NORTH CAROLINA
RESILIENT COASTAL COMMUNITIES PROGRAM

PINE KNOLL SHORES

Final Deliverable - **Resilience Strategy**

MAY 2022

Dewberry

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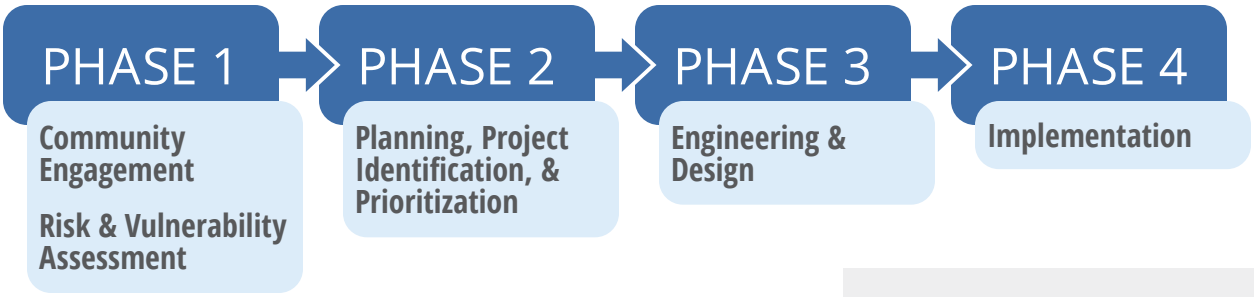
SUMMARY

The Resilient Coastal Communities Program (RCCP) is a grant program administered by the North Carolina Division of Coastal Management (NCDCM). The program objectives are to address barriers to coastal resilience in North Carolina, to assist communities in the preparation of risk and vulnerability assessments and the development of projects to address community risks, to advance coastal resilience projects to construction, and to link communities to funding streams for project implementation. The RCCP emphasizes the identification of, and outreach to, traditionally underserved communities. It also emphasizes the incorporation of natural or nature-based solutions (NNBS) to address community vulnerabilities. As of May 2022, the first two phases of the RCCP are underway, with two additional phases scheduled to begin later in 2022 and subsequent years. The phases of the RCCP are illustrated below.



The Town of Pine Knoll Shores, North Carolina was selected for Phase 2 of the RCCP in 2021. The Town previously completed a Resilience Evaluation and Needs Assessment (RENA) in 2018 that incorporated public feedback and infrastructure data to assess the Town's risk and vulnerability to coastal hazards. During Phase 2 of the RCCP process, using information from the RENA, other regional planning efforts, and input from a Community Action Team (CAT), the Town identified and prioritized a series of projects to address coastal hazards.

Project Portfolio Focus

- **Nature-based or Hybrid Stormwater Solutions**
- **Water Table Monitoring**
- **Saltwater Intrusion Monitoring**
- **Comprehensive Shoreline Management**
- **Dune Stabilization/ Protection Program**

Feedback from the community and the CAT was used to identify the primary coastal hazards facing the Town, which include storm and rainfall-event flooding and shoreline erosion. The same input identified municipal facilities, local roadways, and natural resources as critical assets of concern. To address asset vulnerabilities, the resulting project portfolio emphasizes the use of natural or nature-based stormwater solutions, ongoing monitoring for water quality and saltwater intrusion, shoreline management along the Bogue Sound shoreline, and a dune stabilization program along the ocean shoreline. The CAT identified seven projects for the RCCP project portfolio, which may be implemented under later phases of the RCCP or under other federal, state, or local resilience programs. The enclosed report provides a more in-depth look at the RCCP process and the major outcomes of the effort.

I. Vision and Goals

As a barrier island community, Pine Knoll Shores experiences flooding from coastal storm surge, tidal flooding, and heavy rainfall events. Based on input from the Community Action Team (CAT), the Town wants to build upon and compliment the progress made during the 2018 Resilience Evaluation and Needs Assessment (RENA) pilot program as well as the recent Strategic Plan development. For Pine Knoll Shores, the main goal of the RCCP is to educate and engage residents on the importance of community resiliency. The Town wants to utilize a community-wide effort to develop and rank projects in a project portfolio that addresses the Town's current issues with stormwater management along with projected effects from sea level rise and climate change.

Vision

Build upon and compliment the progress made during the recent Resilience Evaluation and Needs Assessment (RENA) pilot program and the Town Strategic Plan process.

II. Community Action Team (CAT)

The Resilient Coastal Communities Program (RCCP) process requires each community to establish a multi-disciplinary CAT composed of diverse stakeholders to provide input throughout the process and engage the community. Under-represented communities should be reflected in the CAT and in community engagement efforts. Pine Knoll Shores' CAT was established from input from Town staff and is listed in **Table 1**.

CAT meetings were held in November 2021 and March and April 2022; a summary of each meeting is included in **Appendix A**. The CAT membership included Town staff and officials with a range of experience, as well as community partners such as the N.C. Aquariums and the N.C. Coastal Federation. The CAT provided critical insight on historic hazard planning efforts and infrastructure needs, noting the efforts conducted during the recent RENA process and the Town Strategic Plan development.

During initial discussions, the CAT cited poor drainage on local streets, issues with leaking septic tanks, and the safety of the large elderly population as key issues to consider in the RCCP effort. The Town is very interested in the use of natural and

TABLE 1: COMMUNITY ACTION TEAM

NAME	POSITION
John Brodman	Mayor
Paul Payne	Planning Board Chair
John Ferguson	SPC Chair/Business Rep
Robert Cox	HOA President/SPC Member/Town Commissioner
Liz Baird	NC Aquarium
Bree Charron	NC Coastal Federation/Stormwater Engineer
Brian Kramer	Town Manager
Kevin Reed	Town Planner
Bill Knecht	Town Commissioner/HOA Rep

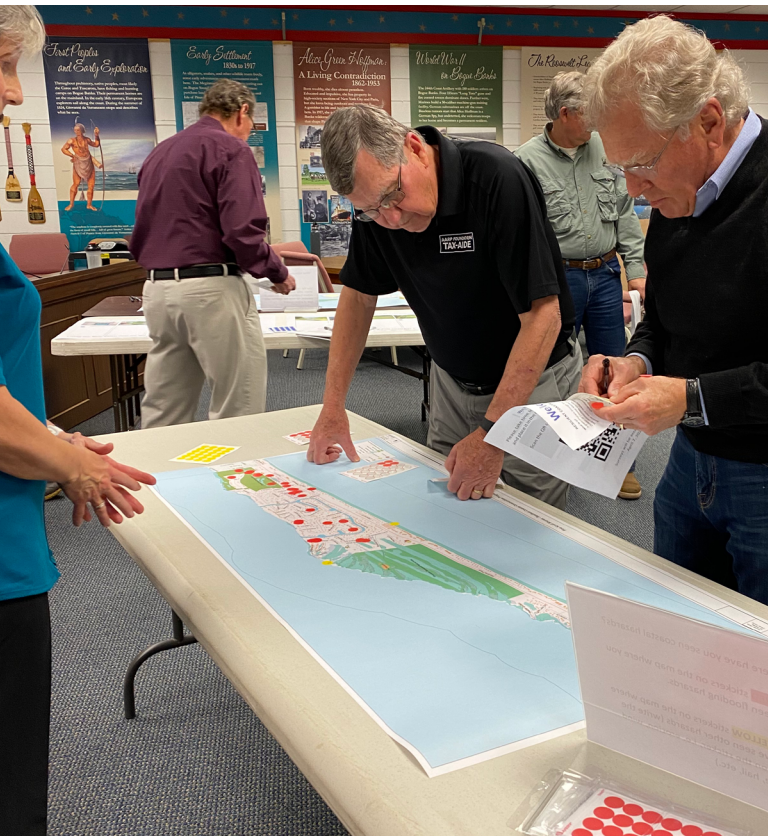
nature-based solutions (NNBS) or a hybrid of NNBS and built solutions to address stormwater issues, protecting public facilities, and stabilizing the shoreline on both the ocean and sound sides.

The CAT encouraged in-person public engagement for the RCCP process, noting that the community was very involved in the 2018 RENA effort and in related discussions of resilience. It was recommended that in-person public engagement meetings with a virtual component be used to obtain community input. Any surveys provided during in-person events would also be available virtually. The public engagement effort is detailed in **Section III**.

Development of the project portfolio, detailed in **Section VI**, focused on stormwater infrastructure upgrades, oceanfront protection, government continuity during major storm events, and addressing concerns with septic tanks impacted by flooding. Eighteen projects were initially included the portfolio, pulling projects from previous local and regional planning efforts; using public feedback and further discussion with the CAT, the project portfolio was refined to focus on dune stabilization, public facility protection, and NNBS and hybrid solutions to stormwater issues.

