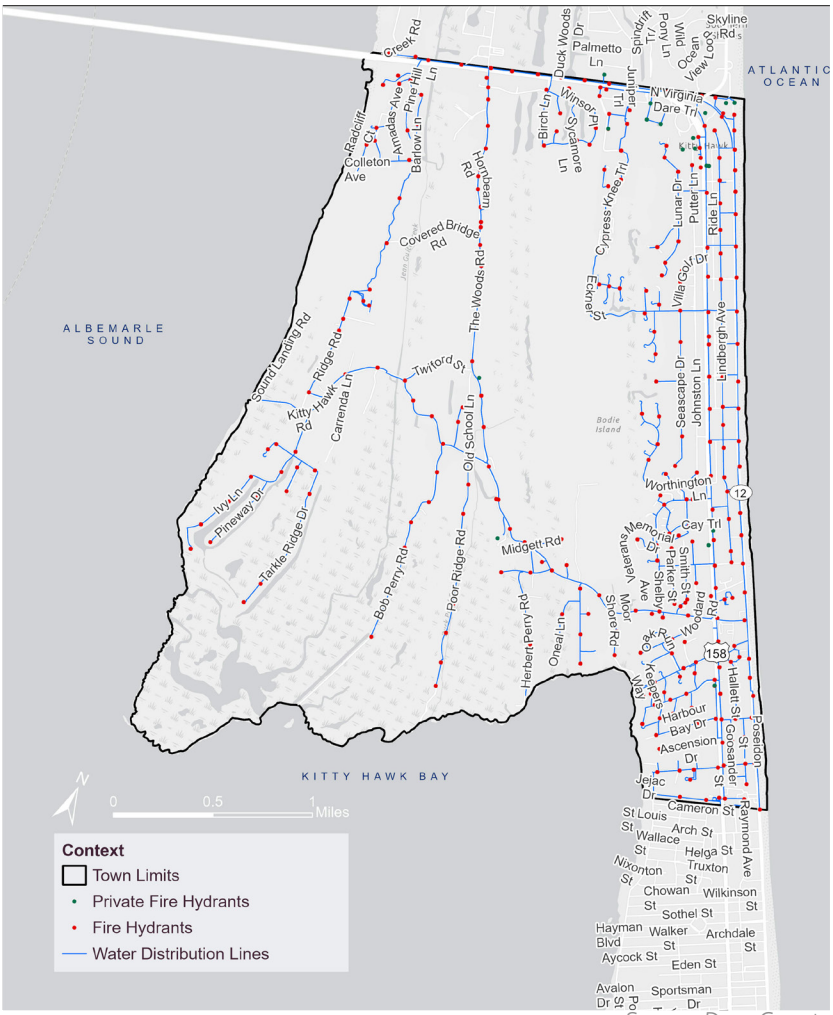
All residential and non-residential uses in Kitty Hawk rely on private septic tank with drainage fields. Dare County Health Department is responsible for overseeing and permitting the use of septic systems.

Electrical and Natural Gas Service

Dominion Energy provides electrical service in the Town of Kitty Hawk. In previous years, Domino Energy installed a micro-grid system including four wind turbines capable of generating 13Kw of electricity and ground mounted solar panels that generate 6 kilowatts to continue to generate power in emergency situations. Main distribution lines run along portions of Highway 158 and along a dune ridge from the electrical substation located on Shelby Avenue.

Duke Energy provides natural gas service to some areas within the Town of Kitty Hawk. Distribution lines consist of both steel transmission line and plastic lines. With plans to extend service to the west side, there are opportunities for transportation improvements in conjunction with this expansion of service area. To mitigate corrosion issues from saltwarer, risers and the city gate is powder coated on an annual basis and meters are replaced regularly.

Water Distribution



Source: Dare County Water Department

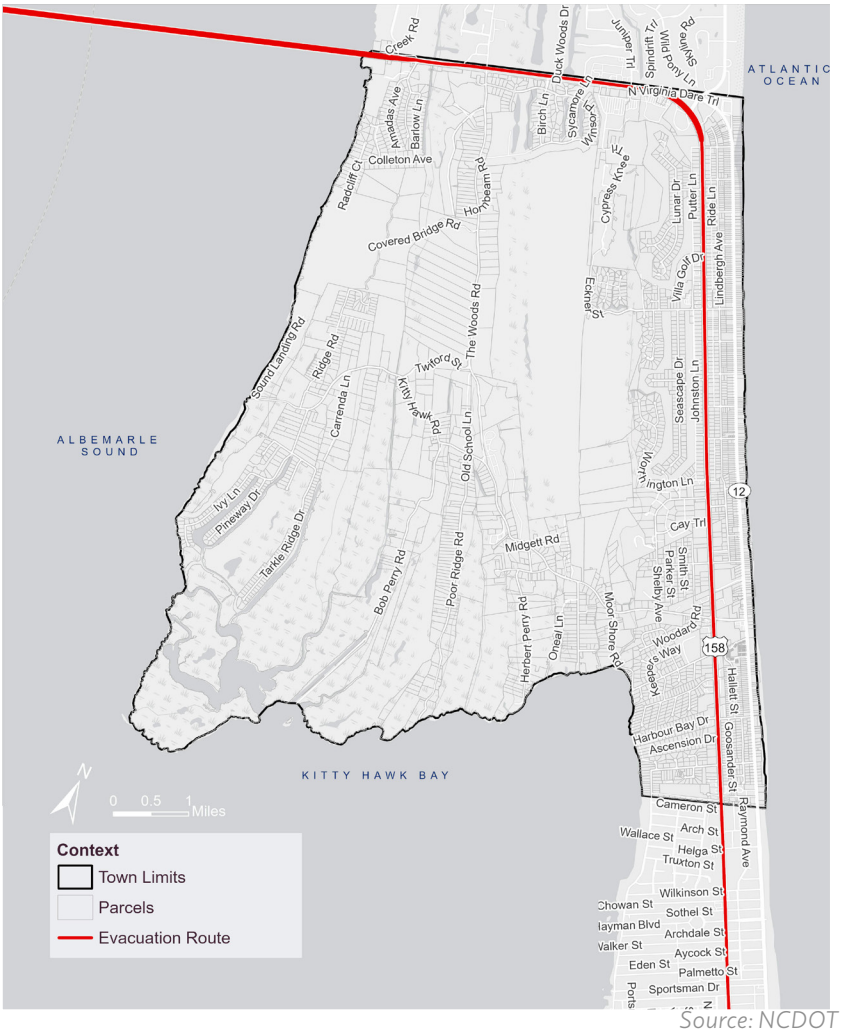
Transportation Systems

The Town of Kitty Hawk consists of approximately 76.01 miles of roads, out of which 54.56 miles are maintained by the Town and the remaining 21.45 are maintained by NCDOT. Highway 158 is the evacuation route that residents and visitors use to evacuate the barrier island in a state of emergency. Residents that live on the Kitty Hawk Village side utilize Kitty Hawk Road, Twiford Street, The Woods Road, or Moor Shore Road to access the evacuation route in emergency situations.

Moor Shore Road is an important roadway in the Town of Kitty Hawk. Not only is the road used as an emergency route and bypass when Highway 158 cannot be accessed but it also has historical and cultural significance. The road provides bikers, joggers, kayakers, and marathon participants views of the beautiful sound side and water access. Moor Shore Road is also tied to the Wright Brothers, serving as the location where they began assembling their first experimental glider in 1928, according to a marker. Moor Shore Road has been experiencing erosion issues due to Kitty Hawk Bay for several years due to sea level rise and shoreline erosion. Several mitigation efforts have been made in previous years, including the installation of seven vertical sills that act as speed bumps and extend approximately 600 feet along the shoreline.

Data from several sources including FEMA, NCDOT, NC Emergency Management, NOAA, and public input was utilized for the risk and vulnerability assessment to determine where inundation of roadways occur in a storm or heavy rain event.

Evacuation Route



Source: NCDOT

Vulnerability Assessment

6

Chapter Contents

RESILIENT
Kitty Hawk

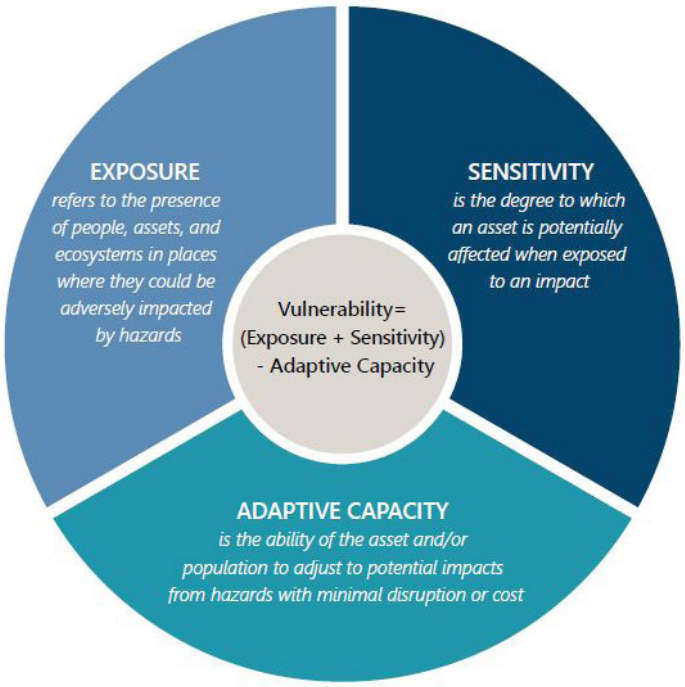
Vulnerability Assessment

The second part of the assessment investigates the vulnerability of critical assets, natural assets, and social vulnerability unique to the Town of Kitty Hawk. Vulnerability of critical assets, natural infrastructure, and vulnerable population to a hazard is a function of exposure, sensitivity, and adaptive capacity. The vulnerability equation (see image to right) was used to derive community vulnerability to climate and non-climate related hazards.

To assess vulnerability, the consultants developed multiple vulnerability indexes which combined exposure, sensitivity, and adaptive capacity to estimate cumulative vulnerability of critical assets within four categories: building infrastructure, utility infrastructure, transportation infrastructure, and natural infrastructure.

For exposure, the consultants analyzed the direct effects from multiple coastal hazards (sea level rise, storm surge, current floodplains, future floodplains, fire hazard) on each of the four categories and categorized them by high, medium or low. For example, if a building was exposed to 2' SLR, storm surge, current and future flood plains, and wildfire it would fall under the highly vulnerable category and would receive a exposure score of 3 indicating high exposure.

Vulnerability Equation



For sensitivity, the consultants analyzed the cumulative effects of risks on the critical assets within each category. For buildings this was based on a percentage threshold of the critical asset effected by a hazard. For instance, if there were no impacts, then a score of 0 indicated there were no impacts from coastal hazards. If 25%-50% of a

Quantifying Vulnerability				
Asset Type	***Exposure Score 0-3***	***Sensitivity Score 0-3***	***Adaptive Capacity 0-3***	***Vulnerability Score <0-6***
Asset name	0= no exposure	0= no sensitivity	0=no adaptive capacity	0-2= Low
	1= low	1=low	1=low	3-4= Medium
	2= medium	2=medium	2= medium	5-6=High
	3= high	3= high	3= high	

building was impacted by a coastal hazard then a score of 2 was given indicating medium sensitivity.

Adaptive capacity was a subjective factor. Factors such as social vulnerability, feasibility of relocation and/or retrofitting, building value, land value, and replacement cost were evaluated for each category. The consultants worked with the CAT team to assign adaptive capacity scores.

See the map on page 59 to view current and future flooding hazards assessed for critical assets during this process.

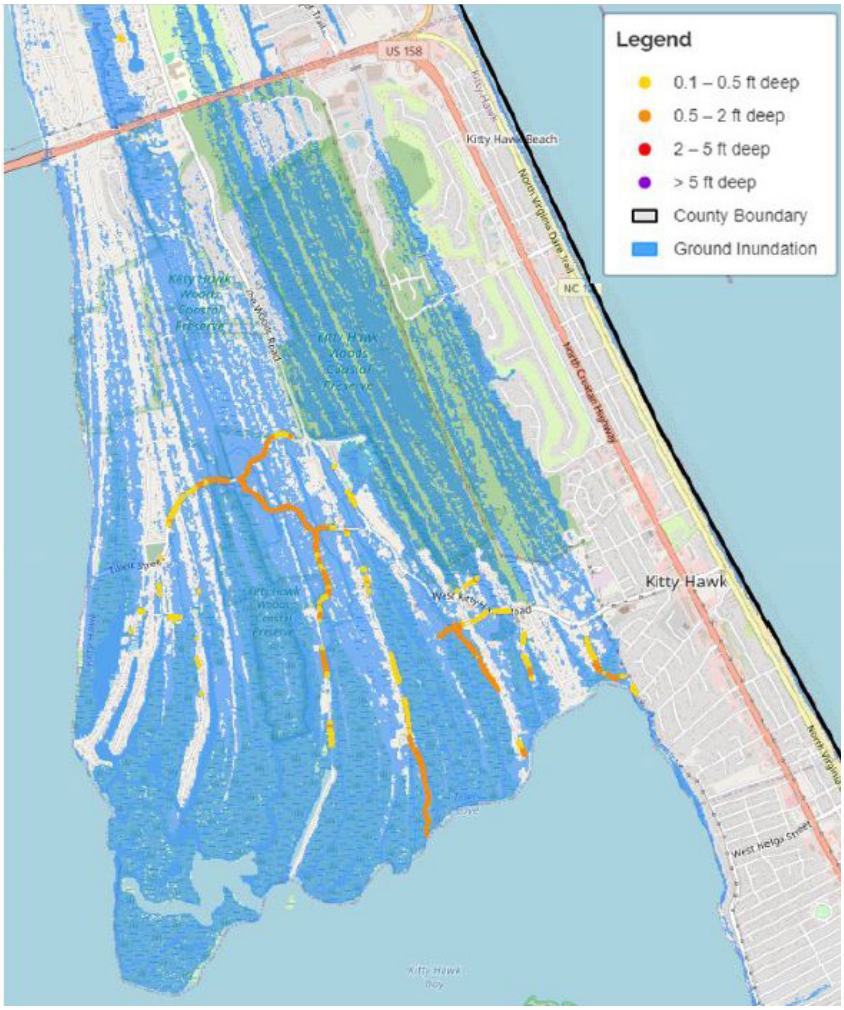
Vulnerability of Critical Assets

With its location on a barrier island, the Town of Kitty Hawk is familiar with the impact from coastal storms and its residents are accustomed to cycles of storm-related damages, accessibility issues, and clearing and/or rebuilding after storm events. Necessary public services and accessibility to essential services, such as grocery stores, building supply retail stores, and fueling stations post-storm is at the fore-front of resiliency planning efforts for Kitty Hawk's year round residents.

Transportation Infrastructure

Accessibility is critical for emergency response and access to essential services. Many roadways in the Town are in low-lying areas, especially in Kitty Hawk Village. Although these roadways are not dedicated evacuation routes, they provide access to Highway 158 and essential services. These important access roads include Kitty Hawk Road, Twiford Street, Bob Perry Road, Poor Ridge Road, Herbert Perry Road Oneal Lane, and portions of Moor Shore Road. Major roadways that local residents use to access Highway 158 include Kitty Hawk Road, Twiford Street, The Wood Road, and Moor Shore Road. Large portions of these roadways are inundated after a heavy rainfall or storm events, and will likely to be subjected to increased tidal flooding with sea level rise, and making it difficult for residents to get to essential services.

Coastal Roadway Inundation Map



Source: Coastal Roadway Inundation Simulator, NCDOT and NC Emergency Management

NCDOT's recommendations for state routes are that they should be planned to be resilient for a 50-year recurrence interval. Presently, there are portions of Poor Ridge Road and Moor Shore Road that are subjected to inundation for a 10-year recurrence interval. These portions of Poor Ridge Road are as low as 1.3' to 1.4' in elevation (NAVD88) with inundation levels ranging from 0.1 to 0.2 feet deep. The portions of Moor Shore Road are as low as 1.5' in elevation with inundation levels at 0.1 ft. deep. In a 25-year recurrence, there are more roadways with inadequate roadway elevation. Twiford Street has some low-lying areas ranging from 1.9' to 2.4', when water elevations reach 2.5' portions of the roadway are inundated from 0.1' to 0.6'. Kitty Hawk Road has several areas that are low-lying ranging from 1.6' to 2.5'. In a 25-year recurrence, inundation on portions of Kitty Hawk Road from Bob Perry Road to Carrenda Lane are inundated from 0.1' to 0.9'. Bob Perry Road is also in a low-lying area with portions of this secondary road ranging from 2.5' to 2.6'. Most of the inundation on Bob Perry Road occurs approaching the intersection of Bob Perry Road and Kitty Hawk Road ranging from 0.1' to 0.4'. Low-lying areas on Poor Ridge Road are located closer to Kitty Hawk Bay and range from 1.3' to 1.9' and become inundated from 0.1' to 1.1' in a 25-year recurrence. Herbert Perry Road has low-lying areas from 1.7' to 2.7', in a 25-year recurrence inundation levels range from 0.2' to 0.9'. Moor Shore Road has low-lying areas especially before and after the bridge, these areas range in elevation from 1.5' to 2.5'. In a 25-year recurrence, inundation levels along this portion of Moor Shore Road range from 0.1' to 1'.