III. Stakeholder Engagement Strategy

Public engagement efforts used a combination of an online survey and in-person meeting to reach as much of the community as possible while adhering to safety guidelines due to the COVID-19 pandemic. The goal was to have robust community input, including participation from non-resident property owners and seasonal residents, to assist in finalizing the Project Portfolio. The purpose of the public engagement was to capture feedback on the types of hazards that impact the Town of Pine Knoll Shores and the locations that have experienced impacts. The engagement effort also sought feedback on proposed options to address these hazards and the types of projects that should be implemented.



The CAT requested that any in-person, public engagement meetings be held in the early evening and include interactive activities to be completed to garner input. Meeting announcements were to clearly identify the objective of the meeting and emphasize that community input is a part of positioning the town for future funding requests.

In response to this guidance, a drop-in, open house-style public meeting was held on March 24, 2022 from 4:00 – 6:00 p.m. at Town Hall and was held in conjunction with an online survey for participants who could not attend. The public meeting and survey were advertised through the Town's existing social media sites and advertised through community mailing lists; the survey was available online for approximately four weeks. A copy of the survey and other public engagement materials is included in **Appendix B**.

During the public engagement period, a total of 104 survey responses were received. Input from residents centered around the following:

- The main coastal hazard concerns are hurricanes and tropical storms (91%), flooding from storm surge and locally heavy rainfall events, and shoreline and beach erosion.
- The main assets vulnerable to flooding are the local roads including a number known as the "tree" streets.
- Other types of hazards noted were tree removal, marine life sustainability, sea level rise, and rip currents.
- The community overwhelmingly prefers the use of nature-based solutions (90%) to address resiliency along with conservation of flood-prone land.
- While all seven potential projects listed on the survey received support, asset mapping, constructing tidal breaks, and dune stabilization/protection received the highest support.

Survey participants were also given an opportunity to identify specific locations where improvements are needed and the solution that would best address the problem. Write-in suggestions included obtaining additional sea rise data, installing stormwater systems with biological components, conducting more community engagement, and limiting tree removal during both residential and commercial construction. Full details of the survey results can be found in the **Appendix B**.

IV. Review of Existing Local and Regional Plans

Pine Knoll Shores has participated in several planning efforts aimed at increasing resiliency for North Carolina's coastal communities. Specifically, the Pamlico Sound Hazard Mitigation Plan (2020) and NCDCM's RENA program (2018) identified critical assets throughout Pine Knoll Shores and qualitatively assessed the vulnerability of those assets. **Section V** of this report summarizes the findings of these efforts, and **Table 2** lists previous efforts to identify critical assets in Pine Knoll Shores and potential options to address coastal hazards.

TABLE 2: EXISTING LOCAL AND REGIONAL PLANS

YEAR	TITLE	DESCRIPTION
2015	CAMA Core Land Use Plan	The CAMA Land Use Plan includes recommendations for growth and addresses some of the weaknesses of the town. It also has demographic trends for the town.
2017	Carteret County Strategic Plan	Plan serves as an economic development strategic plan, and is part of a larger effort by all of Carteret County.
2018	Nine Elements – Watershed Restoration Plan	Focuses on improving water quality in the Town's watershed by considering point and nonpoint sources which possibly impact the watershed.
2018	NCDCM's Resilience Evaluation and Needs Assessment (RENA) Program	Pilot program by NCDCM aimed at creating a guide to assist local governments in resiliency planning. The final guide provides a planning framework – including public engagement, identifying common needs and funding resources, case studies, and discussing adaptation and mitigation strategies.
2015 & 2020	Pamlico Sound Hazard Mitigation Plans	The Hazard Mitigation Plan includes hydrology data, demographics, housing characteristics, and land development trends for Beaufort, Carteret, Craven, and Pamlico Counties. It considers a risk assessment and goals and objectives for mitigation strategies.
2022	Town of Pine Knoll Shores Strategic Plan	Compilation of long-term goals and objectives for the Town of Pine Knoll Shores. Used as a daily guide for short-term decisions to reach long-term goals.

V. Previous Risk and Vulnerability Assessment Efforts

Prior to the RCCP, Pine Knoll Shores has taken steps to assess its vulnerability and risk to coastal hazards. As part of the 2015 and 2020 Pamlico Sound Hazard Mitigation Plan (HMP) Updates, Carteret County, including Pine Knoll Shores, participated in a regional risk and vulnerability assessment at a regional level. Additionally, Pine Knoll Shores participated in NCDCM's 2018 Resilience Evaluation and Needs Assessment (RENA) program, building upon the Pamlico Sound HMP and incorporating local knowledge

into a Town-specific risk and vulnerability assessment.[1] As part of the RENA, The Nature Conservancy (TNC) and the N.C. Coastal Federation assisted Pine Knoll Shores with modeling current conditions and future scenarios.

Some of the findings of these previous efforts include:

- The main coastal hazards affecting Pine Knoll Shores are flooding from storm surge (hurricanes/Nor'easters) and locally heavy rainfall events. Historically, hurricanes and tropical storms, storm surge, and flash floods have caused the most damage in terms of costs.[2]
- Pine Knoll Shores identified the following assets as critical and vulnerable to coastal hazards:[3]
    - Private Marinas
    - Town Hall, Police/Fire/EMS stations
    - Emergency beach access points
    - Cultural resources, including Pine Knoll Shores Aquarium, public library, and heritage trees
    - Local roads prone to frequent flooding
    - Groundwater monitoring wells
    - Utilities
    - Public Trails
- The average age of Pine Knoll Shores residents is 60 years old.[4] The Town's older residents may require additional resources to ensure they can prepare and respond to coastal hazard events when they occur.
- Pine Knoll Shores officials identified potential future projects to improve its resilience to coastal hazards, including, but not limited to, the following activities:[5]
    - Continue participating in the *StormReady* Community program
    - Improve access to the hurricane evacuation route from Pine Knoll Shores neighborhoods
    - Explore alternative electric cable locations and weigh the costs of benefits of above-ground wind damage versus underground water damage to cables
    - Install a pipe under Salter Path Road to pump sand along the east end of Pine Knoll Shores
    - Maintain current regulations regarding tree conservation
    - Continue using sand fences and beach nourishment techniques
    - Increase freeboard requirements
    - Continue public engagement and public education efforts regarding resiliency and coastal hazards

1 North Carolina Division of Coastal Management. (2018). *Resilience Evaluation and Needs Assessment – Final Report.* Pg. 3
2 Holland Consulting Planners, Wood. (2020). *Pamlico Sound Regional Hazard Mitigation Plan*. Table 4.2, Pg. 66
3 North Carolina Division of Coastal Management. (2018). R*esilience Evaluation and Needs Assessment – Final Report.* Pg. 30-32
4 North Carolina Division of Coastal Management. (2018). *Resilience Evaluation and Needs Assessment – Final Report.* Pgs. 6 & 33
5 North Carolina Division of Coastal Management. (2018). *Resilience Evaluation and Needs Assessment – Final Report.* Pg. 17

VI. Project Portfolio

Utilizing feedback from the public, recommendations from previous vulnerability assessments and regional plans, and input from the CAT, a list of projects to address specific coastal hazards and recommended locations was developed. The Project Portfolio, summarized in **Appendix C**, lists the following information on each project:

- Project title and description
- Anticipated cost and needs addressed
- Funding status
- Natural or Nature-Based Solution (NNBS) opportunity
- Project timeline and priority

Factors considered in the development of the Project Portfolio include:

- Inclusion of natural or nature-based solutions (included in the RCCP criteria)
- The need(s) addressed and the scope of the project's benefit
- Project implementation timeline (i.e. an emphasis on shovel-ready projects)
- Other potential funding sources for the project
- Community input and support

Table 3 highlights the top five project priorities included in the Portfolio; the remaining projects are detailed in **Appendix C**.

TABLE 3: PROJECT SUMMARY

PROJECT	DESCRIPTION
Nature-based or Hybrid Stormwater Solutions	Implement nature-based solutions (including infiltration swales, wetland restoration, and other options) to address stormwater issues on Town streets to decrease flooding risk
Water Table Monitoring	Purchase and install automated water level gauge(s) to monitor drinking water capacity and water quality
Saltwater Intrusion Monitoring	Install gauges or other equipment to monitor Town drinking water sources for saltwater intrusion.
Comprehensive Shoreline Management Plan	Develop a comprehensive management plan, detailed to the property/parcel level, to determine appropriate solutions that address erosion and decrease the impact of storm surge and wave activity. The plan should consider the construction of tidal breaks or living shorelines along sections of the Bogue Sound as part of the analysis.
Proactive Dune Stabilization and Protection Program	Develop a Town-wide dune stabilization program, including the use of fencing and/or plantings.

VII. Conclusions and Lessons Learned

Phase 2 of the RCCP provided Pine Knoll Shores an opportunity to build upon previous planning efforts and establish a comprehensive Project Portfolio to guide the Town in pursuing funding sources for project implementation. Potential funding sources include Phases 3 and 4 of the RCCP, which funds the engineering and construction, respectively, for projects that meet specific identified needs in the community. As not all of the projects identified in this process will be eligible for funding under the RCCP, other potential funding opportunities at the federal, state, and local level have been identified to the extent possible.

Based on feedback from the public and from the CAT, storm surge is the primary coastal hazard of concern to residents, though frequent (non-hurricane or tropical storm) rainfall events were also acknowledged as drivers of flooding throughout the community. Survey participants identified locations throughout the Town as prone to flooding, including the series of local streets north of N.C. 58/Salter Path Road (commonly referred to as the "tree" streets) adjacent to the Crystal Coast Golf Club. These areas could be considered for the NNBS or hybrid stormwater improvements that are listed as the top priority in the Project Portfolio.

In addition to infrastructure improvements, the CAT identified the importance of long-term monitoring and assessment, modeling, and comprehensive planning to strategically identify and prioritize hazard mitigation and other infrastructure improvement projects. Drinking water monitoring, including water quality and saltwater intrusion monitoring, was cited as a critical need to identify and address problems as (if not before) they arise. The installation of monitoring gauges and development of a coordinated monitoring program can potentially be implemented gradually by incorporating equipment installation as part of stormwater facility improvements or

other projects throughout the community. Pine Knoll Shores could also consider partnerships with non-governmental organizations or university researchers to implement a comprehensive monitoring effort.

The response to the online public engagement survey as well as the discussions during the CAT meetings indicate that there is a high level of community interest in resilience planning efforts. Continued outreach and community engagement is encouraged to facilitate continued discussion of community needs and potential solutions. Both in-person conversations, as well as virtual survey and meeting opportunities, should be considered to ensure broad participation by both full-time residents and non-resident property owners.

Acknowledgments

We would like to thank the Town of Pine Knoll Shores for its efforts associated with the development of this report and the Project Portfolio. In particular, we would like to thank Kevin Reed and the rest of the Community Action Team for their honest feedback on the community's needs and the challenges that have been faced historically in addressing these needs. We also thank Mackenzie Todd of the N.C. Division of Coastal Management for the guidance and insight she provided throughout this process.

APPENDIX A

COMMUNITY ACTION TEAM MEETING SUMMARIES

MAY 2022

Dewberry

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PINE KNOLL SHORES CAT MEETING #1 DISCUSSION

DATE: November 16, 2021

TIME: 3:30 p.m.

LOCATION: Pine Knoll Shores Town Hall

PURPOSE: Pine Knoll Shores Community Action Team Meeting Discussion Notes

SUMMARY DATE: November 22, 2021

Discussion

1. **Resilience Needs/ Projects to Address Needs:**

   Based on events to date, what do you see as the community's biggest needs? (What keeps you up at night?)

   - Oceanfront protection: Current perception is that oceanside property/infrastructure is adequately protected; concern is that the soundside shoreline receives less attention.
     - The Town recently worked with the County on a 50-year master plan for beach nourishment; developed in conjunction with the neighboring towns and the Carteret County Shore Protection Office.
   - Stormwater: The island's infrastructure was built for a much smaller population and is out of date for today's demands. More work is needed to determine if it is possible to work with other towns and other stormwater utility companies to manage the municipal stormwater system.
     - Do rudimentary water table monitoring, which has been helpful for projects recently conducted with the NC Coastal Federation. Possible project could be for water table and water quality monitoring at key spots within town.
     - Concern about saltwater intrusion into existing water system; do very basic salt measurements to address that. Is it possible for monitoring to ensure no intrusion?
     - As a barrier island, there is vulnerability to saltwater intrusion, but don't know what that means in terms of possible solutions. If we want to take a holistic approach to incorporate Emerald Isle and Indian Beach, does that help projects score higher? How do you plan to prevent the potential need to have to regress off of the island due to the effects of climate change? Could include mapping of assets and having a plan for how to relocate services.
   - Town government continuity: Data security. What happens if Town Hall is destroyed in a storm? Where does data exist- within a data storage cloud? How does the Town function in a temporary facility?
     - Emergency communications are a challenge; rely on the county 911 system.
   - Resilience: Tie this effort to the Town's Strategic Plan, which has now incorporated resilience. The Town is still trying to determine its own definition of resilience.
   - During November 6 nor'easter/king tide event, docks and canals near the sound were underwater (highest levels in years).
   - Climate Change: Think about threats in addition to hurricanes, such as wildfire due to heavy forestation and other climate disasters. What other warning systems does the town need? There was a siren 20 years ago, but it was abandoned due to maintenance issues.
   - The Town is on 100% septic, and it expects future problems as systems get older. Atlantic Beach is considering a sewer system, at least for the causeway. Sewer systems allow for higher development densities, which the Town of Pine Knoll Shores is not interested in.

What projects do you think should be implemented to address the community's needs?

- Construct tidal break; these are seen as more resilient in a storm, though it may be too far out for consideration. Look at all potential locations (in addition to specific homeowners' areas). Beacon's Reach to the west, along with areas to the east near the club. Expect that the impact to the number of homes (especially those located on canals) would be significant, as they would keep waves from coming into the canals.
- Wetland restoration.
- Breakwater project: wouldn't have to be done at once- foresee it being completed over several cycles. (NCDCM mentioned living breakwater project in NY.)
- Recommend some type of living shoreline project.
- Stormwater: opportunity for some type of NNBS along existing street right-of-way, especially on the "tree streets." Conduct this on a Town-wide scale rather than a piecemeal approach. Can there be a planning effort to identify potential solutions and locations?
    - Test project previously implemented, which involved infiltration swales on Cedar and Cypress Streets; this was very effective. Also implemented on oceanfront road. (Worked with Coastal Federation.) There was public pushback on potential property damage, couldn't be mowed, etc.
    - Phase III of the Town's stormwater project.
    - Massive roadway repaving projects to include roadway crowns. Would it be possible to tap into the new infrastructure bill?
- Capture and reuse roof runoff? Development regulations require first two inches of stormwater be captured onsite for newer homes. See it on newer sites, but not on older sites.
- Use of rain barrels, which could be engineered in with rooftop collection systems. The Aquarium uses these with landscaping, etc.
- Solar-power desalinization system, effectively for the whole island? Only thing tackled so far is that the town is connected with other communities. Challenge is in privately owned facilities.
- Water table monitoring on the east side. Where would we want to monitor over time? Have had a lot of wells installed over the years as part of university research studies. Want to see an automated gauge that can be used. The NC Coastal Federation uses Bluetooth enabled gauges, approximately $400/logger. Where can we position these to identify future drinking water issues? (Current gauges don't reach aquifer- is it possible to install one deep enough?) Can monitor existing water supply (at existing four wells) for salinity.
- Wastewater treatment system survey- an assessment of where things stand today? Plan to help make things up to date, areas to focus on.
- Putting electric lines underground. Hard to do only within community.
- The Town has a lot of data; is there software or a program to allow the Town to examine specific areas/aspects of infrastructure that incorporates the infrastructure assessments- are we green going to yellow, yellow to red, etc.? Help identify gaps or trends in resilience (good or bad).
    - The town has identified all of the septic systems. Can we have a further study to identify when those systems were put in, to anticipate problems?

Of these projects, which are the most important (or have the most impact) to the overall community?

- Priorities are ones that are likely to get funding.
- Largest overall issue is stormwater and flooding, particularly soundside flooding. The Town wants to fix what it has now, and expand capacity where possible.
- Stormwater infrastructure is the priority, with infrastructure deficiency the second. Have identified some things and are getting them fixed with funds from FEMA and others. However, this funding doesn't cover everything; trying to cover immediate needs now.

Other feedback:

- Dealing with issues caused by stormwater infrastructure installed by NCDOT on NC 58, which has developed leaks, sinkholes. It is has turned into a frustrating battle between local and state governments. (The Town will provide specific locations.) Experienced a similar issue in last week's king tide: the outfall installed by NCDOT at the intersection coming from Atlantic Beach caused flooding (causeway and Salter Path road).