In Kitty Hawk Beach, property owners were mostly concerned about flooding in low-lying areas and ocean overwash. The Town installed suction basins and standpipes in recent years that allow pumping of stormwater into the Atlantic Ocean.

The methodology used for assessing vulnerability of the evacuation route and other major roadways included exposure to flooding from 2' and 3' sea level rise and ocean overwash. Sensitivity was factored in by the number of homes cut off from essential services due to roadway inundation and overall percentage of roadway impacted by inundation. When factoring in adaptive capacity, the consultants and the CAT team discussed overall cost and feasibility of the project.

The bridge along Kitty Hawk Road west of Twiford Street was elevated in previous years leading to increased inundation at this intersection. With future sea level rise and increased tidal flooding Moor Shore Road and Kitty Hawk Road is in need of elevation along large portions of each

Transportation Infrastructure Vulnerability Assessment

Exposure:

High: Future Base Flood + 1' Sea Level Rise, Category 3 Storm Surge, Ocean Overwash, Social Vulnerability Factor (>50% homes unable to access essential services(Kitty Hawk Village))

Medium: Future Base Flood + 2' Sea Level Rise, Category 2 Storm Surge, Social Vulnerability Factor (25%-50% homes unable to access essential services(Kitty Hawk Village))

Low: Future Base Flood, 3' Sea Level Rise, Category 1 Storm Surge, Social Vulnerability Factor (<25% homes unable to access essential services (Kitty Hawk Village))

Sensitivity:

High: >50% of asset vulnerable to hazard

Medium: 25%-50% of asset vulnerable to hazard

Low: <25% of asset vulnerable to hazard

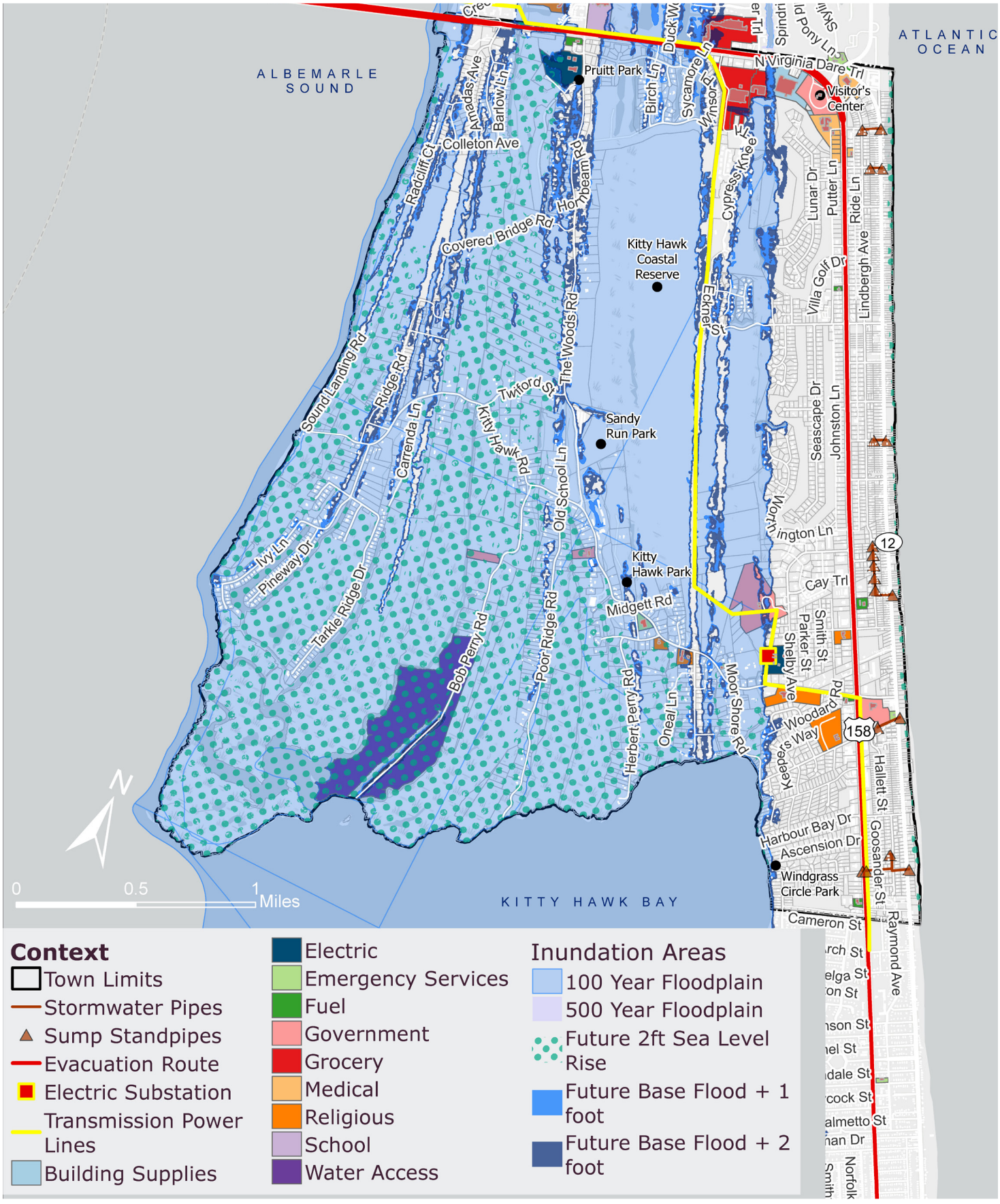
Adaptive Capacity:

High: Low cost to elevate

Medium: Moderate cost to elevate

Low: Significantly high cost to elevate

Critical Assets with Current and Future Flooding Hazards



roadway. Coordination with NCDOT and DCM will be necessary on any future projects that would increase the resiliency of these roadways. A feasibility study should be conducted for Kitty Hawk Road that includes mapping location and size of culverts, stormwater modeling, potential to increase elevation and exact locations where increased elevation should occur, replacement and/or installation of culverts, creation of swales to improve infiltration, study of marsh migration, and potential pedestrian access options. The feasibility study should be coordinated with other state agencies, especially as the state implements the NCSMAP.

Building Infrastructure

These include buildings and functions that are necessary for the continued operation of the town and provide essential services to its residents (see page 50-51). When assessing the town's critical infrastructure facilities the most vulnerable facilities were Bob Perry Landing, the Waste and Recycling Center and Boat Launch, the Unitarian Universalist Congregation of the Outer Banks Church, the Public Works Department, and Town Hall.

Building Infrastructure Vulnerability Assessment

Exposure:

High: Current 100-year and 500-year floodplains, Future Base Flood + 1' Sea Level Rise, and Category 3 Storm Surge with property and structure impacts, and high wildfire risk

Medium: Current 100-year floodplain**,** Future Base Flood + 2' Sea Level Rise, Category 2 Storm Surge with property and structure impacts, and moderate wildfire risk

Low: Current 100-year floodplain**,** Future Base Flood, 3' Sea Level Rise, Category 1 Storm Surge with property exposure and no impacts to structure, and low wildfire risk

Sensitivity:

High: >50% of asset vulnerable to hazard

Medium: 25%-50% of asset vulnerable to hazard

Low: <25% of asset vulnerable to hazard

Adaptive Capacity:

High: Replacement cost less than $2.5 million, Rated high importance by community and CAT

Medium: Replacement cost between $2.5- $8 million, Rated moderately important by community and CAT

Low: Replacement cost between $8-$20 million, Rated not as important by community and CAT

Utility Infrastructure

Utility infrastructure includes the Town's water supply system, electrical system, natural gas lines, private septic systems, stormwater infrastructure, and suction basins and standpipes. When discussing with stakeholders and the CAT team, corrosion from salt water, salt water intrusion, obstructions, and wind damage were some of the biggest concerns for the Town's utility infrastructure. Utility providers and the Town's public works department take measures on an annual basis to maintain utility infrastructure.

Utility Infrastructure Vulnerability Assessment

Exposure:

High: Current 100-year and 500-year floodplains, Future Base Flood + 1' Sea Level Rise, and Category 3 Storm Surge

Medium: Current 100-year floodplain, Future Base Flood + 2' Sea Level Rise, and Category 2 Storm Surge

Low: Current 100-year floodplain, Future Base Flood, 3' Sea Level Rise, and Category 1 Storm Surge

Sensitivity:

High: >50% of asset vulnerable to hazard

Medium: 25%-50% of asset vulnerable to hazard

Low: <25% of asset vulnerable to hazard

Adaptive Capacity:

High: Low replacement cost

Medium: Moderate replacement cost

Low: High replacement cost

Natural Infrastructure

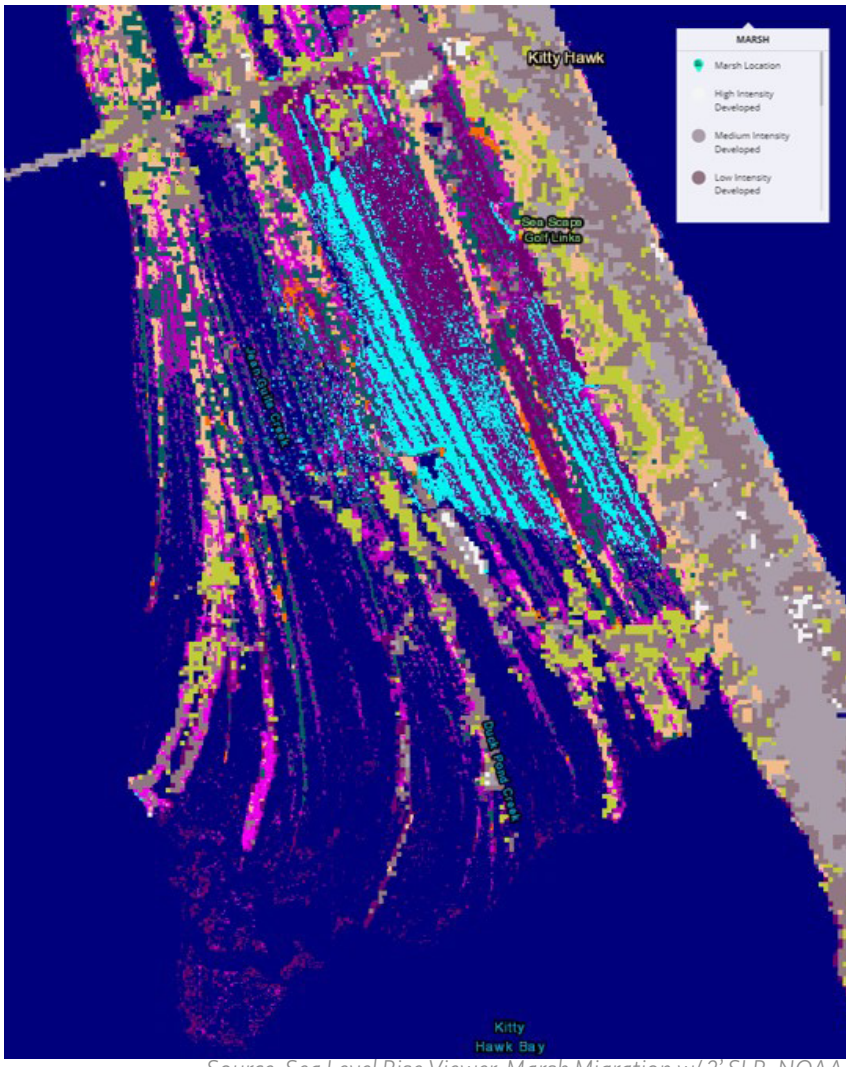
Natural infrastructure is critically important to both Kitty Hawk Beach and Kitty Hawk Village in terms of coastal protection, economic vitality, and residents livelihoods. In the Village, it is anticipated salt marshes will migrate to Kitty Hawk Woods with 2' sea level rise. Further analysis is needed to study the potential impacts from marsh migration on these forested wetlands, including accelerated erosion and bulk species loss.

Using wetland data from NCCREWS, there is approximately 1,508 acres of salt marshes in Kitty Hawk. According to NC DCM data, there is a potential to restore 504 acres of salt marshes. This dataset identifies former wetland areas that have been altered from their natural condition to the extent that the site no longer meets the vegetative, hydrologic, and/or soil conditions required to be classified as jurisdictional wetlands. There is approximately 1,291 acres of non-coastal wetlands in the Town of Kitty Hawk, including estuarine shrub/scrub, maritime forest, and pine flats. According to NC DCM data, 310 acres of non-coastal wetlands have the potential to be restored.

In Kitty Hawk Beach, natural infrastructure includes the dunes, dune vegetation, and sandy beaches. These protect properties on the ocean side from ocean overwash during storm events. Beach renourishment is completed every 5 or more years to help protect properties from being inundated. Prior to storm events, public works employees will take equipment and fill in dune lines that are open for public access.

As storm events become more frequent and more powerful, storm surge and

Marsh Migration w/ 2' SLR



Source: Sea Level Rise Viewer, Marsh Migration w/ 2' SLR, NOAA

increased wave activity will continue to erode dunes and shorelines. This causes the beach to become narrower and lower in elevation. This retreat of the shoreline threatens beach-related tourism, coastal properties, including businesses, primary residences, and short-term rentals, road infrastructure, and exposes private septic systems to saltwater intrusion.

A combination of strategies is necessary as a long-term solution to address sea level rise and increased storm activity. These strategies include living shorelines, wetland and salt marsh restoration, more frequent debris removal in creeks, and other best management practices such as rainwater harvesting, permeable pavement, and other green infrastructure.

Natural Infrastructure Vulnerability Assessment

Exposure:

High: Current 100-year and 500-year floodplains, Future Base Flood + 1' Sea Level Rise, and Category 3 Storm Surge

Medium: Current 100-year floodplain**,** Future Base Flood + 2' Sea Level Rise, and Category 2 Storm Surge

Low: Current 100-year floodplain**,** Future Base Flood, 3' Sea Level Rise, and Category 1 Storm Surge

Sensitivity:

High: >50% of asset vulnerable to hazard

Medium: 25%-50% of asset vulnerable to hazard

Low: <25% of asset vulnerable to hazard

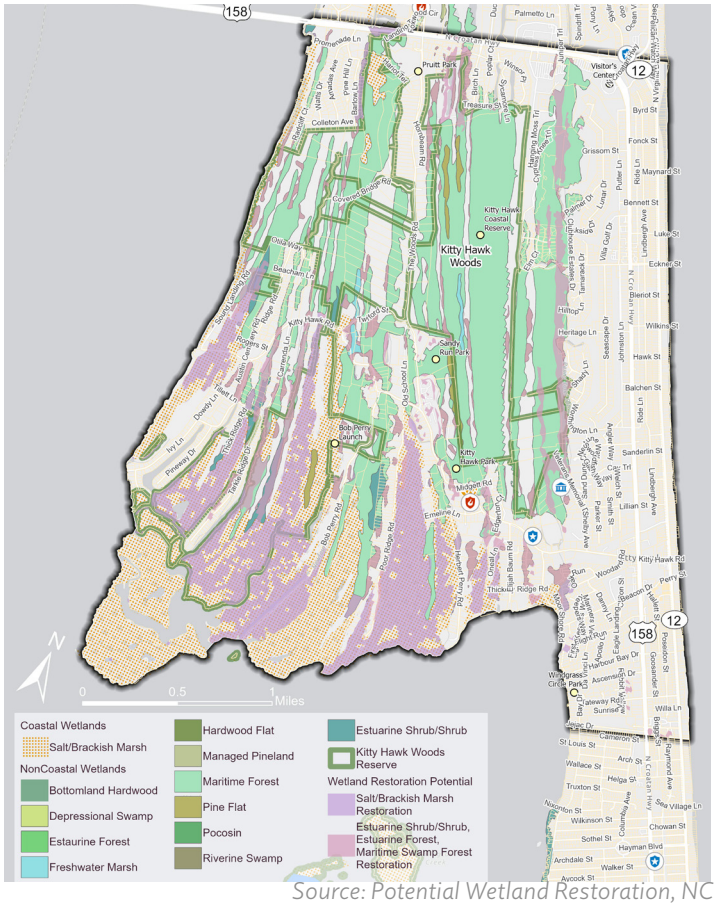
Adaptive Capacity:

High: Low cost

Medium: Moderate cost

Low: High cost

Potential Wetland Restoration



Source: Potential Wetland Restoration, NC Division of Coastal Management

Composite Vulnerability

The composite vulnerability amalgamates all assigned vulnerability scores from the risk and vulnerability assessment for building infrastructure. Scores from all four assessed categories can be found in the Appendix of this document. Higher values indicate building infrastructure that is highly vulnerable to hazards such as flooding, sea level rise, wildfires, and current and future floodplains. Building infrastructure along Kitty Hawk Road have the highest composite vulnerability scores.

Estimated Risks

Understanding the financial loss communities experience when hazards occur is critical in determining what level(s) of risk call for immediate action. Building infrastructure utilized the total tax evaluation (structure and land) from Dare County parcel tax data. Utility infrastructure includes total tax evaluation (structure and land). Natural infrastructure used the total tax value of the land within these areas.

Call for Action

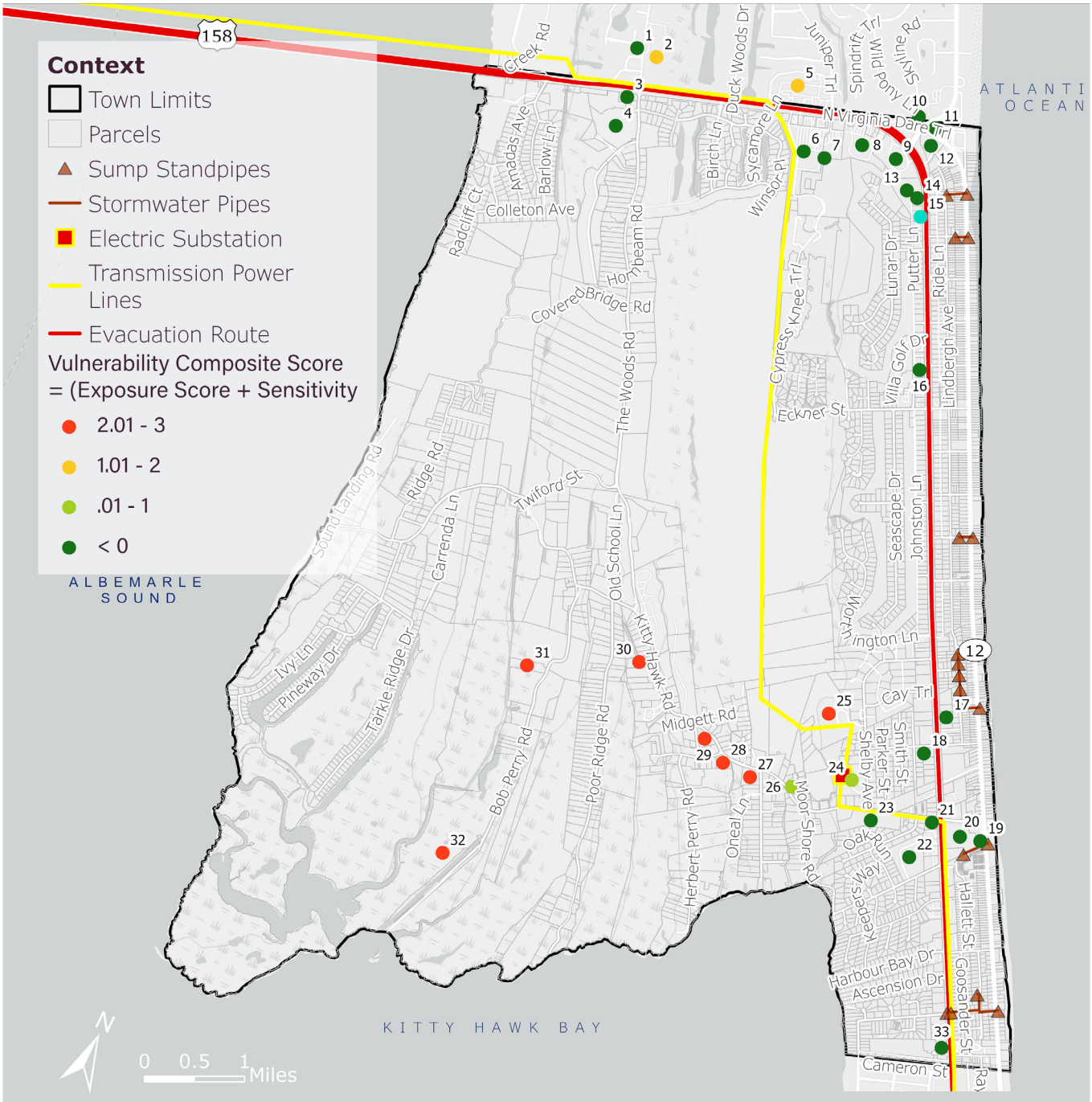
Based on the risk and vulnerability assessment, the following assets were identified as assets where action was critical to mitigate issues from current and future hazards:

- Ridge Road to Colleton Road Access Expansion (to provide an alternative route for emergency services and residents when other secondary routes are inundated)
- Moor Shore Road Improvements and Living Shoreline Expansion (to mitigate erosion issues and safeguard this alternate evacuation route)
- Kitty Hawk Road and Twiford Street Drainage and Road Elevation Feasibility Study
- Town Hall Resiliency Improvements
- Wetland Restoration/Marsh Migration,/SAV Restoration

Some projects need further studies and could take a phased approach to assist with achieving the overall resiliency goals. As funding becomes available to assist with feasibility studies, project prioritizations could shift to address hazards in different areas in the Town of Kitty Hawk. Project prioritization is discussed in the following section.

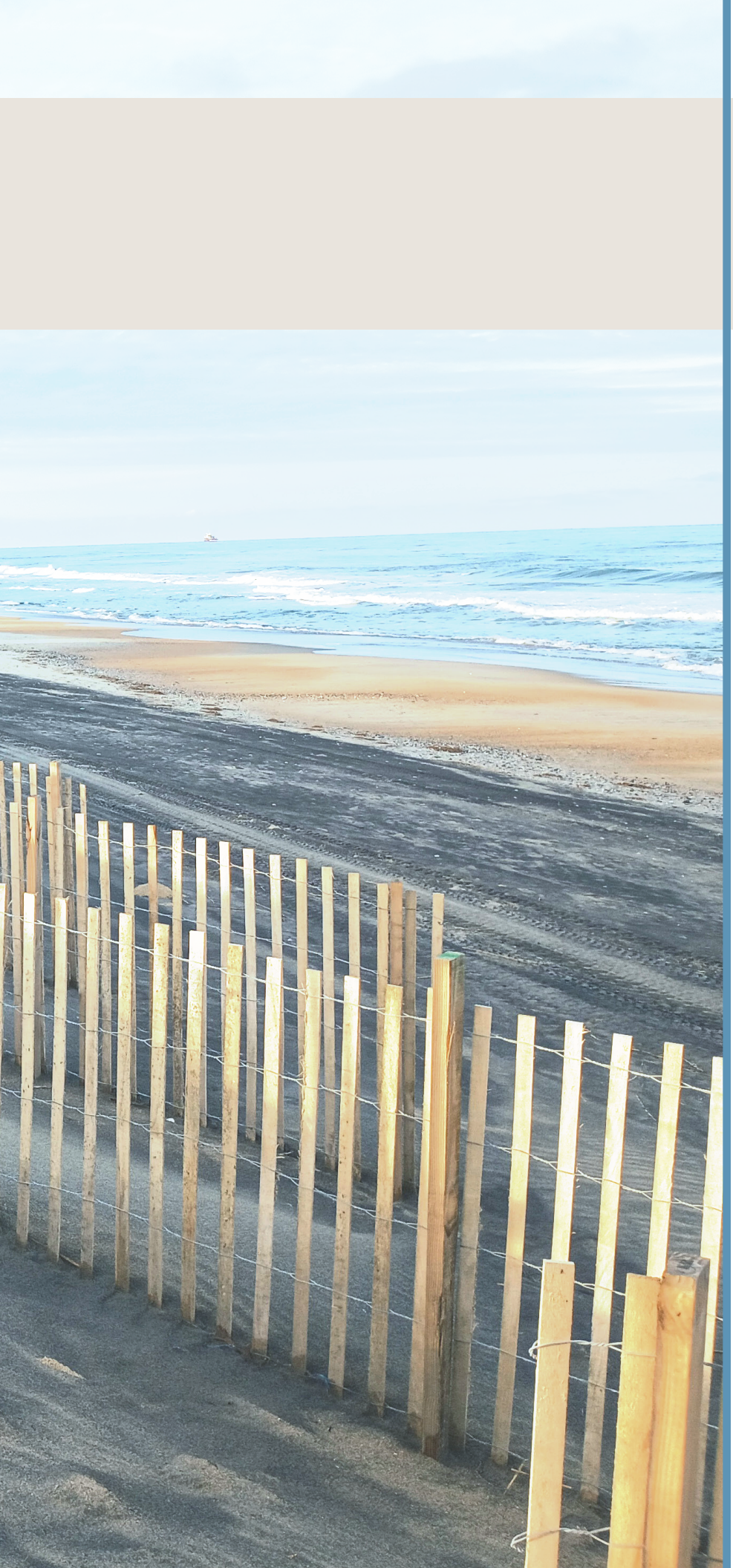
Summary of Composite Vulnerability and Value	
Composite Vulnerability	***Estimated Value***
<0	$83,816,460.00
.01-1	$28,242,973.00
1.01-2	$48,429,800.00
2.01- 3	$12,500,369.00
Total	**$179,989,602.00**

Composite Vulnerability



1 - Emergency Services - Fire/EMS
2 - Kitty Hawk Elementary
3 - Gas Station (7-Eleven)
4 - Dominion Energy Office
5 - Food Lion
6 - Walmart
7 - Harris Teeter
8 - Home Depot
9 - Outer Banks Visitor's Center
10 - Emergency Services - Police
11 - Gas Station (BP)
12 - Walgreens
13 - Beach Medical, Bear Drugs, Future PD
14 - Medical Office - Therapy Center
15 - Medical Office - Urgent Care, Primary Care
16 - Gas Station (Shell)
17 - Gas Station (Mobil)
18 - Religious - Kitty Hawk Baptist Church
19 - Lifeguard Station
20 - USPS
21 - Gas Station (7-Eleven)
22 - Religious - Lighthouse Christian Fellowship
23 - Religious - Holy Redeemer Catholic Church
24 - Dominion Substation
25 - Town Hall
26 - Emergency Services - Police
27 - Religious - Kitty Hawk Methodist Church
28 - Religious - Unitarian Universalist Congregation of the Outer Banks
29 - Emergency Services - Fire
30 - Public Works
31 - Waste and Recycling Center, Bob Perry Boat Launch
32 - Vulcan Materials
33 - Gas Station (Citgo)
34 - Emergency Services - State Highway

Project Portfolio



7

Chapter Contents

RESILIENT
Kitty Hawk

Project Criteria

After the vulnerability and risk assessment was conducted, the CAT team developed a set of projects to mitigate specified hazards. The projects offer non-structural, structural, and nature-based solutions that address multiple hazards and having co-benefits extending beyond resiliency. The potential projects are listed with a description, location, type of solution, project map, any scoping questions, the hazards the project addresses, existing and potential funding opportunities, an estimated timeline, the community lifeline the project supports, and anticipated benefits.

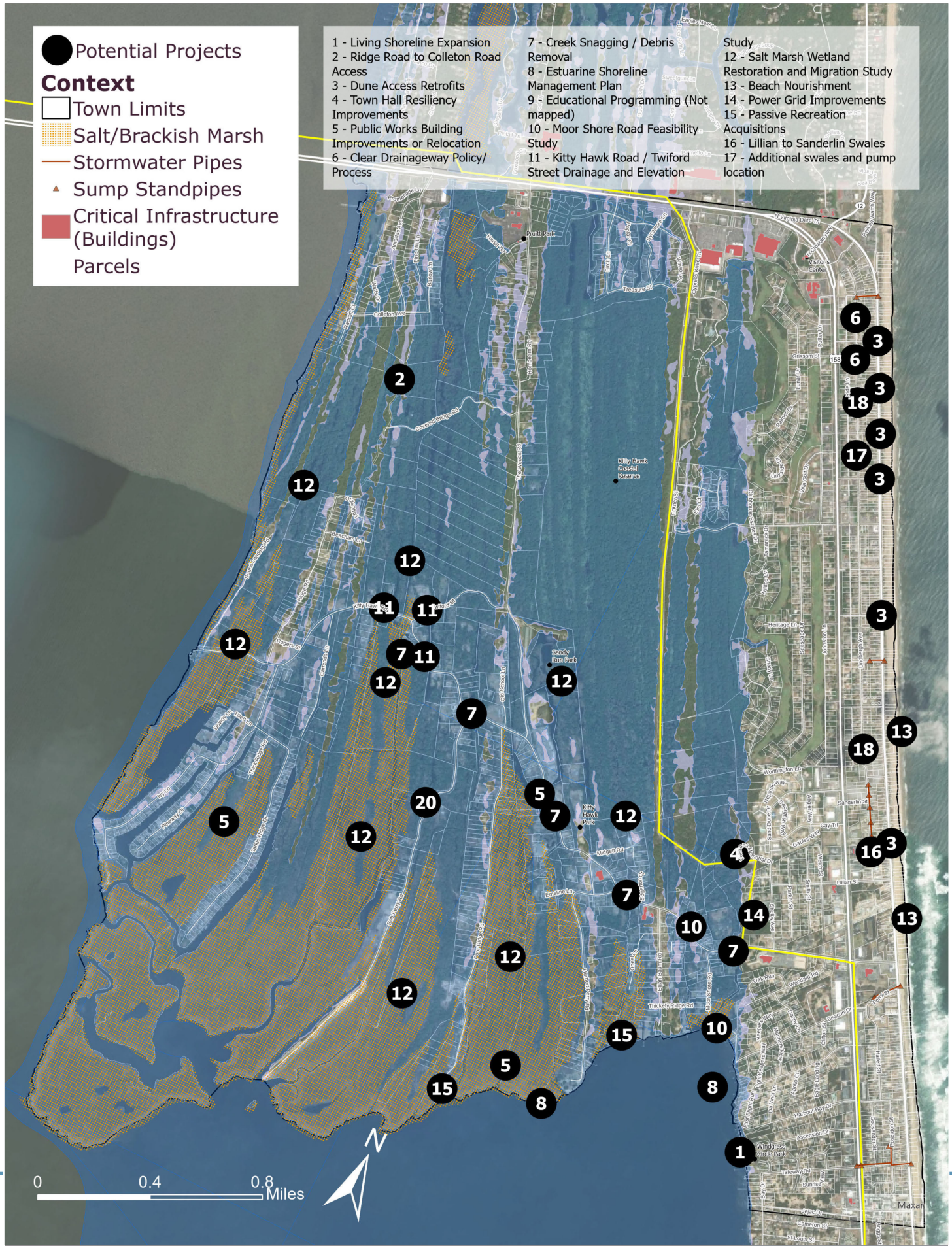
The following section describes the prioritization measures that were used when considering the order of which projects should be conducted.

Prioritization Measures

The STAPLEE evaluation method is a cost/benefit rating system to take into consideration: social, technical, administrative, political, legal, economic, and environmental impacts of proposed non-design intervention and design-intervention projects. The cost-benefit rating system utilizes a high/medium/low scoring system to predict benefits and cost of each potential solution. The social equity rating also utilizes a low/medium/high rating system to determine if the proposed project benefits a limited population, vulnerable populations, or benefits the entirety of the town. The internal capacity considers the capacity of town resources. Co-benefits for each individual project were also considered.

Prioritization Measures	
Cost-Benefit	Low (1) – 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 (2) – Benefits entirety of the Town High (3) – 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 (1) – Benefits are limited to location of project Medium (2) – Benefits neighborhoods beyond project area (>25 homes or some cut off) High (3) – Benefits large part of town or provides vital access to significant area or number of homes)
Internal Capacity	Considers the capacity of town resources (staff effort, scheduling, funding) Low (1) –Requires more interdepartmental and external coordination and scheduling, town funding and external resources. Medium (2) – Requires some interdepartmental coordination and funding. High (3) - Minimal staff efforts and town funding required or similar project completed by town.

Project Map


Potential Projects
Context
Town Limits
Salt/Brackish Marsh
Stormwater Pipes
Sump Standpipes
Critical Infrastructure (Buildings)
Parcels
1 - Living Shoreline Expansion
2 - Ridge Road to Colleton Road Access
3 - Dune Access Retrofits
4 - Town Hall Resiliency Improvements
5 - Public Works Building Improvements or Relocation
6 - Clear Drainageway Policy/ Process
7 - Creek Snagging / Debris Removal
8 - Estuarine Shoreline Management Plan
9 - Educational Programming (Not mapped)
10 - Moor Shore Road Feasibility Study
11 - Kitty Hawk Road / Twiford Street Drainage and Elevation Study
12 - Salt Marsh Wetland Restoration and Migration Study
13 - Beach Nourishment
14 - Power Grid Improvements
15 - Passive Recreation Acquisitions
16 - Lillian to Sanderlin Swales
17 - Additional swales and pump location
Pruitt Park
Kitty Hawk Coastal Reserve
Sandy Run Park
Kitty Hawk Park
Windgrass Mini Park
Visitors Center
0
0.4
0.8
Miles
N
Maxar

Town of Kitty Hawk Project Prioritization

As part of the community engagement process, community members were introduced to resilience strategies aimed at reducing exposure and sensitivity to hazards while strengthening the adaptive capacity of community assets and vulnerable populations. These strategies included structural, nonstructural, and nature-based solutions. At this meeting, the community was asked to rank strategies as presented. Project categories included Design or Implementation Ready, Other Implementation, and Additional Study or Analysis Needed.