2. **Community Engagement Strategy:**

What techniques (in-person meetings, virtual options) have been the most effective at getting feedback?

- Best public engagement is in the early evening, live, with exercises. Can include an online survey to capture those who can't attend.
- Make sure to have a clear objective for gathering public input; emphasize that this will help position the town for funding.

What strategy do you recommend for this effort? Are there upcoming efforts/events that we can partner with on community outreach?

- Soundside Hall at the Aquarium would be available (would allow for more distancing/safety protocols).
- Recommended incorporating an online meeting in conjunction with the in-person meeting. Can capture feedback through chat or polls. The online component will be critical for owners who live out of state.
- Work with Kevin Reed on logistics.

Other feedback:

-

Action Items

ACTION ITEM	ASSIGNED TO	DATE DUE	STATUS
Schedule Public Engagement event/prepare online survey #1	Dewberry	12/3/21	
Provide feedback on Meeting #1 discussion	CAT	12/3/21	

Dewberry

Resilient Coastal Communities Program

Pine Knoll Shores- Community Action Team Meeting #1

November 16, 2021

1

Agenda

- Welcome and Introductions
- Resilient Coastal Communities Program Overview
- Discussion
- Wrap-up: Action Items, Next Steps

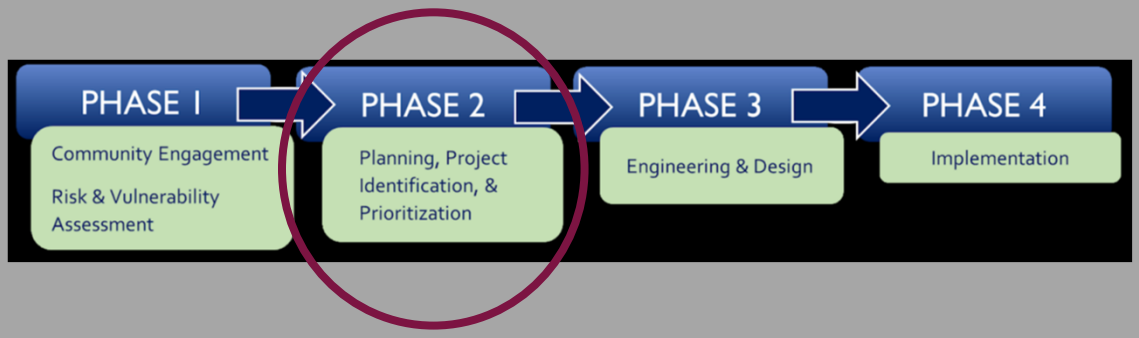
2

Program Objectives

- Address barriers to coastal resilience in North Carolina at the local level, such as limited capacity, economic constraints, and social inequities;
- Assist communities with risk and vulnerability assessments and developing a portfolio of planned and prioritized projects;
- Advance coastal resilience projects to shovel-readiness, or ready for implementation; and
- Link communities to funding streams for project implementation

3

Program Overview



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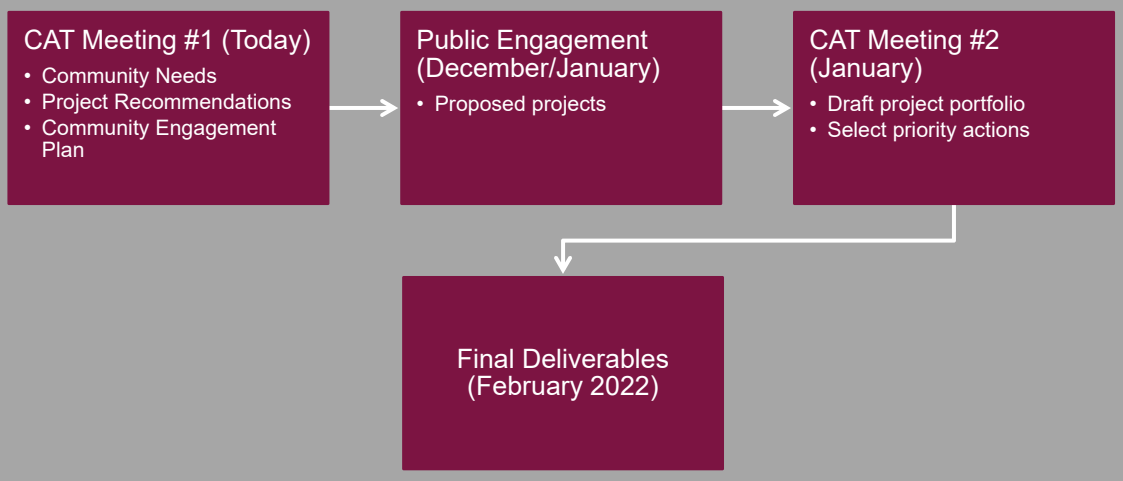
Deliverables

- Project Portfolio

5

Schedule



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Discussion

- Community Resilience Needs
- Projects to Address Community Resilience
- Community Engagement Strategy

7

Community Needs

- Beachfront Erosion
- Stormwater Management/Flooding
- Disaster Recovery
- Infrastructure Deficiency/Capacity
- Hurricane Evacuation
- Climate Change

8

Next Steps

- Action Items
  - Dewberry/PKS: Schedule Public Engagement event/survey
  - CAT: Provide feedback on today's discussion/proposed projects

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Thank you!

Beth Smyre, PE 919-424-3771
esmyre@dewberry.com

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PINE KNOLL SHORES CAT MEETING #2 DISCUSSION

DATE: March 17, 2022

TIME: 11:00 a.m.

LOCATION: Virtual meeting

PURPOSE: Pine Knoll Shores Community Action Team Meeting: Discuss Public Survey

Discussion

The purpose of the meeting was to review the proposed list of projects to be included in the public survey for the Resilient Coastal Communities Program (RCCP). An online public survey was offered in conjunction with the March 24 in-person public meeting, and the survey asks respondents to provide input on potential solutions to address coastal hazards throughout the community.

As a result of the discussion, the following changes were made to the public survey:

- The group discussed that water table monitoring and saltwater intrusion should be listed as separate items, as they address separate community needs. There is currently no system in place to monitor saltwater intrusion.
- The proposed Tidal Break project was updated into a Comprehensive Shoreline Management Plan, intended to address needs along the entire Bogue Sound shoreline. The plan would look at potential options by parcel, if appropriate, and consider the use of both tidal breaks and living shorelines. The current effort that is underway in the Town of Nags Head was cited as an example.
- The group recommended adding in a project previously discussed, the Proactive Dune Stabilization and Protection Program, to address dune stabilization needs along the oceanfront shoreline. Options for incorporating detailed photogrammetry datasets, and potentially using a citizens' science project, were discussed for this effort.
- The proposed Rainwater Reuse project was removed from the list, as it was expected this would be implemented at only a limited number of facilities.

The CAT also noted that the overall strategy developed under the RCCP effort should be tied into the Town's recently adopted Strategic Plan, which addresses resilience.

Attendees

Name	✓	Organization	Email
Beth Smyre	✓	Dewberry	esmyre@dewberry.com
Mackenzie Todd		NC Division of Coastal Management	Mackenzie.Todd@ncdenr.gov
John Brodman	✓	Mayor, Pine Knoll Shores	Mayor@townofpks.com
Paul Payne		Planning Board Chair	beagle@ec.rr.com
John Ferguson		SPC Chair/Business Representative	jdf0331@gmail.com
Robert Cox		HOA President/SPC Member	robertcox@townofpks.com
Liz Baird		NC Aquarium	liz.baird@ncaquariums.com
Bree Charron	✓	NC Coastal Federation	breet@nccoast.org

Brian Kramer	✓	Pine Knoll Shores Town Manager	manager@townofpks.com
Kevin Reed	✓	Pine Knoll Shores Town Planner	kreed@townofpks.com
Bill Knecht		Town Commissioner/HOA Representative	wlk253@aol.com

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PINE KNOLL SHORES CAT MEETING #3 DISCUSSION

DATE: April 5, 2022

TIME: 10:00 a.m.