Design or Implementation Ready Projects

Structural

1. Living Shoreline -Moor Shore Rd. to Windgrass Circle
2. Ridge Road to Colleton Rd. Emergency Road Extension
3. Dune Access Retrofits
4. Town Hall Resiliency Improvements
5. Public Works Retrofit

Other Implementation

6. Establish Drainageway Policy
7. Creek Snagging/Debris Removal
8. Estaurine Shoreline Management Plan
9. Educational Programming

Additional Study or Analysis Needed

10. Moor Shore Rd. Feasibility Study
11. Kitty Hawk Rd./Twiford Rd. Drainage and Elevation Study
12. Salt Marsh Wetland Restoration and Migration Study

Additional Projects or Programs

13. Beach Nourishment
14. Power Projects
15. Passive Recreation
16. Additional Pump Location and Drainage Improvements (i.e., Lillian to Sanderlin Swales)
17. Tree Planting Program
18. Community Action Team Continued Coordination Meetings

The project categories are color coded. Please use key below.

Project Key:

Project Next Steps (by type)	
Design or Implementation Ready	Structural or nature-based solutions with project locations and type of design solution identified This category includes projects that are "implementation ready" and/or necessary steps to take that would make the project "implementation ready".
Other Implementation	This category includes policy, programming, maintenance, and planning projects.
Additional Study or Analysis Needed	Projects that need additional analysis, detailed planning, specific location(s) outlined, and/or suitability and/or feasibility analysis.
Additional Projects or Programs	Projects, programming, and additional ongoing steps necessary to increase the Town of Kitty Hawk's resiliency.

Project #1: Living Shoreline Expansion Design or Implementation Ready	
Project Description	Expand living shoreline to cover area near Windgrass Circle.
Location	Kitty Hawk Bay Shore from Moor Shore Road to Windgrass Circle.
Source	CAT members, Town staff, Vulnerability and Risk Assessment
Scoping Questions	Extent of need may be less than full 2,000 linear feet. Areas of concern include the area near the intersection of Beacon Drive and Moor Shore Road, an area of greenway just south of there and area of erosion near Windgrass Circle Trailhead.
Hazard(s) Addressed	Flooding, storm surge, shoreline erosion, wave attenuation
Supporting Function	
Type of Solution	Infrastructure
Estimated Timeline	1-2 years
Responsible Entity	Planning and Inspections or Public Works
Potential Partners	NCDCM, US Army Corps of Engineers, NCDEQ, Dare County Soil and Water, NC DOT, Volunteers
Existing Funding	TBD
Potential Funding Sources	NC RCCP Phase III and Phase IV, NC Coastal Federation, NCDEQ grants, National Fish and Wildlife Federation (NFWF), NOAA Coastal Resilience grants, Wildlife Conservation Society Climate Adaptation Fund
Estimated Cost	$300-600 (per lf cost) = $180-360k
Anticipated Benefit	The expansion of the living shoreline along the Bay in this area will provide protection to existing trees, the greenway, Moor Shore Road and private properties from the expected deterioration and erosion from the expected higher-strength wave action associated with sea-level rise (SLR).
CAT Team Priority Rating	High
Overall Rating	2nd

Project Map(s)	
Prioritization Measures	
Cost-Benefit	Medium (2) – Protects shoreline and transportation infrastructure
Social Equity	Medium (2)
Internal Capacity	High (3) – Completed similar project in 2019
Co-Benefits	Vehicular connections, greenway connectivity, evacuation route, protection of natural resources including existing trees.
Public Ranking	2nd

Project #2: Ridge Road to Colleton Road Access Expansion Design or Implementation Ready	
Project Description	Establish an alternate route for residents to travel to reduce vulnerability from hazardous events or when main routes are inundated. Feasibility analysis can be part of design phase. Easements need to be in place for this project to come to fruition.
Location	Ridge Road to Colleton Avenue (approximately 2,350ft)
Source	CAT members, Town staff
Scoping Questions	Coordination is needed between state and private property owners to have proper easements and/or agreements in place and to finalize location and design of the route.
Hazard(s) Addressed	Flooding, storm surge, sea level rise, storms
Supporting Functions	
Type of Solution	Infrastructure
Estimated Timeline	1-2 years
Responsible Entity	Town staff (Public Works/Planning and Inspections)
Potential Partners	State of North Carolina
Existing Funding	Town CIP
Potential Funding Sources	RCCP Phase III and Phase IV
Estimated Cost	$150,000-$200,000
Anticipated Benefits	Improve alternate routes for neighborhoods and/or residents to reduce vulnerability when main routes become inundated.
CAT Team Priority Rating	High
Overall Rating	1st, but after conversations with DCM more coordination between state agencies is needed.

Project Map(s)	
Prioritization Measures	
Cost-Benefit	High (3) – Relatively inexpensive alternative to elevating a longer segment of Kitty Hawk Road.
Social Equity	High (3) - 300+ homes potentially served by secondary evacuation route or alternative means of public safety access.
Internal Capacity	High (3) – Similar project executed in 2023
Co-Benefits	N/A
Public Ranking	1st

Project #3: Dune Access Retrofits Design or Implementation Ready	
Project Description	Retrofitting key access points with boardwalks will improve preparedness for storms. Currently staff moves sand prior to major storms to fill in gaps. *Note: For pedestrian access points only. Vehicular access points would remain at grade.*
Location	Priority locations include Luke Street and Bleriot Street due to improved parking in the vicinity.
Source	Planning staff, CAT members, Town staff
Scoping Questions	Survey needed to determine location of utilities, property lines and other assets. Coordination with NCDOT, utility companies and DCM needed to determine final design.
Hazard(s) Addressed	Flooding, storm surge, sea level rise, storms
Supporting Function	
Type of Solution	Infrastructure
Estimated Timeline	1-3 years
Responsible Entity	Town Staff
Potential Partners	NCDOT, NCDCM
Existing Funding	TBD
Potential Funding Sources	Division of Coastal Management Beach & Waterfronts Access Grants, NC Coastal Federation, NCDEQ grants, National Fish and Wildlife Federation (NFWF), NOAA Coastal Resilience grants, Wildlife Conservation Society Climate Adaptation Fund
Estimated Cost	$100,000-120,000 each location
Anticipated Benefits	The current “at grade “ crossing are gaps or areas of vulnerability in the Town’s permanent protection as provided by the dune system, from the storm surges, tidal action, wave actions and some wind actions.
Retrofitting key access points with boardwalks will improve preparedness for storms. Currently staff moves sand prior to major storms to fill in gaps.	
CAT Team Priority Rating	Medium (2)
Overall Rating	Tied for 3rd

Project Map(s)	 
Prioritization Measures	
Cost-Benefit	High (3)
Social Equity	Medium (2)
Internal Capacity	Medium (2)
Co-Benefits	Will save on maintenance costs and time spent by Public Works preparing for storms.
Public Ranking	Tied for 3rd

Project #4: Town Hall Resiliency Improvements Design or Implementation Ready	
Project Description	Three-phased approach to address site and building improvements necessary to address flooding, wind exposure and wildfire risk. The first phase includes defensible space improvements. The second phase includes elevating the building 2 feet to improve the structures resiliency against storm surge and flooding events. The third phase would include siding and replacement of glass to improve the structural integrity of the building against high winds and fire.
Location	101 Veterans Memorial Dr.
Source	CAT members, Town staff, Vulnerability and Risk assessment
Scoping Questions	Town staff needs to have office space while these retrofits are being completed. Could plan on Town staff working in the old Sentara building during phases II and III. Currently, there is no office space available, would need to plan these phases once leases have expired.
Hazard(s) Addressed	Flooding, storm surge, sea level rise, wildfire
Supporting Function	
Type of Solution	Infrastructure
Estimated Timeline	1-3 years
Responsible Entity	Town staff (interdepartmental coordination)
Potential Partners	
Existing Funding	Town CIP
Potential Funding Sources	FEMA, RCCP Phase III, RCCP Phase IV
Estimated Cost	$-$$
Anticipated Benefit	Finished floor elevation is 8.7 ft. Base flood elevation is 4 ft. This could increase with sea level rise. The building is located in the wildland/urban interface zone and has a high exposure to potential wildfire. Increasing the elevation of the structure by 1-2 feet and/or retrofitting the building for wind resistance, fire resistance siding or improving defensible space would make the Town Hall more resilient.
Priority Rating	4th

Project Map(s)	
Prioritization Measures	
Cost-Benefit	High (3)
Social Equity	Medium (2)
Internal Capacity	Medium (2)
Co-Benefits	Savings on maintenance and recovery costs and add operational resiliency.
Public Ranking	4th

Project #5: Public Works Building Improvements Design or Implementation Ready	
Project Description	Building improvements that elevate necessary equipment needed prior to and after storm events.
Location	965 W. Kitty Hawk Road
Source	Vulnerability and Risk assessment, CAT members, Town staff
Scoping Questions	Evaluation of costs, conceptual design and alternatives needed.
Hazard(s) Addressed	Flooding, storm surge, sea level rise
Supporting Function	
Type of Solution	Infrastructure
Estimated Timeline	1 year
Responsible Entity	Public Works Department
Potential Partners	
Existing Funding	Town CIP
Potential Funding Sources	FEMA, RCCP Phase III and IV
Estimated Cost	$-$$
Anticipated Benefit	Reduce equipment exposure to flooding.
Priority Rating	5th

Project Map (s)	
Prioritization Measures	
Cost-Benefit	High(3)
Social Equity	Medium (2)
Internal Capacity	Medium (2)
Co-Benefits	Savings on equipment replacement and maintenance costs
Public Ranking	5th

Project #6: Establish Drainageway Policy Other Implementation	
Project Description	Development of a policy and process to keep drainageways clear that drain to suction basins along Lindbergh Ave.
Location	E of Highway 158, properties near suction basins
Source	Town staff, CAT members
Scoping Questions	Evaluation of precedent policies and enforcement procedures necessary.
Hazard(s) Addressed	Coastal hazards, emergency preparedness, flooding,
Supporting Function	
Type of Solution	Policy/programming, mapping and analysis
Estimated Timeline	1 year
Responsible Entity	Public Works
Potential Partners	Planning and Inspections
Existing Funding	Town General Fund
Potential Funding Sources	RCCP Phase III
Estimated Cost	$
Anticipated Benefit	Improve hazard awareness and education on emergency preparedness, flooding, etc
Priority Rating	1st
Project Map (s)	N/A
Prioritization Measures	
Cost-Benefit	High (3)
Social Equity	Low (1)
Internal Capacity	High (3)
Co-Benefits	Ensures drainageways remain free from obstruction.
Public Ranking	2nd (Other Implementation category)

Project #7: Creek Snagging/Debris Removal Other Implementation	
Project Description	Establish a schedule to regular cleaning and maintenance of creeks.
Location	West of Highway 158 (Jean Guite Creek, Duck Pond Creek, Kitty Hawk Landing creeks, other creeks on soundside)
Source	CAT members
Scoping Questions	
Hazard(s) Addressed	Flooding, storm surge
Supporting Function	
Type of Solution	Maintenance
Estimated Timeline	Ongoing
Responsible Entity	Public Works
Potential Partners	NCDEQ
Existing Funding	TBD
Potential Funding Sources	RCCP Phase III, STRAP Program
Estimated Cost	$
Anticipated Benefit	Removal of debris allows water to flow more quickly out of creeks and away from infrastructure, buildings, etc.
Priority Rating	2nd
Project Map(s)	N/A
Prioritization Measures	
Cost-Benefit	Medium (2)
Social Equity	Medium (2)
Internal Capacity	Medium (2)
Co-Benefits	Ensures creeks are clear prior to and after storm events.
Public Ranking	1st (for Other Implementation category)

Project #8: Estuarine Shoreline Management Plan Other Implementation	
Project Description	The project would involve the development of an Estuarine Shoreline Management Plan to comprehensively address the management of the Town's estuarine shoreline. It will assess erosion, coastal and climate hazards, ecosystem health, public health, and recreational opportunities.
Location	Soundside shorelines adjacent to the Town of Kitty Hawk Limits (Kitty Hawk Bay, Albemarle Sound)
Source	Planning staff, Town staff
Scoping Questions	
Hazard(s) Addressed	Flooding, storm surge, shoreline erosion, wave attenuation
Supporting Function	
Type of Solution	Infrastructure
Estimated Timeline	1-2 years
Responsible Entity	Planning and Inspections
Potential Partners	Dare County, NCDCM
Existing Funding	Town General Fund
Potential Funding Sources	Golden Leaf Flood Mitigation Program, Phase III RCCP, Town Planning Fund
Estimated Cost	$100k-150k
Anticipated Benefit	A prioritized list of estuarine shoreline projects, increased resilience against flooding, increased protection against shoreline erosion, and improved ecosystem health.
Priority Rating	3rd
Project Map(s)	See Project Map on page 69.
Prioritization Measures	
Cost-Benefit	High (3)
Social Equity	Medium (2)
Internal Capacity	High (3)
Co-Benefits	
Public Ranking	5th (For Other Implementation category)

Project #9: Educational Programming Other Implementation	
Project Description	Educate new/existing homeowners about mitigation strategies that can be taken prior to storm events.
Location	Town of Kitty Hawk
Source	CAT members
Scoping Questions	
Hazard(s) Addressed	Emergency preparedness
Supporting Function	
Type of Solution	Policy/programming
Estimated Timeline	Ongoing
Responsible Entity	Planning and Inspections
Potential Partners	Local Realtors, home inspectors
Existing Funding	Town General Fund
Potential Funding Sources	RCCP Phase III
Estimated Cost	$
Anticipated Benefit	Improve hazard awareness and education on emergency preparedness, flooding, etc.
Priority Rating	4th
Project Map (s)	N/A
Prioritization Measures	
Cost-Benefit	High (3)
Social Equity	Medium (2)
Internal Capacity	High (3)
Co-Benefits	More prepared residents
Public Ranking	4th

Project #10: Moor Shore Rd. Feasibility Study Additional Study or Analysis Needed	
Project Description	Study the potential for elevation improvements along Moor Shore Rd., including necessary stormwater modeling. Potential for boardwalk along Moor Shore Road to continue greenway. Project could be executed in tandem with or separate from expanding living shoreline to cover area near Windgrass Circle.
Location	South Kitty Hawk, from Kitty Hawk Rd. to Beacon Dr.
Source	CAT members, Town staff, Vulnerability and Risk assessment
Scoping Questions	Coordination with NCDOT to determine the state's plans for Moor Shore Rd. Survey and feasibility study to determine alternatives and next steps for elevation of Moor Shore Rd.
Hazard(s) Addressed	Flooding, storm surge, sea level rise
Supporting Function	
Type of Solution	Infrastructure
Estimated Timeline	1-3 years
Responsible Entity	NCDOT
Potential Partners	Town of Kitty Hawk
Existing Funding	TBD
Potential Funding Sources	Local, state, and federal grant funding, RCCP Phase III
Estimated Cost	$ (Study), $$$ (Design and Construction)
Anticipated Benefit	Long-term Moor Shore Road is threatened by sea-level rise. Elevating the road and bridge should be studied in order to preserve alternative vehicular connections in the event of ocean overwash or heavy rainfall closing Highway 12 and 158.
Priority Rating	1st

Project Map(s)	
Prioritization Measures	
Cost-Benefit	Low (1)
Social Equity	Medium (2)
Internal Capacity	Low (1)
Co-Benefits	Provide alternate evacuation route when other routes are inundated.
Public Ranking	3rd

Project 11: Kitty Hawk Rd./Twiford St. Drainage and Road Elevation Study Additional Study or Analysis Needed	
Project Description	•Asset mapping to locate and size culverts and determine material condition •Stormwater modeling to understand flow during designed storms •Potential to increase elevation of roads, replace or install culverts, create swales to improve infiltration, storage and conveyance. •Study of pedestrian access options Until this project has been studied and phased, the Town should coordinate with NCDOT to place markers in right-of-way to allow drivers crossing inundated roads to know where the edge of the road is located.
Location	West Kitty Hawk Road and Twiford Street intersection and West Kitty Hawk Road to Rogers Street
Source	Public Input, CAT members, Town Staff, and Vulnerability and Risk Assessment
Scoping Questions	Determine project study area, scope and phasing. Also determine potential intermediate improvements that could include flags or other delineation of the location of the roadway while the road is flooded.
Hazard(s) Addressed	Flooding, storm surge, sea level rise
Supporting Function	
Type of Solution	Infrastructure
Estimated Timeline	1-3 years
Responsible Entity	NCDOT
Potential Partners	Town of Kitty Hawk, NCDEQ,
Existing Funding	N/A
Potential Funding Sources	Future RCCP Feasibility Study Program
Estimated Cost	$-$$$

Anticipated Benefit	Asset mapping and conditions assessment of culverts will provide baseline conditions and inventory of the Town's assets. This can facilitate the planning of maintenance, replacement and/or upgrade of each asset. The observed conditions, mapped data and a hydraulic analysis can used as during a study to predict performance of culverts, swales and roads during future rains and/or tidal events. The results of such analyzes will inform Town leadership to plan/ build projects to protect private and critical public infrastructure and facilitate resident and emergency vehicle access to west Kitty Hawk. Note that this area was also identified as a priority for a multi-use path to improve bicycle and pedestrian connectivity. An elevated boardwalk or parallel MUP should be evaluated with roadway and drainage improvement options.
Priority Rating	2nd
Project Map(s)	
Prioritization Measures	
Cost-Benefit	Low (1)
Social Equity	High (3)
Internal Capacity	Low (1)
Co-Benefits	Safe route for emergency services and residents.
Public Ranking	Tied for 1st (In Additional Study or Analysis needed)

Project #12: Salt Marsh Wetland Restoration and Migration Study Additional Study or Analysis Needed	
Project Description	Inventory and map threatened, degraded, or eroded marsh complexes based on acreage, ecological, and protective functions Prioritize identified sites for restoration based on federal, state, and/or local criteria. Update and refine existing marsh migration projection maps to account for existing drainage systems, tidal and rainfall patterns, etc. With this effort, develop strategies to manage new development in low-lying areas to avoid blocking potential migration paths and prioritize strategies (i.e.; acquisition, conservation, land development updates, marsh migration on conservation lands (Kitty Hawk Woods)) that facilitate marsh migration.
Location	Southwest Kitty Hawk near Kitty Hawk Bay, West of Highway 158, North of West Kitty Hawk Road, Kitty Hawk Woods Natural Heritage Area, State and Locally owned managed areas
Source	Public input, CAT members, Town staff
Scoping Questions	Will need to have proper easements and/or legal agreements in place, property is privately owned
Hazard(s) Addressed	Flooding, storm surge, sea level rise
Supporting Function	
Type of Solution	Nature-based
Estimated Timeline	Ongoing in phases
Responsible Entity	Town of Kitty Hawk
Potential Partners	Division of Coastal Management, Dare County
Existing Funding	N/A
Potential Funding Sources	RCCP Phase III and Phase IV, NC Coastal Federation, NCDEQ grants, National Fish and Wildlife Federation (NFWF), NOAA Coastal Resilience grants, Wildlife Conservation Society Climate Adaptation Fund
Estimated Cost	$

Anticipated Benefit	Biodiversity: Wetlands support a diverse array of plant and animal species, many of which are specially adapted to wetland habitats. They serve as important breeding grounds, nurseries, and stopover sites for migratory birds, fish, amphibians, and other wildlife. Flood Control: Wetlands act as natural sponges, absorbing and storing excess water during periods of heavy rainfall or flooding. By slowing the flow of water and reducing peak flood levels, wetlands help to mitigate flood risks for nearby communities and adjacent critical assets. Water Quality Improvement: Wetlands filter and purify water by trapping sediments, nutrients, and pollutants. They help to improve water quality by removing excess nutrients, such as nitrogen and phosphorus, reducing the concentration of harmful contaminants, and reducing silt and organic material deposits in canal and channels throughout the Bay. Erosion Control: Wetland vegetation helps to stabilize shorelines and prevent erosion by absorbing wave energy and holding soils in place. This helps to protect coastlines, canal and channels banks , riverbanks, and other vulnerable areas from erosion and sedimentation. Threat of erosion due to increased wave action from storms will increase in coming years with sea level rise. Recreation and Tourism: Wetlands provide opportunities for recreational activities such as birdwatching, fishing, hiking, and kayaking. They attract visitors and tourists, contributing to local economies through ecotourism and outdoor recreation. Economic Benefits: Wetlands support commercial fisheries, agriculture, and forestry by providing habitat for fish and wildlife, replenishing groundwater supplies, and enhancing soil fertility. They also provide valuable ecosystem services, such as pollination and nutrient cycling, that support agricultural productivity.
Priority Rating	3rd
Project Map(s)	See Salt Marsh Restoration Potential Map on page (TBD)
Prioritization Measures	
Cost-Benefit	High (3)
Social Equity	Medium (2)
Internal Capacity	Medium (2)
Co-Benefits	Increased resiliency for residents in Kitty Hawk.
Public Ranking	1st (In Additional Study or Analysis Needed)

Additional Projects or Programs	
Project Name	**Project Description**
13. Beach Nourishment	The Town has a beach nourishment management plan and should continue to reinforce beach nourishment as a way to protect both its tourism economy and full-time and part-time residents and business owners.
14. Power projects	Electricity is essential to support critical facilities for disaster relief and recovery efforts after storm events. Ongoing coordination is necessary for emergency preparedness, ensure recovery and response is adequate in the aftermath of a storm event, surging power demands, etc. The town should continue to partner with Dominion Energy to ensure service is not disrupted for long periods of time.
15. Passive Recreation	Consider buy-outs along KH Bay to reduce exposure of private property to use for passive recreation while improving water quality, protecting private property values, and the potential to mitigate eroding shorelines.
16. Lillian to Sanderlin Swales	Addition of swales along roads to facilitate water removal and direct to existing pump out locations
17. Additional pump location and drainage improvements	Add pump location North of Luke Street, add swales and driveway culverts between Bennett St. and Luke St.
18. Tree Planting Program	Develop a tree planting program with aims at increasing tree canopy coverage east of Highway 158 to reduce stormwater runoff, improve water quality, calm traffic, provide shade, increase aesthetics and more. Other focus areas should be where older trees are at risk of dying, disease, etc.
19. Community Action Team Continued Coordination meetings	Continuing CAT team meetings; maintaining this network will build community capacity and may help address future resilience concerns
20. Relocation of Bob Perry Convenience Center	Current convenience center is threatened by flooding. Feasibility study needed to determine property needs and potential locations.

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Appendix

A

Chapter Contents

RESILIENT
Kitty Hawk

Tables of Assets and Final Vulnerability Scores

The following table describes the vulnerability assessment for critical facilities.

Critical Facilities

Asset ID Number	Asset Name	Address	Asset Type
32	Bob Perry Landing	4200 BOB PERRY RD	Water Access
31	Waste and Recycling Center and Boat Launch	4190 BOB PERRY RD	Government
28	Religious - Unitarian Universalist Congregation of the Outer Banks	843 HERBERT PERRY RD	Religious
30	Kitty Hawk Public Works Department	965 KITTY HAWK RD	Government
25	Town Hall	101 VETERANS MEMORIAL DR	Government
27	Religious - Kitty Hawk Methodist Church	803 KITTY HAWK RD	Religious
29	Kitty Hawk Fire Department	859 KITTY HAWK RD	Emergency Services
5	Food Lion	5500 CROATAN HWY	Grocery
2	Kitty Hawk Elementary School	16 DOGWOOD TRL	School
26	Kitty Hawk Police Department	722 KITTY HAWK RD	Emergency Services
24	Dominion Substation	3912 SHELBY AVE	Electric
8	Home Depot	5300 CROATAN HWY	Building Supplies
23	Religious - Holy Redeemer Catholic Church	301 KITTY HAWK RD	Religious
1	Southern Shores Fire Station 12	15 DOGWOOD TRL	Emergency Services
4	Dominion Energy Office	5300 THE WOODS RD	Electric
6	Walmart	5400 M CROATAN HWY	Grocery
13	Medical Office - Old Sentara Facility	5200 CROATAN HWY	Medical
7	Harris Teeter	5400 A-K CROATAN HWY	Grocery

Ownership	Estimated Value	Exposure Score	Sensitivity Score	Adaptive Capacity	Estimated Vulnerability
Private	$1,816,874.00	3.0	2	1	High
Public	$227,700.00	2.6	3	3	High
Private	$823,143.00	2.4	3	3	High
Public	$660,462.00	2.4	3	3	High
Public	$2,435,800.00	2.2	2	2	High
Private	$3,659,790.00	2.2	2	2	High
Public	$2,876,600.00	2.2	2	2	Medium
Private	$17,368,000.00	1.2	1	1	Medium
Public	$34,717,600.00	1.2	0	0	Medium
Public	$635,900.00	2.0	2	3	Medium
Private	$27,607,073.00	0.6	0	0	Low
Private	$11,868,000.00	0.6	0	1	Low
Private	$9,425,200.00	0.4	0	1	Low
Private	$1,028,019.00	1.2	1	3	Low
Private	$3,171,600.00	1.2	0	2	Low
Private	$12,498,300.00	0.2	0	1	Low
Public	$7,716,200.00	0	0	1	Low
Private	$5,671,000.00	0.8	0	2	Low

Critical Facilities

Asset ID Number	Asset Name	Address	Asset Type
3	Fuel - 7 Eleven - Northern Kitty Hawk	6100 CROATAN HWY	Fuel
20	United States Postal Service	3841 CROATAN HWY	Government
9	Kitty Hawk Visitor's Center	5230 CROATAN HWY	Government
12	Walgreens	5312 VA DARE TRL	Medical
14	Medical Offices - Therapy Center	5133 PUTTER LN	Medical
15	Medical Office -Urgent Care, Primary Care, Pharmacy	5107 CROATAN HWY	Medical
22	Religious - Lighthouse Christian Fellowship	100 BEACON DR	Religious
17	Fuel - Mobil	4017 CROATAN HWY	Fuel
34	Dare County Highway Patrol Office	2601 CROATAN HWY	Emergency Services
33	Fuel - Citgo	3500 CROATAN HWY	Fuel
10	Southern Shores Police Department	5375 VA DARE TRL	Emergency Services
11	Fuel - BP	5361 VA DARE TRL	Fuel
16	Fuel - Shell	4728 CROATAN HWY	Fuel
18	Religious - Kitty Hawk Baptist Church	3946 CROATAN HWY	Religious
19	Lifeguard Station	3840 VA DARE TRL	Emergency Services
21	Fuel - 7-Eleven - Southern Kitty Hawk	3868 CROATAN HWY	Fuel

Ownership	Estimated Value	Exposure Score	Sensitivity Score	Adaptive Capacity	Estimated Vulnerability
Private	$2,505,300.00	0.6	0	2	Low
Public	$4,575,000.00	0.2	0	2	Low
Public	$3,421,423.00	0	0	2	Low
Private	$2,646,700.00	0	0	2	Low
Private	$568,300.00	0	0	2	Low
Private	$2,071,100.00	0	0	2	Low
Private	$2,646,700.00	0	0	2	Low
Private	$1,218,296.00	0.4	0	3	Low
Public	$1,531,800.00	0.4	0	3	Low
Private	$1,132,825.00	0.2	0	3	Low
Public	$2,129,897.00	0	0	3	Low
Private	$1,433,400.00	0	0	3	Low
Private	$507,800.00	0	0	3	Low
Private	$2,052,200.00	0	0	3	Low
Public	$546,400.00	0	0	3	Low
Private	$907,400.00	0	0	3	Low

Table of Utility Assets and Final Vulnerability Scores

The following table describes the vulnerability assessment for critical facilities.

Utilities					
Asset Name	***Asset Type***	***Exposure Score***	***Sensitivity Score***	***Adaptive Capacity***	***Estimated Vulnerability***
Suction Basins/standpipes	Public Safety	1	1	3	Low
Water System (lines, hydrants)	Utility	3	2	1	High
Electricity (Power lines, substation)	Utility	3	3	1	High
Septic	Utility	3	1	3	Low

Tables of Assets and Final Vulnerability Scores

The following table describes the vulnerability assessment for critical facilities.

Transportation					
Asset Name	***Asset Type***	***Exposure Score***	***Sensitivity Score***	***Adaptive Capacity***	***Estimated Vulnerability***
US 158 (Evacuation Route)	Transportation	1	1	1	Low
W Kitty Hawk Rd.	Transportation	2	2	1	High
Twiford Rd.	Transportation	1	3	3	Medium
Tillett Ln.	Transportation	1	2/5	2	Low
Tarkle Ridge Dr.	Transportation	1	1	2	Low
Bob Perry Rd.	Transportation	1	2.5	1	High
Poor Ridge Rd.	Transportation	1	2	1	Medium
Emeline Rd.	Transportation	1	3	3	Low
Herbert Perry Rd.	Transportation	1	2.5	3	Low
Oneal Lane	Transportation	1	2	3	Low
Moor Shore Rd. and greenway	Transportation	1	3	3	High
NC 12	Transportation	3	3	1	High

GIS Critical Assets Fields Metadata

GIS Field Name	Long Name	Description	Notes
Asset_Name	Asset Name	Name of Asset	
Asset_ID	Asset ID	Numbering of Assets	Does not indicate level of importance or priority
AssetType_1	Asset Type	Assets categorized by type	
Ownership	Ownership	Public or private	
Exposure_ PreviouslyFlooded	Exposure Previously Flooded	Yes or No	Yes, the property has previously flooded, No, the property has not been flooded
Exposure_2_ft_SLR	Exposure 2 ft SLR	Yes or No	Yes, building is exposed to 2 ft SLR using the Intermediate High scenario, No, the building is not exposed to 3 ft. SLR using the Intermediate High scenario
Exposure_3_ft_SLR	Exposure 3 ft SLR	Yes or No	Yes, building is exposed to 3 ft SLR using the Intermediate High scenario, No, the building is not exposed to 3 ft. SLR using the Intermediate High scenario
Exposure_SLR_Property_ Exposure	Exposure SLR Property Exposure	Yes or No	Yes, the property is exposed (does not include the building), No, the property is not exposed to SLR
Exposure_100_yr_ Floodplain	Exposure 100 yr Floodplain	Yes or No	Yes, the asset intersects with the 1% annual chance floodplain, No, it does not

GIS Critical Assets Fields Metadata

GIS Field Name	Long Name	Description	Notes
Exposure_500_yr_Floodplain	Exposure 500 yr Floodplain	Yes or No	Yes, the asset intersects with the 0.2% annual chance floodplain, No, it does not
Exposure_Floodplain_Property_Exposure	Exposure Floodplain Property Exposure	Yes or No	Yes, the property is located in the 1% or 0.2% annual chance floodplain, No, it is not
Exposure_Slosh_Cat_1	Exposure Slosh Category 1	Yes or No	Yes, the asset is susceptible to storm surge in a Category 1 event, No, the asset is not susceptible to storm surge in a Category 1 event
Exposure_Slosh_Cat_2	Exposure Slosh Category 2	Yes or No	Yes, the asset is susceptible to storm surge in a Category 2 event, No, the asset is not susceptible to storm surge in a Category 2 event
Exposure_Slosh_Property	Exposure Slosh Property	Yes or No	Yes, the property is susceptible to storm surge in a Category 1 and 2 event, No, the property is not susceptible to storm surge
Exposure_BaseFlood_1_ft	Exposure BaseFlood 1 ft.	Yes or No	Yes, the asset is exposed to the base flood with 1 ft SLR, No, the asset is not exposed to the base flood with 1 ft. SLR
Exposure_Base_Flood_2_ft	Exposure Baseflood 2 ft	Yes or No	Yes, the asset is exposed to the base flood with 2 ft SLR, No, the asset is not exposed to the base flood with 2 ft. SLR

GIS Critical Assets Fields Metadata

GIS Field Name	Long Name	Description	Notes
Exposure_Fire	Exposure - Fire	3= Very High to High Wildfire Risk 2= Moderate Wildfire Risk 1= Low to Very Low Wildfire Risk 0= No Wildfire Risk	
Land_Value	Land Value	Estimated Land Value	
Structure_Value	Structure Value	Estimated Structure Value	
Structure_Value_125	Structure Vale @ 125%	Estimated Replacement Cost	
Est_Total_Value	Est Total Value	Estimated Total Value= Land Value + Structure Value	
Cost_to_Replace	Cost to Replace	Cost to Replace= Land Value + Estimated Replacement Cost	
Structure_Present	Structure Present	Yes or No	
YearBuilt	Year Built	Estimated Construction Year	
FFE_ft	Finished Floor Elevation, in feet	Describes the height of the lowest habitable floor above sea level, in feet	
Freeboard_1_ft_SLR	Freeboard at 1 ft SLR	Height of the finished floor above a SLR of 1 ft=FFE minus 1	
Freeboard_2_ft_SLR	Freeboard at 2 ft SLR	Height of the finished floor above a SLR of 2 ft=FFE minus 2	
Current_Adaptive_Capacity_Efforts	Current Adaptive Capacity Efforts	Type of adaptive capacities in place	
Potential_for_Adaptive_Capacity	Potential for Adaptive Capacity	Type of adaptive capacity	