LOCATION: Pine Knoll Shores Town Hall

PURPOSE: Pine Knoll Shores Community Action Team Meeting: Discuss Project Portfolio for the Resilient Coastal Communities Program

Discussion

The purpose of the meeting was to review the proposed list of projects to be included in the project portfolio for Phase 2 of the Resilient Coastal Communities Program (RCCP). Before discussing the current draft of the portfolio, the Community Action Team (CAT) reviewed the results of the public engagement, including the feedback gathered during the March 24 public meeting and the corresponding online public survey. A total of 96 responses to the online survey, along with 8 hard copy surveys, were received during the comment period. Flooding and shoreline erosion were listed as the main concerns of survey respondents. Of the projects included in the survey for comment, the Comprehensive Shoreline Management Plan and the Proactive Dune Stabilization and Protection Program received the most support. Additional write-in responses suggested projects such as water table monitoring, updates to building codes, stormwater drainage improvements, and natural area protection.

As of March 2022, the draft portfolio listed seven potential projects to address coastal hazards and overall community resilience; all seven projects were included in the public survey for comment. Based on the community feedback and further input from the CAT, the following adjustments were made to the project portfolio:

- The Asset Mapping project was shifted to the end of the list, as it is seen as a lower priority. While the current mapping needs updates, current infrastructure data in GIS is available.
- The Nature-based or Hybrid Stormwater Solutions was recommended as the top priority; part of the purpose of the project is to identify locations for further monitoring and construction. The CAT will provide an initial recommended list of locations based on historic flooding locations.
- The Water Table Monitoring and Saltwater Intrusion Monitoring projects will remain separate items, as they address two distinct monitoring needs. Monitoring gauges may also be installed as part of other infrastructure improvement projects as project budgets allow.
- As part of the Comprehensive Shoreline Management Plan, the Town should facilitate continued efforts between private property owners and partners such as the N.C. Coastal Federation to determine potential solutions and identify appropriate project funding sources.
- A detailed dune survey may be completed under a similar effort that is part of the Town's new Strategic Plan; this should be noted as part of the Proactive Dune Stabilization and Protection Program.

It was decided to include all seven projects in the project portfolio in order to demonstrate the breadth of the Town's program.

Beth reviewed the next steps in the process, which include finalizing the project portfolio as well as the overall report for Phase 2 of the RCCP. The Phase 3 (funding for project engineering) application period opened in late March and will close in early June. Mackenzie Todd (NCDCM) noted that the preference for Phase 3 is that the funds provided will get projects to shovel-ready status, in preparation for construction funds to be awarded under Phase 4. Projects selected under Phase 3 must include a natural or nature-based component.

Attendees

Name	✓	Organization	Email
Beth Smyre (via webinar)	✓	Dewberry	esmyre@dewberry.com
Mackenzie Todd	✓	NC Division of Coastal Management	Mackenzie.Todd@ncdenr.gov
John Brodman	✓	Mayor, Pine Knoll Shores	Mayor@townofpks.com
Paul Payne		Planning Board Chair	
John Ferguson		SPC Chair/Business Representative	jdf0331@gmail.com
Robert Cox	✓	HOA President/SPC Member	robertcox@townofpks.com
Liz Baird		NC Aquarium	liz.baird@ncaquariums.com
Bree Charron		NC Coastal Federation	breet@nccoast.org
Brian Kramer	✓	Pine Knoll Shores Town Manager	manager@townofpks.com
Kevin Reed	✓	Pine Knoll Shores Town Planner	kreed@townofpks.com
Bill Knecht	✓	Town Commissioner/HOA Representative	wlk253@aol.com

Dewberry

Resilient Coastal Communities Program

Pine Knoll Shores- Community Action Team Meeting #3

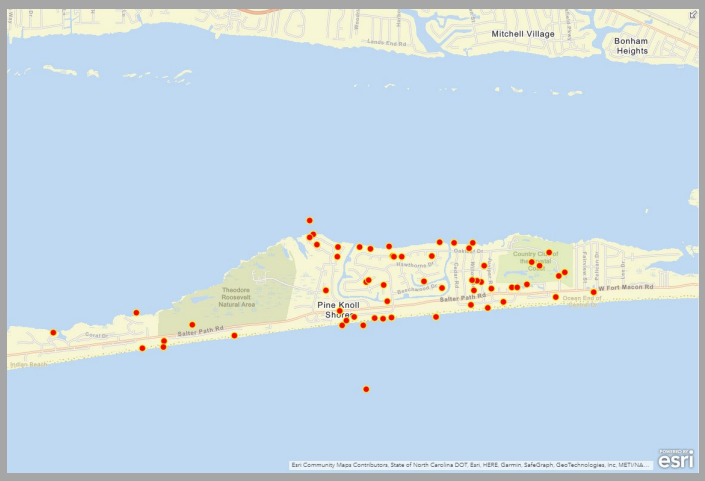
April 5, 2022

Agenda

- Welcome and Meeting Objectives
- Public Engagement Summary
- Draft Project Portfolio
- Wrap-up: Final Deliverable Outline, Action Items, Next Steps

Public Engagement Summary

- 96 online survey responses (8 hard copy surveys)
- Flooding and shoreline erosion listed as main concerns



Public Engagement Summary

- Project preferences (to date):
  - Highest: Comprehensive Shoreline Management Plan
  - Second: Proactive Dune Stabilization and Protection Program
- Write-in project suggestions:
  - Install water table monitoring, combine with rainfall data to model flooding issues – drive flooding mitigation decisions
  - Update building codes
  - Upgrade stormwater drainage on the “tree” streets
  - Protect natural areas on sound to address shoreline erosion
  - Construct a living shoreline on the sound
  - Improve the power grid
  - Construct crowns on roadways as repave to assist drainage

Project Portfolio

- Projects listed that should be removed?
- Projects that should be added?
- Project priorities? Candidate for RCCP Phase 3?
- Details on project scope, estimated cost, completion timeline?

Final Deliverable Outline

- Vision and Goals
- Community Action Team
- Stakeholder Engagement Strategy/Summary
- Existing Local/Regional Plans
- Risk and Vulnerability Assessment
- Project Portfolio
- Conclusions/Lessons Learned

Next Steps

- Action Items
  - CAT: Provide feedback on today's discussion/proposed projects
  - Dewberry: Develop final project portfolio and report for CAT review

RCCP Phase 2
- Final Deliverables: April 2022

→

RCCP Phase 3 (Engineering)
- Application Window: March 2022 – June 3, 2022

→

RCCP Phase 4 (Construction)
- Application Window: TBD

Thank you!

Beth Smyre, PE 919-424-3771
esmyre@dewberry.com

APPENDIX B

PUBLIC ENGAGEMENT MATERIALS AND SUMMARY RESULTS

MAY 2022

Dewberry

Dewberry

PINE KNOLL SHORES PUBLIC INVOLVEMENT SUMMARY

DATE: March 24, 2022

TIME: 4:00 p.m.-6:00 p.m.

LOCATION: Pine Knoll Shores Town Hall

PURPOSE: Pine Knoll Shores Public Meeting Summary

SUMMARY DATE: April 18, 2022

A Public Involvement opportunity for the Resilient Coastal Communities Program (RCCP) was held on March 24, 2022. The purpose of the event was to gather the community's feedback on the Town's perceived vulnerabilities to coastal hazards and the proposed projects to address these concerns.

The meeting had five stations. The first was a sign-in station with a welcome poster that described the purpose of the meeting. The second station used two posters: the first listed project recommendations from previous planning efforts to address coastal hazards and the second asked for opinions on those recommendations or for additional recommendations.

The third station had a map of the Town and instructions for respondents to use stickers to indicate areas where they have witnessed or knew of flooding or other coastal hazards (wind damage, erosion, etc.). The fourth station had three elements: two posters with eight images (four typical nature-based solutions and four built infrastructure solutions) of potential mitigation measures along with a map of Swansboro. The two posters asked respondents to indicate with a sticker their top four solution preferences for addressing flooding and other coastal hazards. On the map, respondents would use sticky notes to indicate recommended locations for future projects, the need the project would address, and the preferred type of project (nature-based or built infrastructure). Finally, at the fifth station, participants could complete a hard copy of the public survey or scan a QR code to access the online version.

Attendance

Ten people attended the public involvement event. A total of 103 responses to the survey were received: 96 online responses and seven hard copies.

Interactive Station Results

Locations of concern:

- Flooding at Magnolia Court
- Flooding on the greens of the Crystal Coast Country Club in multiple places
- Flooding on Oakleaf Drive near the Country Club
- Flooding on Laurel Court
- Flooding on Myrtle Court
- Flooding on Juniper Court
- Flooding in multiple places on Willow Road
- Flooding at the east end of Knollwood Circle
- Flooding on Pinewood Circle
- Flooding at the low point at 117 Cedar Road and other places on the road
- Flooding at the end of Acorn Court
- Flooding on Oak Leaf Drive between Poplar Court and Sycamore Drive
- Flooding at the end of Carob Court
- Erosion at multiple places on the Atlantic side, including near Pinewood Court and near Dogwood Circle

- Flooding at multiple points on Loblolly Drive
- Flooding on Salter Path Rd near Dogwood Circle
- Flooding Live Oak Court
- Flooding at multiple places on Arborvitae Court
- Erosion at multiple points on the sound side. Mostly located in the Theodore Roosevelt Natural Area, though some are located near Westport Drive.
- Flooding in various spots on Marina Drive.