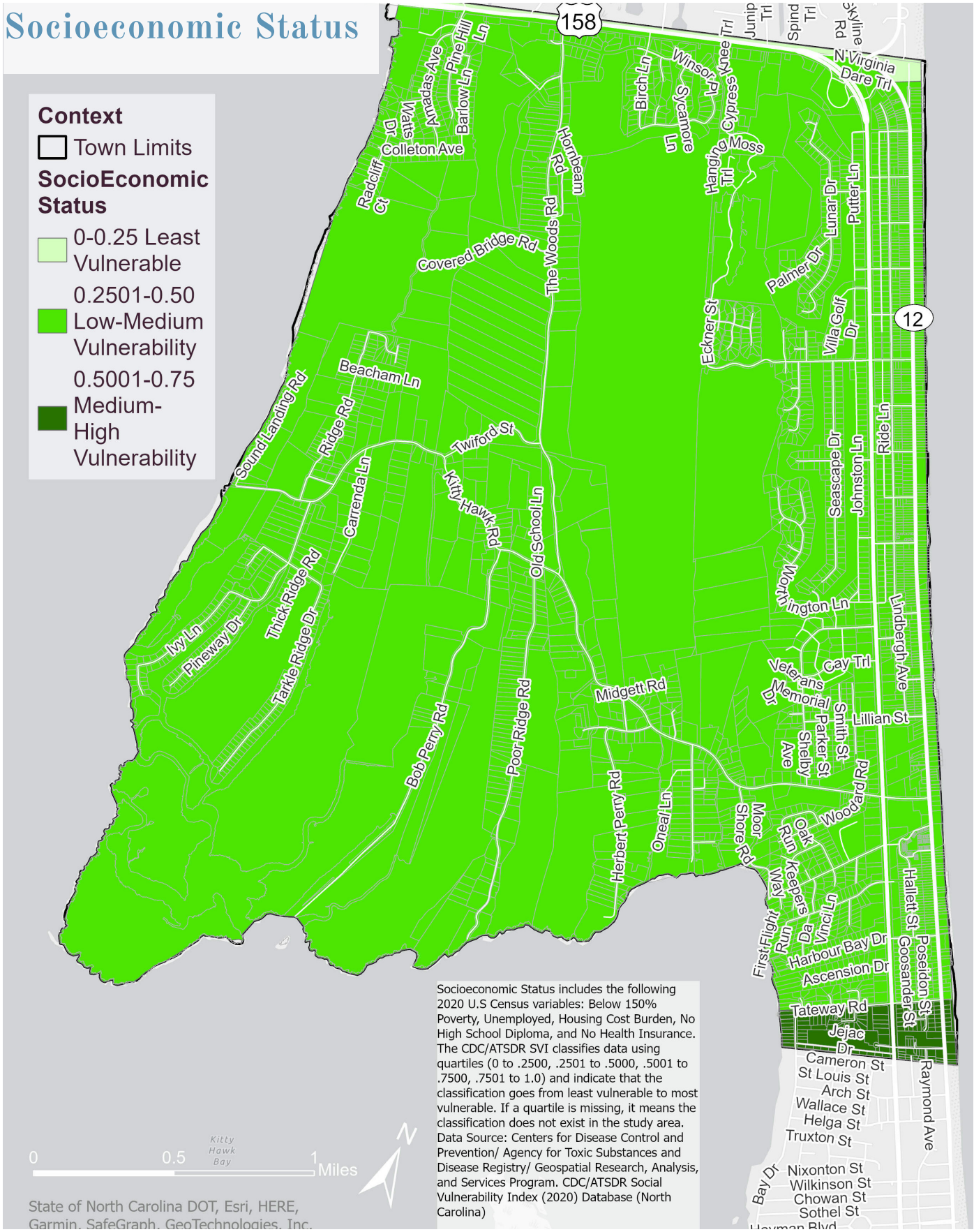
GIS Critical Assets Fields Metadata

GIS Field Name	Long Name	Description	Notes
Building_Impact_SLR	Building Impact- SLR	Percentage of building impacted	
Building_Impact_Floodplain	Building Impact - Floodplain	Percentage of building impacted	
Building_Impact_Future_Flooding	Building Impact Future Flooding	Percentage of building impacted	
RAW_Exposure_SLR	RAW Exposure - SLR	0=No exposure, 1= Property exposed to 1', 2= Property and building exposed to 2' of SLR, 3= Property and building exposed to 3' of SLR	
RAW_Exposure_SLOSH	RAW Exposure - SLOSH	0=No exposure to storm surge, 1= property exposed to storm surge, 2= property and building exposed to storm surge in Category 1 event, 3= property and building exposed to storm surge in Category 2 event	
RAW_Exposure_Current_FLD	RAW exposure to current 100-year and 500-year floodplains	0=No impacts, 1= property with flood exposure, 2=building and property exposed to 100-year floodplain, 3= building and property exposure to 100-year and 500-year floodplain	
RAW_Exposure_Future_FLD	RAW Exposure - Future FLD	0=No impacts, 1= property with base flood and 2' SLR , 2=building and property exposed to base flood and 2' SLR , 3= building exposure to base flood and 1' of SLR	

GIS Critical Assets Fields Metadata

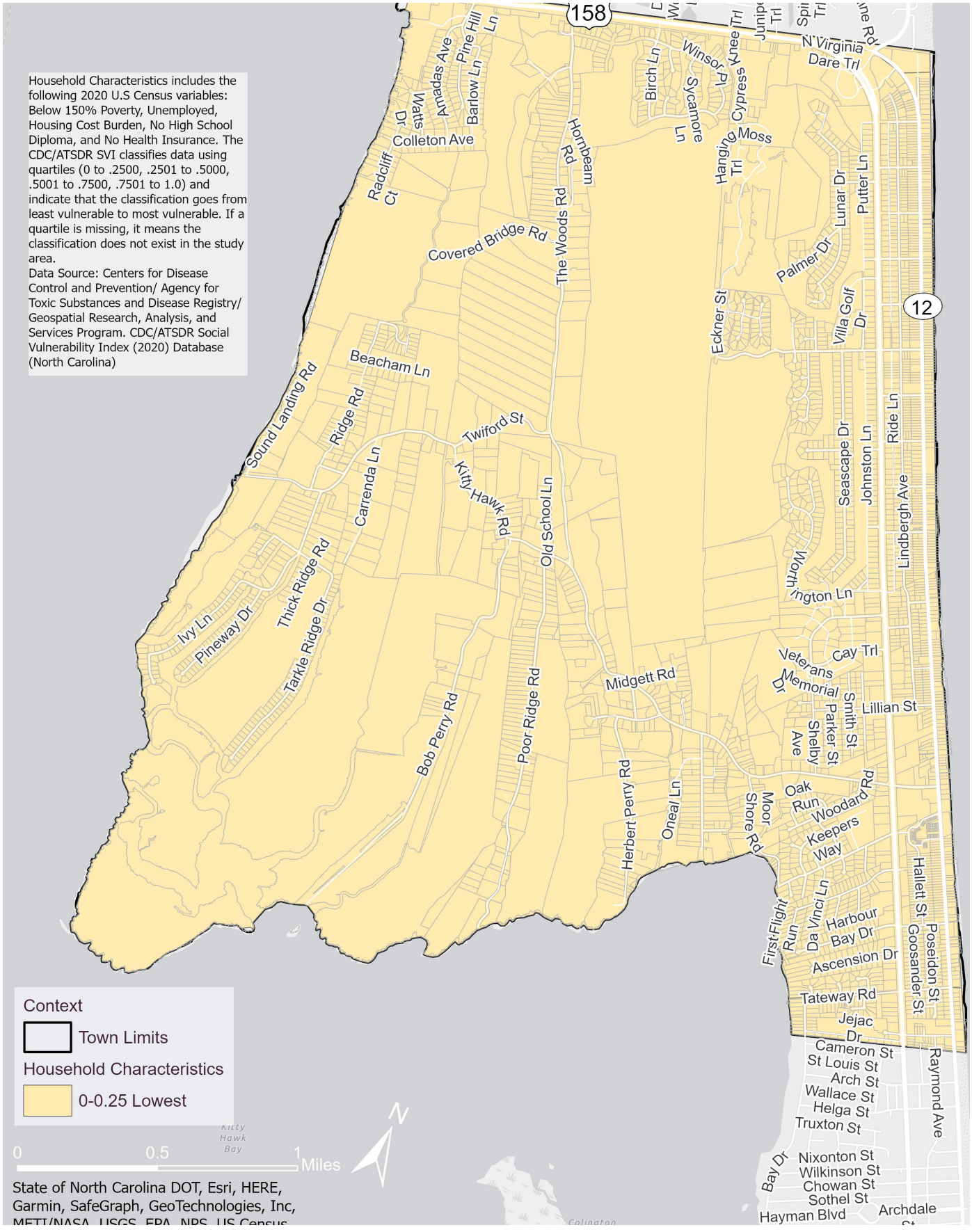
GIS Field Name	Long Name	Description	Notes
RAW_Exposure_Fire	RAW Exposure-Fire	0=No impacts, 1=less than 25% of building impacted, 2= 25%-50% of the building impacted, 3=>50% of building impacted	
Exposure Score	Exposure Score	Average of RAW exposure scores	
Sensitivity_Score	Sensitivity Score	0= No Impacts, 1= 1 impact, 2= 2 impact, 3= 3 impacts	
Adaptive_Capacity_Score	Adaptive Capacity Score	0=>$20 million replacement cost, 1= $8 million- $20 million replacement cost, 2= $2.5 million- $8 million replacement cost, 3=<$2.5 million	
Vulnerability_ CompositeScore	Vulnerability Composite Score	Exposure Score + Sensitivity Score -Adaptive Score	

Socioeconomic Status

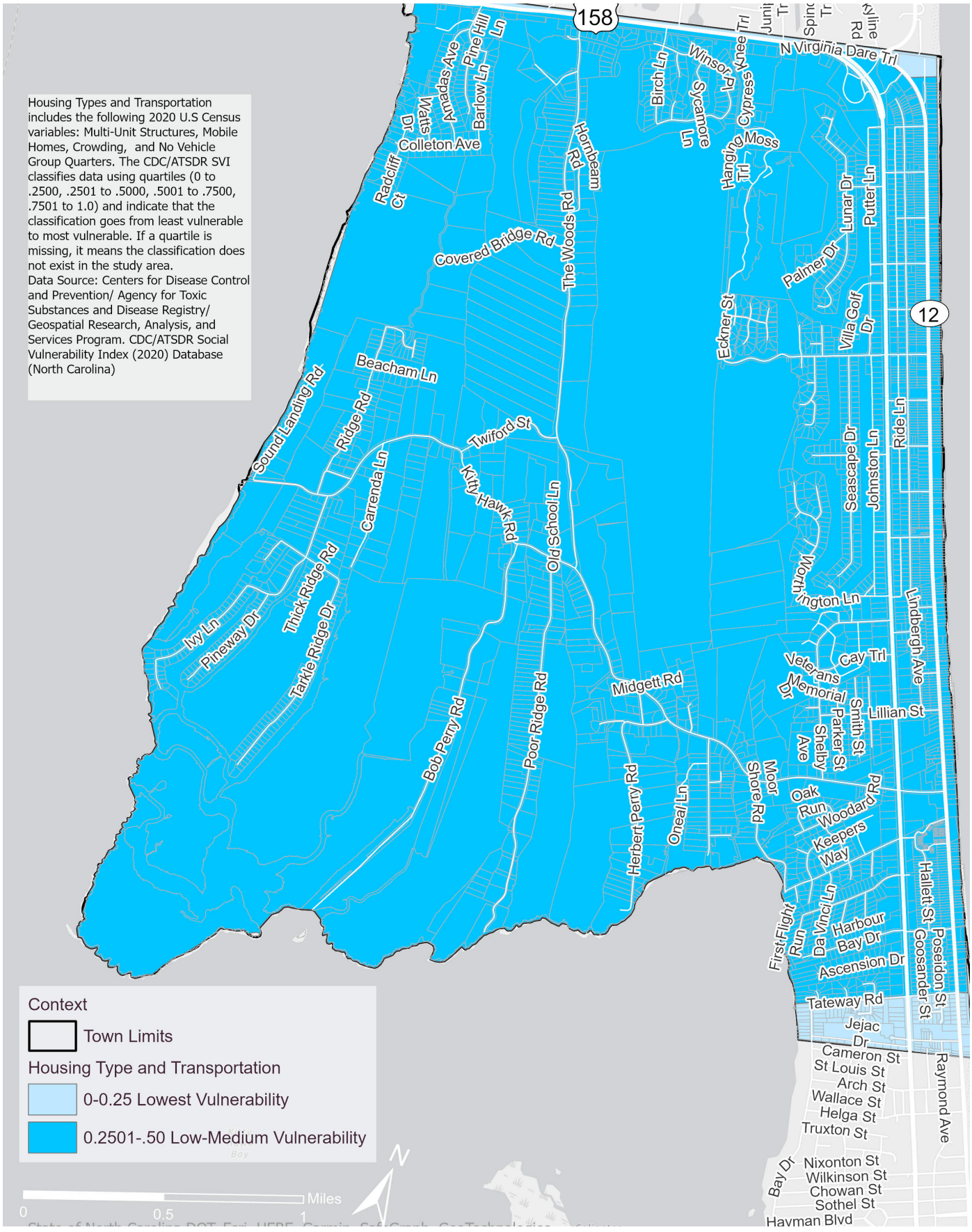


Socioeconomic Status includes the following 2020 U.S Census variables: Below 150% Poverty, Unemployed, Housing Cost Burden, No High School Diploma, and No Health Insurance. The CDC/ATSDR SVI classifies data using quartiles (0 to .2500, .2501 to .5000, .5001 to .7500, .7501 to 1.0) and indicate that the classification goes from least vulnerable to most vulnerable. If a quartile is missing, it means the classification does not exist in the study area. Data Source: Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. CDC/ATSDR Social Vulnerability Index (2020) Database (North Carolina)