Preferred Project Types:

Emergency Sheltering Improvements	III
Installation of Green Street Designs	
Resizing of Culverts to prevent roadway flooding	III
Raising or Acquiring Homes	IIIII
Upgrade to the Power Grid	IIIIII
Stream Restoration	
Shellfish Reefs/Oyster Restoration	IIIIIII
Living Shoreline	IIIIIII
Forest Restoration, Enhancement or Creation	IIII
Wetland Restoration, Enhancement, or Creation	IIIIIIIIII

Locations and ideas for projects:

- Expand stormwater drainage on Cedar, Holly, and Willow Roads.
- Protection of low-lying areas on the sound side with sandbags for wave dissipation.
- Establishment of a no-wake zone some distance from the sound side to mitigate wake erosion.
- Monitor and remediate the water quality in the canal.
- Restoration of the Roosevelt Natural Area to its original 265 acre footprint.
- Strengthen frontal dune system

Write-in project ideas:

- Construct swales and other runoff controls
- Water quality monitoring
- Include businesses in projects that are within their purview
- Monitor water table overtime to overlay with precipitation data and then make decisions regarding flood mitigation
- Crowns on roads
- Downspout runoff management
- Rain gardens
- Prevent and mitigate salt water intrusion
- Encourage the community to use rain barrels which are available to them through the Coastal Federation
- Maintain ditches and other drainage along roadways
- Integrate new greenway and park improvements
- Incorporate and follow through with plans

Survey Results

1. Coastal hazards of concern

What type of coastal or climate hazards concern you the most in your community?

- Hurricanes and tropical storms were the most common concern (91%), followed by shoreline or beach erosion (80%), and flooding (67%).
- Some write in responses included:
    - Tree removal
    - Marine life sustainability
    - Sea-level rise
    - Rip currents

What kind of flooding concerns you most?

- The majority of respondents indicated storm surge as their primary concern (60%).
- The rest of the types of flooding were generally equal.

2. Property damage

Have you ever witnessed property or infrastructure damage due to coastal or climate hazards in your community?

- About 86% of respondents answered yes.

What type of damage did you witness?

- Respondents showed that they have seen all types of damage (Property, utility, personal health, transportation, and government service disruption).
- Property damage (86%), utility disruption (78%), and damage or disruption to transportation systems (63%) were the top three types of damage witnessed.
- A write in response noted that there are limited resources for repairing damage.

3. Resilience projects to be implemented

What resilience projects should the Town of Pine Knoll Shores implement?

- Arborvitae Court drainage.
- Cedar Road drainage.
- Fixing the shorelines along the Sound.
- Continue to improve the power grid.
- Development of a water table monitoring system.
- Building codes should be updated.
- Artificial reefs should be considered.
- Natural areas along the Sound, especially the undeveloped area behind Town Hall and the Natural Area, should be protected.
- Oceanfront dunes need to be nourished.
- Sound side living shoreline.
- More freeboard in low areas.
- Construction of a drainage collection site.
- Beach protection with a sea wall.

- Construction of jetties.
- Maintenance of dunes and sea grass growth.
- Addition of more shoreline vegetation.
- Renewal of rip rap.
- Periodic renourishment for the beach.
- Attention to the flooding at the part of Oakleaf Drive which has the golf course on either side of the street.
- Construction of sloping away from the houses.

What are the top five project types that would make your community more resilient to storms?

- Only 14 of the 103 respondents answered this question.
- All of the project types received some level of support.
- Of the respondents who answered this question, 90% of respondents showed an interest in nature based solutions.

The Town of Swansboro is considering several projects to increase resilience. Please rank the top three projects that would generate the greatest benefit to the community.

- All options received some level of support.
- Nature-based or hybrid stormwater solutions (68%), proactive dune stabilization and protection (67%), and comprehensive shoreline management plan (67%) were the top three projects desired by the community.
- The remaining projects were evenly split on level of priority.
- Some write in comments included:
    - A desire for more community input.
    - More data is needed regarding sea level rise and its impacts on PKS. Local researchers should be involved in the project.
    - Sound side homeowners have historically not had the same resources for rebuilding as those on the ocean side. Both homeowners should have the same consideration.
    - Interest in stormwater systems with a biological component.
    - Concern that salt water is from a deep aquifer rather than just surface sources.
    - Promotion for each homeowner to do their own small projects rather than attempting large scale engineered solutions.
    - Concern that excessive tree removal is done during new construction.

What options would you support for paying for these projects?

- All payment options received some level of support.
- About 97% of respondents indicated a preference for state or federal funding.

North Carolina Resilient Coastal Communities Program **March 2022**
Town of Pine Knoll Shores
Public Input Questionnaire

The Town of Pine Knoll Shores is gathering public feedback on proposed options to improve the Town's resilience to coastal hazards. Pine Knoll Shores received a grant under North Carolina's Resilient Coastal Communities Program to develop a list of projects to address critical Town infrastructure needs, and public input is a key part of the process to determine what improvements are most important to the community.

Thank you for your feedback!

1. What type of coastal or climate hazards concern you the most in your community? (*Select all that apply.*)

	Flooding		Severe Weather (Thunderstorm Winds, Lightning, & Hail)
	Shoreline/Beach Erosion		Wildfires
	Extreme Heat		Other:
	Hurricanes and Tropical Storms		

2. If you selected flooding, what kind of flooding concerns you the most? Rank these options from **least (1)** to **most (4)** concerning.

	Tidal (from king tides, nor'easters, etc.)		Stormwater/Rainfall
	Storm surge (from hurricanes, tropical storms, etc.)		Riverine (rising river water levels, etc.)

3. Have you ever witnessed property or infrastructure damage due to coastal or climate hazards in your community? (Circle one: **YES/NO**) If **Yes**, what type of damage did you witness?

	Property damage, including homes, businesses, or personal possessions (including vehicles)		Damage or disruption to transportation systems (e.g., flooded roadways, transportation delays)
	Utility disruption, including power loss or lack of access to clean drinking water		Limited access to services, such as healthcare, education, or government offices
	Injury, illness, and/or concerns for personal health and safety		Other:

4. Where do you think the Town of Pine Knoll Shores should implement resilience projects to minimize future damage from storms, floods, and other coastal hazards? What type of projects should the Town consider?

_____

_____

Please send your comments to:
Beth Smyre, Dewberry, 2610 Wycliff Road, Suite 410, Raleigh NC 27607
or esmyre@dewberry.com

5. Please select the **top <u>five</u> project types** that you think would make your community more resilient to storms, floods, and other coastal hazards. (Check up to **5** options.)

	Nature-based solutions, such as living shorelines or habitat restoration		Elevations of homes, businesses, and public infrastructure, including roads
	Acquisition and conservation of flood-prone land		Utility upgrades for community facilities, such as increased generator capacity for hospitals
	Increased stormwater drainage capacity		Resilience planning, policies, and development standards
	Structural protection, such as floodwalls or tide gates		Public education and outreach
	Other:		

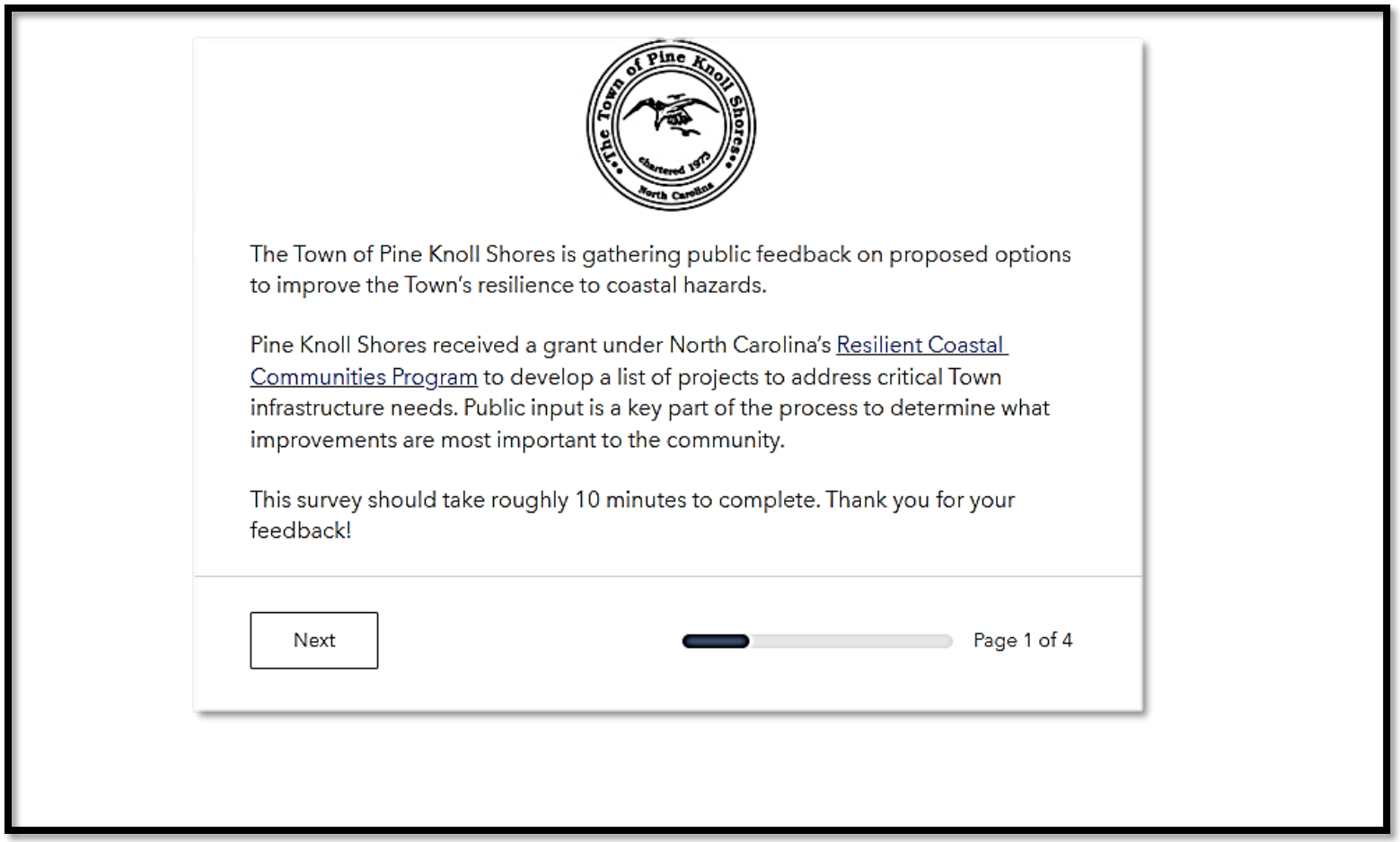
6. The Town of Pine Knoll Shores is considering several projects to increase its resilience to coastal and climate hazards. Based on this list, please rank the three projects you think would generate the greatest benefit to the community (1 = greatest benefit).

	Asset Mapping: Evaluate existing Town infrastructure mapping/datasets and update as needed. Identify service needs and opportunities to provide system redundancy in the event of primary system damage.		**Operational Continuity**: Explore options to increase data security and to ensure continuity of Town operations in the event that Town facilities are damaged during a storm.
	Nature-based or Hybrid Stormwater Solutions: Implement nature-based solutions (including infiltration swales, wetland restoration, and other options) to address stormwater issues on Town streets to decrease flooding risk.		**Comprehensive Shoreline Management Plan**: Consider construction of tidal breaks or living shorelines along sections of the Bogue Sound shoreline to decrease impact of storm surge and wave activity.
	Water Table Monitoring: Purchase and install automated water level gauge(s) to monitor drinking water capacity and water quality.		**Proactive Dune Stabilization and Protection Program**: Develop a dune stabilization program, including the use of fencing and/or plantings.
	Saltwater Intrusion Monitoring: Install gauges or other equipment to monitor Town drinking water sources for saltwater intrusion.		

7. What options would you support for paying for these projects? (Select all that apply.)

	Local taxes or levies		Loans
	State or federal funding (grant funds, budget allocations, etc.		Public-private partnerships
	Local bonds		Other:

ONLINE PUBLIC ENGAGEMENT SURVEY SCREENSHOTS



Hazard Perceptions and Experiences

The following section includes questions about which hazards you believe most affect your community and your experiences with hazards in the past.

What type of coastal or climate hazards concern you the most in your community?*

Select all that apply.

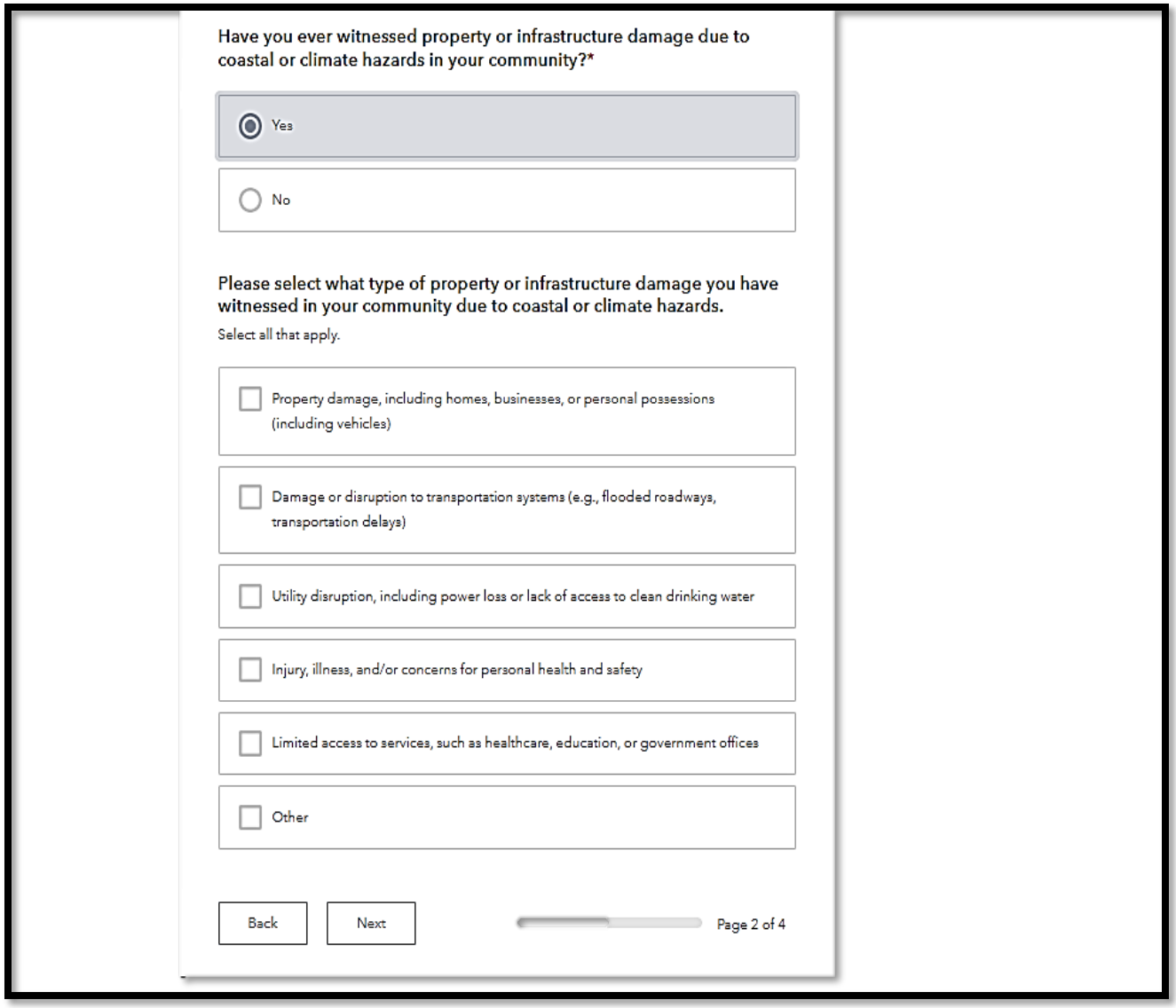
- [ ] Flooding
- [ ] Shoreline or Beach Erosion
- [ ] Extreme Heat
- [ ] Hurricanes and Tropical Storms
- [ ] Severe Weather (including thunderstorm winds, lightning, & hail)
- [ ] Wildfires
- [ ] Other

What kind of flooding concerns you the most?*

Please rank these options from least (1) to most (4) concerning by dragging the boxes in order.