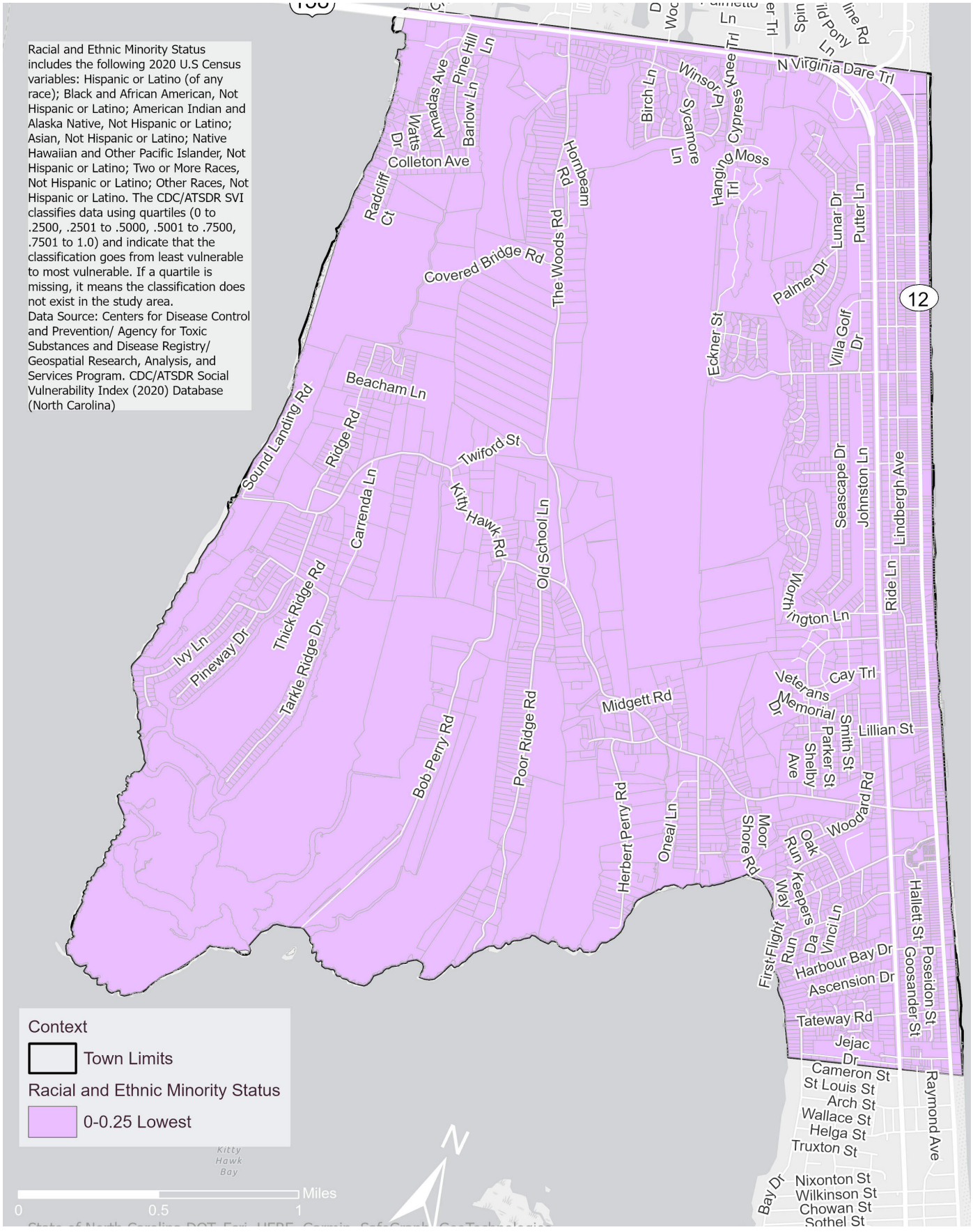
Household Characteristics



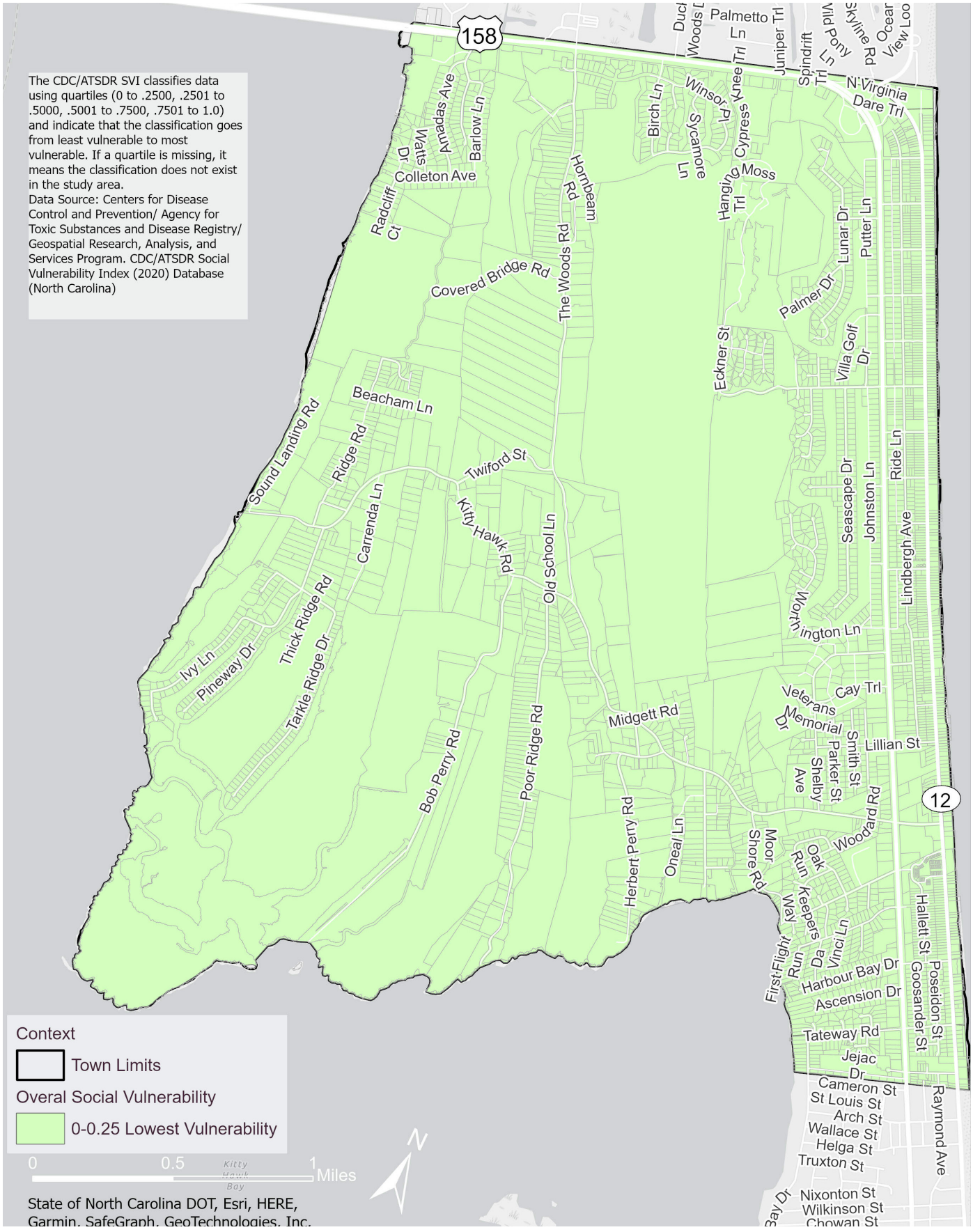
Housing Type and Transportation



Racial and Ethnic Minority Status

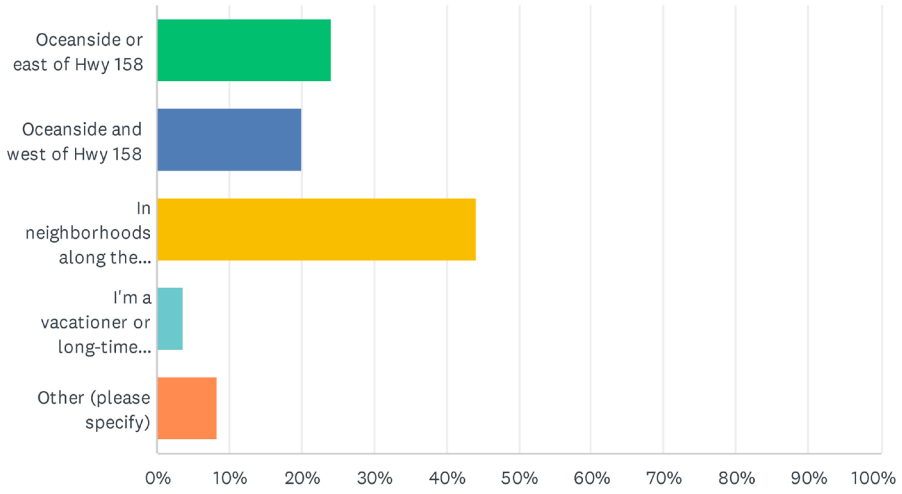


Overall Social Vulnerability



Q1 Generally speaking, where do you live or own property? Select the best one.

Answered: 170 Skipped: 0



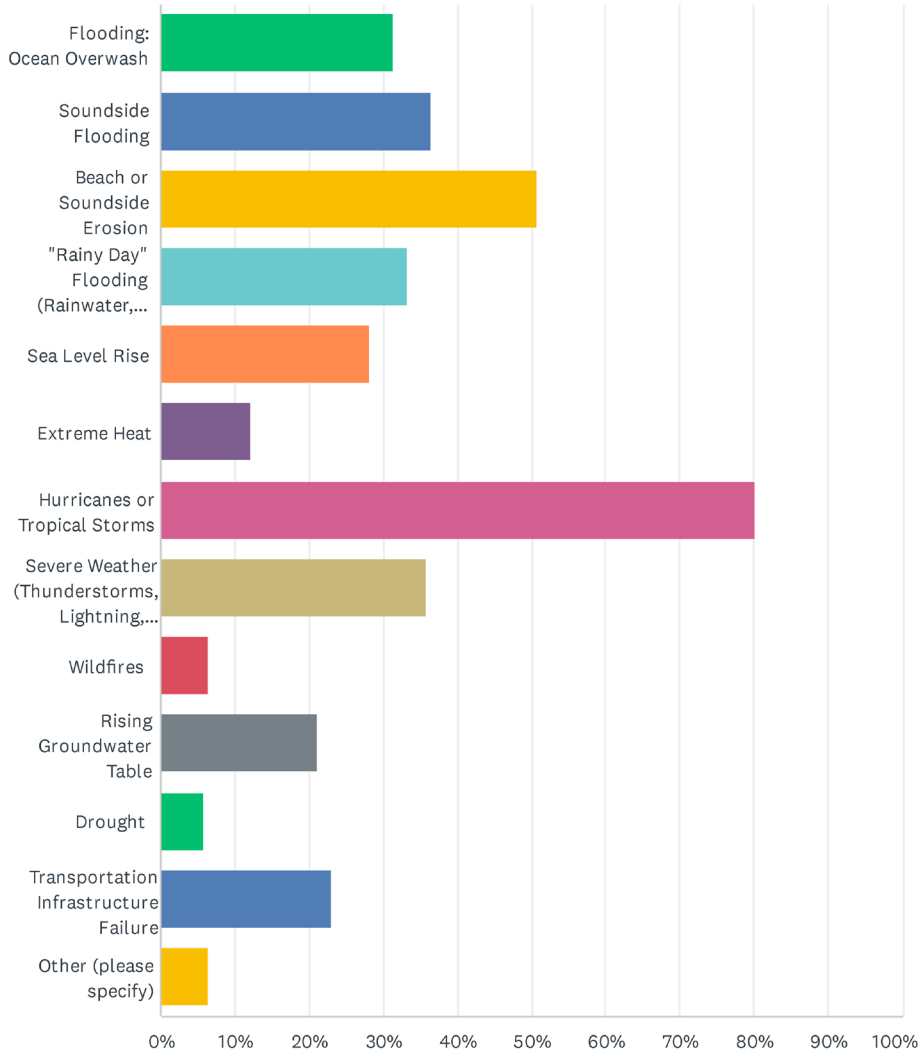
ANSWER CHOICES	RESPONSES	
Oceanside or east of Hwy 158	24.12%	41
Oceanside and west of Hwy 158	20.00%	34
In neighborhoods along the sound, near the Reserve or west of W. Kitty Hawk Road	44.12%	75
I'm a vacationer or long-time visitor	3.53%	6
Other (please specify)	8.24%	14
TOTAL		170

#	OTHER (PLEASE SPECIFY)	DATE
1	Seascape neighborhood on west side of 158	2/20/2024 2:41 PM
2	Martins Point	2/13/2024 10:10 AM
3	Kitty Hawk Estates	2/12/2024 6:58 PM
4	Kitty Hawk Estates	2/12/2024 4:54 PM
5	W Kitty Hawk Rd close to 158	2/11/2024 7:07 PM
6	Behind the Smelly Asphalt Plant	2/10/2024 2:16 PM
7	west of bypass	2/10/2024 7:38 AM
8	West if Hwy 158 (Options 3 & 4 make no sense as written)	2/9/2024 7:15 PM
9	Fronts the beach road	2/9/2024 4:28 PM
10	West of Hwy158	2/9/2024 3:53 PM

11	Seascape on Lunar	2/9/2024 3:31 PM
12	Seascape	2/9/2024 2:41 PM
13	non-resident property owner	2/9/2024 2:07 PM
14	SEASCAPE	2/9/2024 1:28 PM

Q2 What types of potential hazards concern you the most? Choose up to five.

Answered: 156 Skipped: 14

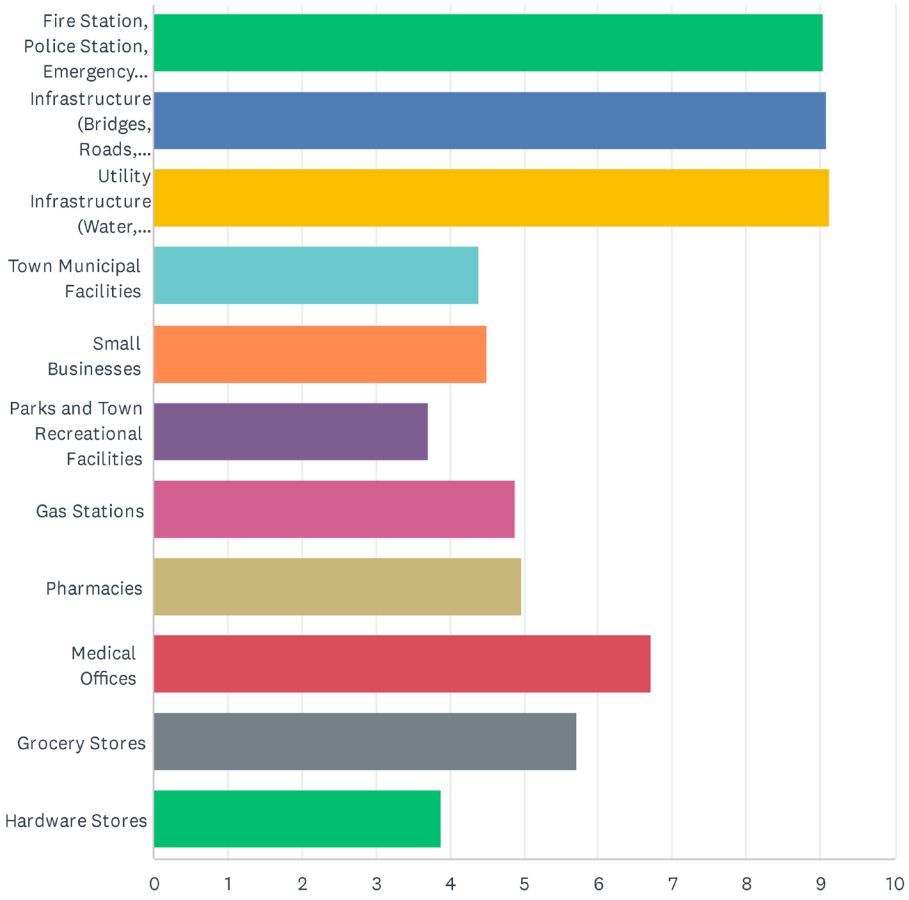


ANSWER CHOICES	RESPONSES	
Flooding: Ocean Overwash	31.41%	49
Soundside Flooding	36.54%	57
Beach or Soundside Erosion	50.64%	79
"Rainy Day" Flooding (Rainwater, Stormwater flooding)	33.33%	52
Sea Level Rise	28.21%	44
Extreme Heat	12.18%	19
Hurricanes or Tropical Storms	80.13%	125
Severe Weather (Thunderstorms, Lightning, Tornadoes)	35.90%	56
Wildfires	6.41%	10
Rising Groundwater Table	21.15%	33
Drought	5.77%	9
Transportation Infrastructure Failure	23.08%	36
Other (please specify)	6.41%	10
Total Respondents: 156		

#	OTHER (PLEASE SPECIFY)	DATE
1	Wind damage	2/20/2024 12:46 PM
2	Drainage to keep septic tanks working and streets clear for emergency vehicles and personal cars	2/12/2024 7:02 PM
3	better quality drinking water	2/12/2024 3:00 PM
4	Evacuation routes	2/11/2024 7:11 PM
5	Infrastructure collapse / island access	2/9/2024 7:19 PM
6	Powerline infrastructure. Bury it.	2/9/2024 6:15 PM
7	Over building	2/9/2024 4:26 PM
8	High winds	2/9/2024 4:14 PM
9	downed utility wires	2/9/2024 2:05 PM
10	blown sand / building dunes that are encroaching on the beach road and oceanside shoulder	2/9/2024 1:07 PM

Q3 Please rank the following community assets that should be prioritized in this plan by order of importance, with 1 being most important and 11 being least important.

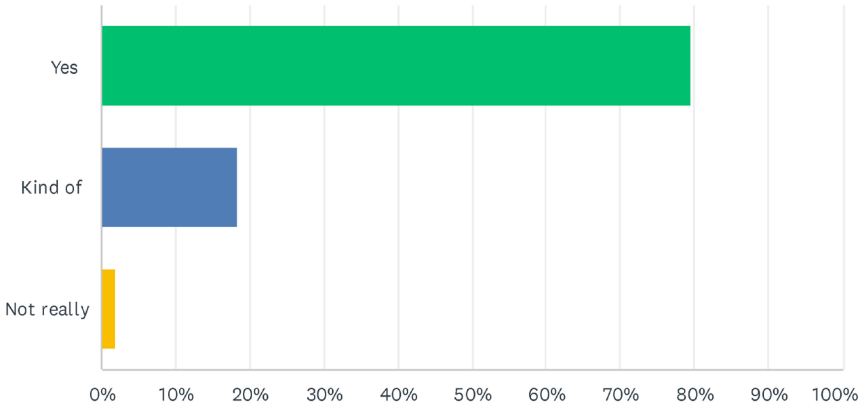
Answered: 156 Skipped: 14



	1	2	3	4	5	6	7	8	9	10	11
Fire Station, Police Station, Emergency Services	34.62% 54	14.74% 23	25.64% 40	8.97% 14	3.85% 6	3.21% 5	0.64% 1	2.56% 4	3.21% 5	1.28% 2	1
Infrastructure (Bridges, Roads, Stormwater Conveyance/Ditches	25.00% 39	26.28% 41	23.08% 36	11.54% 18	5.77% 9	1.28% 2	2.56% 4	0.64% 1	1.28% 2	0.64% 1	1
Utility Infrastructure (Water, Electricity, Etc.)	22.44% 35	35.26% 55	18.59% 29	9.62% 15	4.49% 7	1.92% 3	1.92% 3	1.28% 2	3.21% 5	0.64% 1	0
Town Municipal Facilities	1.28% 2	2.56% 4	4.49% 7	4.49% 7	10.90% 17	8.33% 13	9.62% 15	12.18% 19	17.31% 27	20.51% 32	8
Small Businesses	4.49% 7	0.64% 1	3.85% 6	7.05% 11	7.05% 11	7.69% 12	12.82% 20	10.26% 16	16.67% 26	21.79% 34	7
Parks and Town Recreational Facilities	1.28% 2	3.85% 6	5.77% 9	8.33% 13	7.05% 11	5.13% 8	3.21% 5	3.85% 6	5.77% 9	14.74% 23	41
Gas Stations	1.28% 2	2.56% 4	5.13% 8	10.26% 16	8.33% 13	13.46% 21	14.10% 22	11.54% 18	12.18% 19	7.69% 12	13
Pharmacies	1.28% 2	2.56% 4	1.92% 3	5.13% 8	12.82% 20	17.31% 27	15.38% 24	18.59% 29	9.62% 15	8.97% 14	6
Medical Offices	4.49% 7	8.33% 13	7.05% 11	23.72% 37	15.38% 24	12.82% 20	10.26% 16	4.49% 7	7.05% 11	4.49% 7	1
Grocery Stores	3.21% 5	2.56% 4	4.49% 7	8.33% 13	19.87% 31	16.67% 26	14.74% 23	10.90% 17	10.26% 16	7.69% 12	1
Hardware Stores	0.64% 1	0.64% 1	0.00% 0	2.56% 4	4.49% 7	12.18% 19	14.74% 23	23.72% 37	13.46% 21	11.54% 18	16

Q4 Do you support the following vision statement for the town's recovery?“The Town of Kitty Hawk is a thriving Outer Banks village, focused on improving its long-term viability by prioritizing the enhancement and protection of its natural resources, preparing infrastructure assets, and providing effective response and recovery to residents and visitors.”

Answered: 152 Skipped: 18



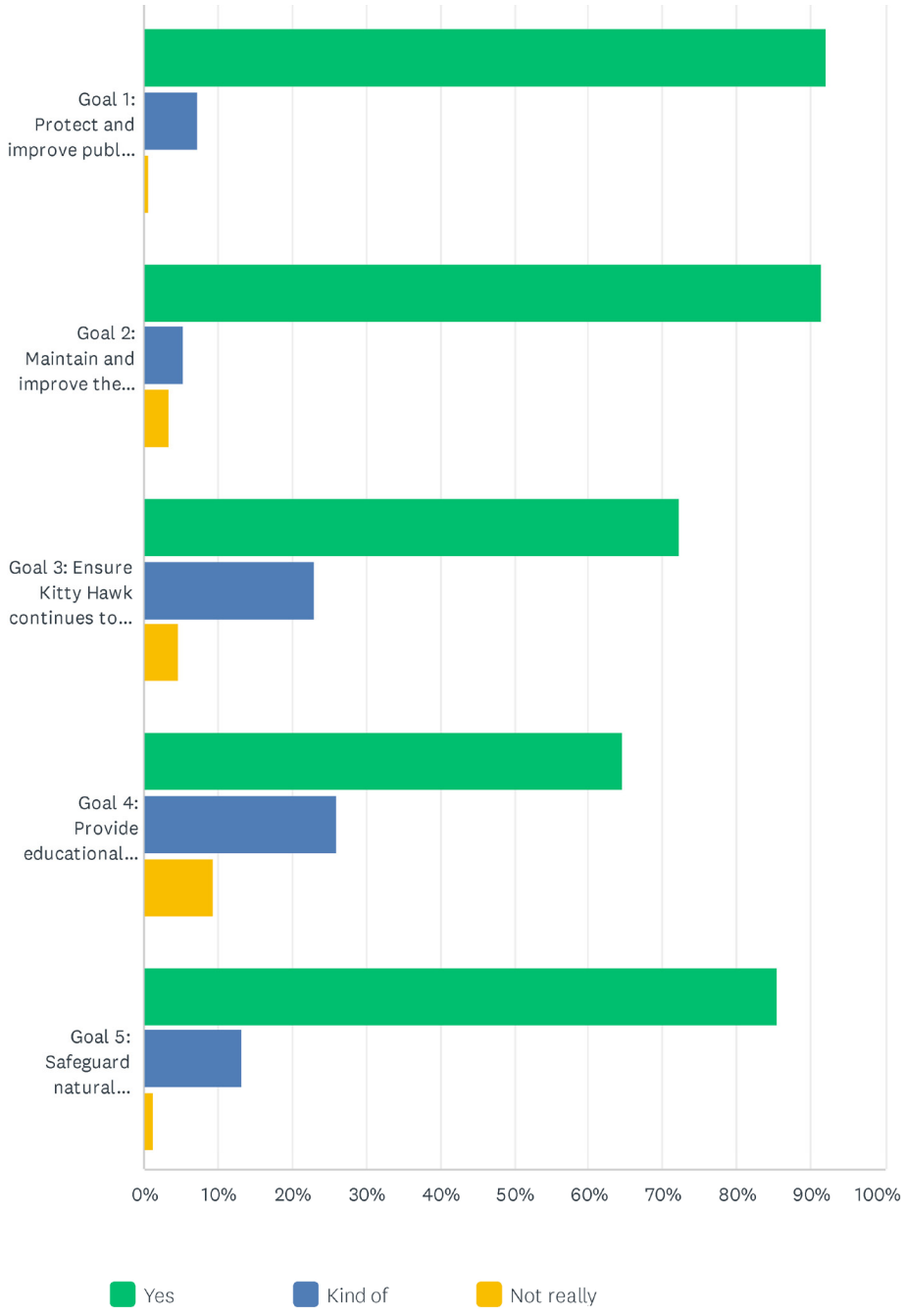
ANSWER CHOICES	RESPONSES	
Yes	79.61%	121
Kind of	18.42%	28
Not really	1.97%	3
TOTAL		152

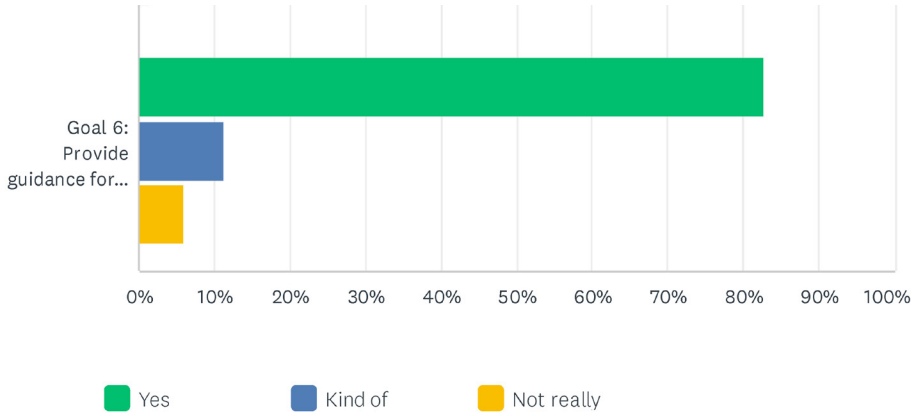
#	HOW WOULD YOU CHANGE IT?	DATE
1	Save live oaks as much as possible. Consider long term affects on over development and consider why people liked the outer banks (Remoteness, and nature). We do not need it to become Virginia Beach.	2/21/2024 4:14 PM
2	Holding down taxes added to statement	2/20/2024 12:51 PM
3	Thriving is not really the word more like stable	2/14/2024 4:35 AM
4	DOSNT MENTION PROPERTY OWNER/TAXPAYERS. WITH THEM INVESTING, MAINTAINING, AND PROVIDING QUALITY FACILITIES THERE WOULD BE NO RESIDENTS AND VISITORS.	2/13/2024 12:33 PM
5	Drainagez drainage, drainage	2/12/2024 7:04 PM
6	do not approve CRAP like Sugar Kingdom, a blight on our landscape!	2/12/2024 4:58 PM
7	We have to be very mindful of too much new construction with the rising water table.	2/11/2024 11:20 AM

10	I would add in a statement about protection of the diversity of homes and limiting the approval of oversized homes	2/10/2024 12:15 PM
11	Lower taxes	2/10/2024 8:17 AM
12	Sugar Kingdom is not helping any of the above.	2/10/2024 7:43 AM
13	Not sure what you mean by “preparing infrastructure assets”.	2/9/2024 9:55 PM
14	...focused on providing effective response and recovery to residents and visitors, preparing infrastructure assets and the enhancement and protection of its natural resources. (you need to put the people first)	2/9/2024 7:25 PM
15	I would place providing effective response first, then the infrastructure, then the long term viability of natural assets	2/9/2024 5:58 PM
16	I would say that the town should be carrying out a vision based on the majority of it's populous. Not the mayor, not long time generational residents - a cohesive voice of the entire town.	2/9/2024 4:56 PM
17	Replace "village" with "town"	2/9/2024 4:35 PM
18	We need sidewalks along the Bypass from the KH Rest area to Kitty Hawk Road. Promote SAFE walking traffic for the communities along the bypass as well as down Kitty Hawk Road. Excited for the new Police/Emergency Response offices opening off Putter Ln.	2/9/2024 3:37 PM
19	We are way past the days of being a "village."	2/9/2024 2:29 PM
20	inhance emergency response	2/9/2024 2:13 PM
21	Stop all the building	2/9/2024 1:59 PM
22	Effect more stringent zoning laws	2/9/2024 1:38 PM
23	The Town of Kitty Hawk is a thriving Outer Banks village, focused on improving its long-term viability by prioritizing the enhancement and protection of its natural resources, developing and implementing resiliency plans, including preparing infrastructure assets, and providing effective leadership of response and recovery to residents and visitors.	2/9/2024 1:37 PM
24	Sand replenishment regularly	2/9/2024 1:29 PM

Q5 Do the following draft goals reflect your hopes for recovery for Kitty Hawk?

Answered: 152 Skipped: 18



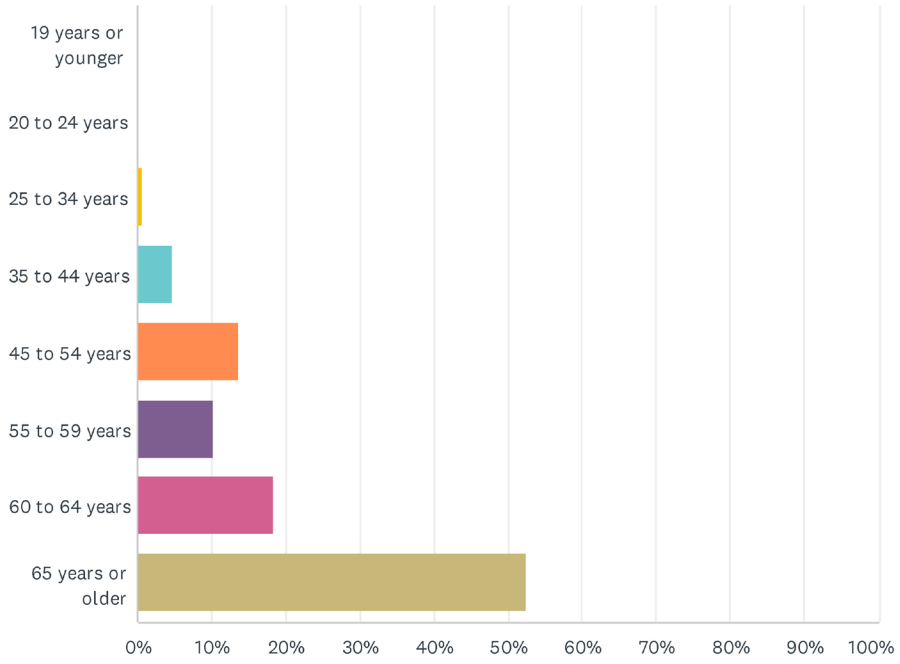


Resilient Kitty Hawk

	YES	KIND OF	NOT REALLY	TOTAL
Goal 1: Protect and improve public infrastructure to reduce impacts from natural hazards and increase coastal resilience.	92.11% 140	7.24% 11	0.66% 1	152
Goal 2: Maintain and improve the effectiveness and resiliency of public safety response.	91.39% 138	5.30% 8	3.31% 5	151
Goal 3: Ensure Kitty Hawk continues to be a livable community with diverse economic opportunities.	72.37% 110	23.03% 35	4.61% 7	152
Goal 4: Provide educational opportunities to increase public awareness and understanding of coastal risks and resiliency.	64.67% 97	26.00% 39	9.33% 14	150
Goal 5: Safeguard natural resources including existing tree canopy, wetlands, beaches, dunes, and shorelines, and encourage green stormwater infrastructure and low impact development techniques in new development.	85.43% 129	13.25% 20	1.32% 2	151
Goal 6: Provide guidance for future investment, planning, and regulatory changes to manage stormwater, and limit future property impacts.	82.78% 125	11.26% 17	5.96% 9	151

Q6 Which best describes your age?

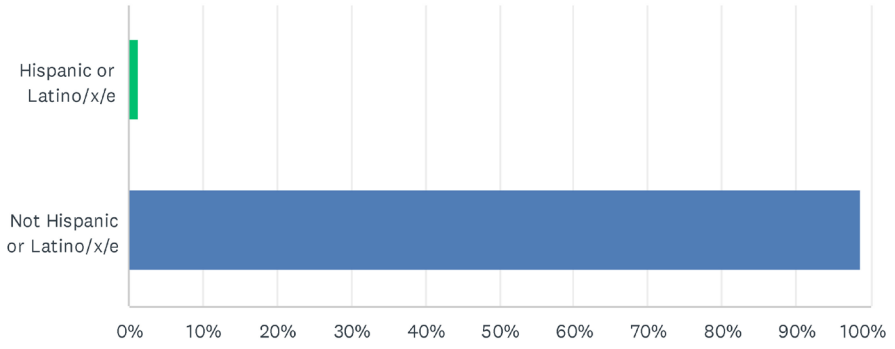
Answered: 147 Skipped: 23



ANSWER CHOICES	RESPONSES	
19 years or younger	0.00%	0
20 to 24 years	0.00%	0
25 to 34 years	0.68%	1
35 to 44 years	4.76%	7
45 to 54 years	13.61%	20
55 to 59 years	10.20%	15
60 to 64 years	18.37%	27
65 years or older	52.38%	77
TOTAL		147

Q7 What is your ethnicity?

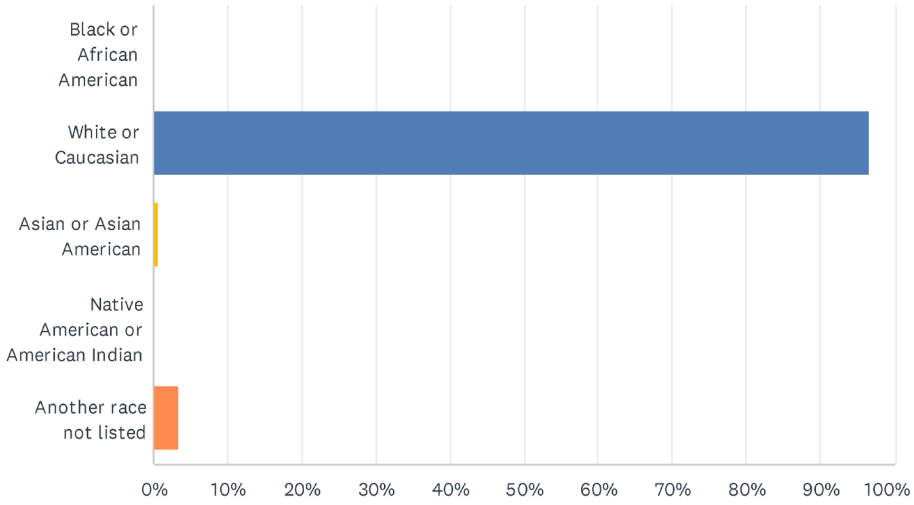
Answered: 145 Skipped: 25



ANSWER CHOICES	RESPONSES	
Hispanic or Latino/x/e	1.38%	2
Not Hispanic or Latino/x/e	98.62%	143
TOTAL		145

Q8 Which best describes your race? (Select all that apply)

Answered: 145 Skipped: 25

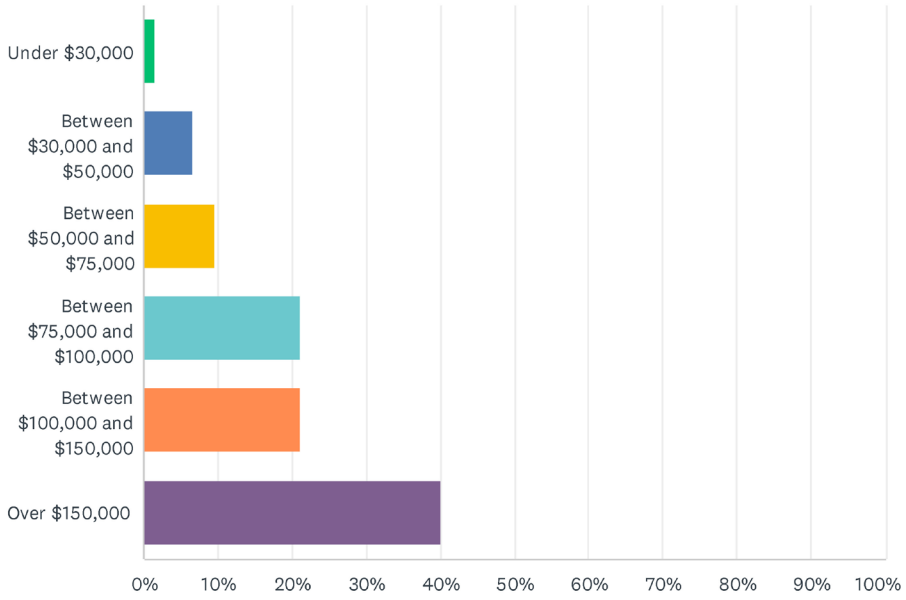


ANSWER CHOICES	RESPONSES	
Black or African American	0.00%	0
White or Caucasian	96.55%	140
Asian or Asian American	0.69%	1
Native American or American Indian	0.00%	0
Another race not listed	3.45%	5
Total Respondents: 145		

#	ANOTHER RACE NOT LISTED	DATE
1	Prefer not to answer	2/9/2024 9:55 PM
2	no response	2/9/2024 4:45 PM
3	American	2/9/2024 4:25 PM
4	Pacific Islander/ half Greek	2/9/2024 4:02 PM
5	this is not in line with this survey	2/9/2024 2:15 PM

Q9 Which best describes your annual household income?

Answered: 137 Skipped: 33



ANSWER CHOICES	RESPONSES	
Under $30,000	1.46%	2
Between $30,000 and $50,000	6.57%	9
Between $50,000 and $75,000	9.49%	13
Between $75,000 and $100,000	21.17%	29
Between $100,000 and $150,000	21.17%	29
Over $150,000	40.15%	55
TOTAL		137

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Kitty Hawk