- Storm Surge (from hurricanes, tropical storms, etc.)
- Riverine
- Tidal (from king tides, nor'easters, etc.)
- Stormwater or Rainfall

Reset


Have you ever witnessed property or infrastructure damage due to coastal or climate hazards in your community?*
Yes
No
Please select what type of property or infrastructure damage you have witnessed in your community due to coastal or climate hazards.
Select all that apply.
Property damage, including homes, businesses, or personal possessions (including vehicles)
Damage or disruption to transportation systems (e.g., flooded roadways, transportation delays)
Utility disruption, including power loss or lack of access to clean drinking water
Injury, illness, and/or concerns for personal health and safety
Limited access to services, such as healthcare, education, or government offices
Other
Back
Next
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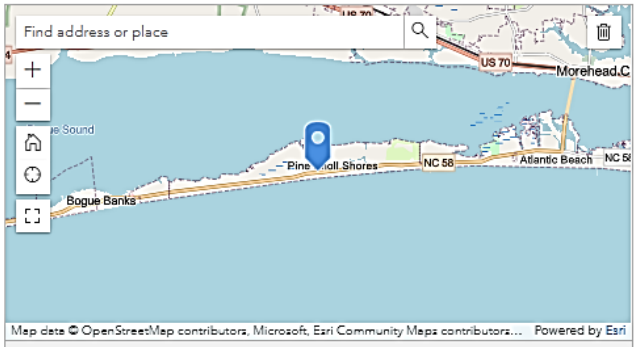
Resilience Project Identification

The following section aims to understand which types of projects you believe would benefit the Town of Pine Knoll Shores the most.

Optional: Identify a location where you believe the Town of Pine Knoll Shores should implement a resilience project to minimize future damage from storms, floods, and other coastal hazards.

Place a point on the map by zooming and clicking on the map, or entering an address into the search bar.



Lat: 34.69546 Lon: -76.81804

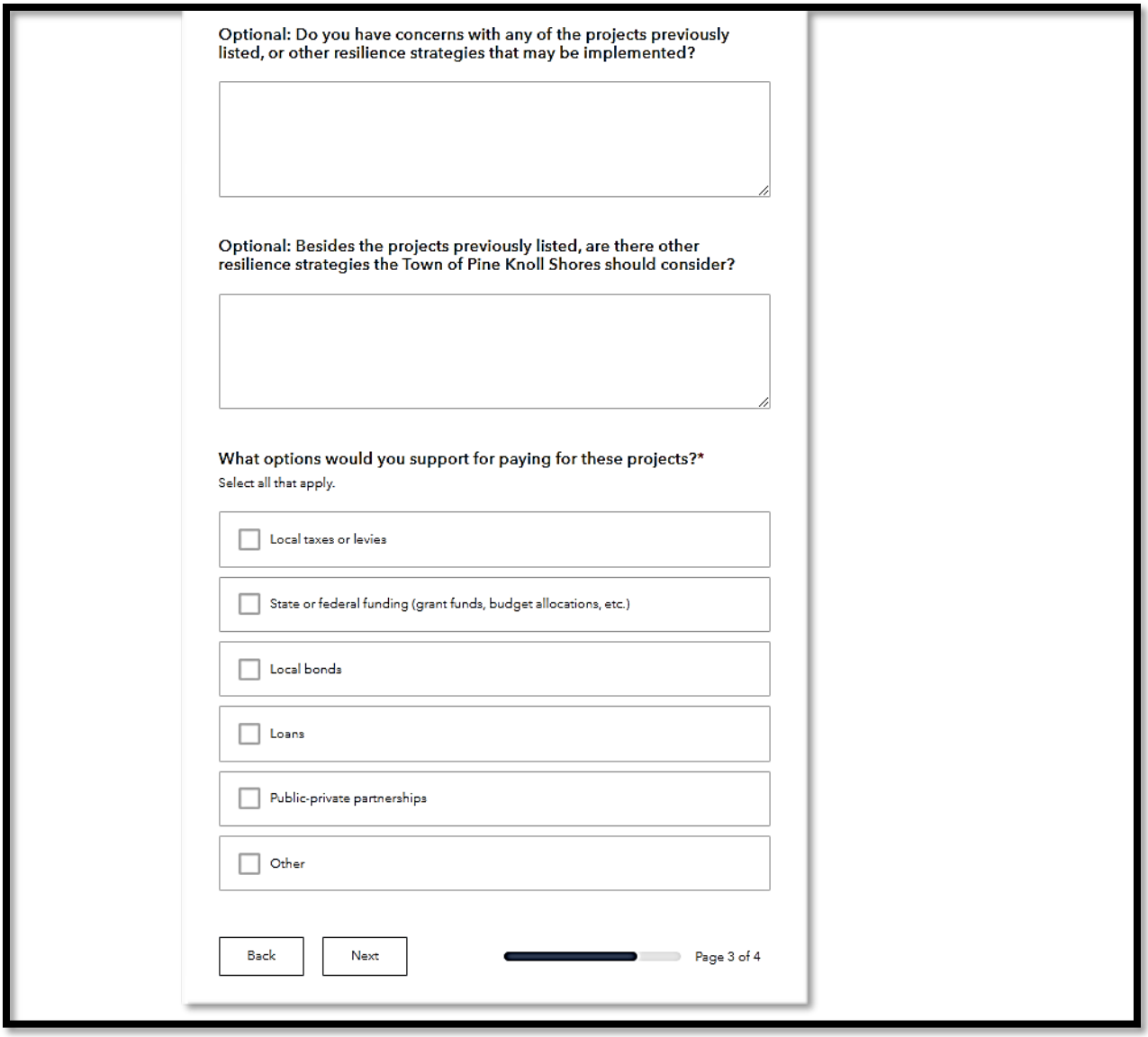
Optional: What hazard affects this location?

- ○ Flooding
- ○ Shoreline or Beach Erosion
- ○ Extreme Heat
- ○ Hurricanes and Tropical Storms
- ○ Severe Weather (including thunderstorm winds, lightning, & hail)
- ○ Wildfires
- ○ Other

Optional: Please provide a description of the project you think this location would benefit from.

The Town of Pine Knoll Shores is considering several projects to increase its resilience to coastal and climate hazards. Based on this list, please select the three projects you think would generate the greatest benefits to the community.*

- [ ] Asset Mapping: Evaluate existing Town infrastructure mapping/datasets and update as needed. Identify service needs and opportunities to provide system redundancy in the event of primary system damage.
- [ ] Nature-based or Hybrid Stormwater Solutions: Implement nature-based solutions (including infiltration swales, wetland restoration, and other options) to address stormwater issues on Town streets to decrease flooding risk.
- [ ] Water Table Monitoring: Purchase and install automated water level gauge(s) to monitor drinking water capacity and water quality.
- [ ] Saltwater Intrusion Monitoring: Install gauges or other equipments to monitor Town drinking water sources for saltwater intrusion.
- [ ] Operational Continuity: Explore options to increase data security and to ensure continuity of Town operations in the event that Town facilities are damaged during a storm.
- [ ] Proactive Dune Stabilization and Protection Program: Develop a dune stabilization program, including the use of fencing and/or plantings as appropriate.
- [ ] Comprehensive Shoreline Management Plan: Consider construction of tidal breaks or living shorelines along sections of the Bogue Sound shoreline to decrease impact of storm surge and wave activity.



Optional: Do you have concerns with any of the projects previously listed, or other resilience strategies that may be implemented?

Optional: Besides the projects previously listed, are there other resilience strategies the Town of Pine Knoll Shores should consider?

What options would you support for paying for these projects?*

Select all that apply.

- [ ] Local taxes or levies
- [ ] State or federal funding (grant funds, budget allocations, etc.)
- [ ] Local bonds
- [ ] Loans
- [ ] Public-private partnerships
- [ ] Other

Back Next Page 3 of 4

Residency & Demographics

The following section includes questions about your relationship to the Town of Pine Knoll Shores, as well as optional demographic questions.

Which best describes you?*

- [ ] Full-time resident
- [ ] Part-time resident
- [ ] Work or own business in the Town of Pine Knoll Shores
- [ ] Represent a jurisdiction, agency, or organization with vested interest in the Town of Pine Knoll Shores
- [ ] Other

What is your zip code?*

123

Optional: Select your race or ethnicity.

Select all that apply.

- [ ] American Indian or Alaska Native
- [ ] Asian
- [ ] Black or African American
- [ ] Native Hawaiian or Pacific Islander
- [ ] White
- [ ] Hispanic/Latino
- [ ] Other

Optional: Select your age bracket.

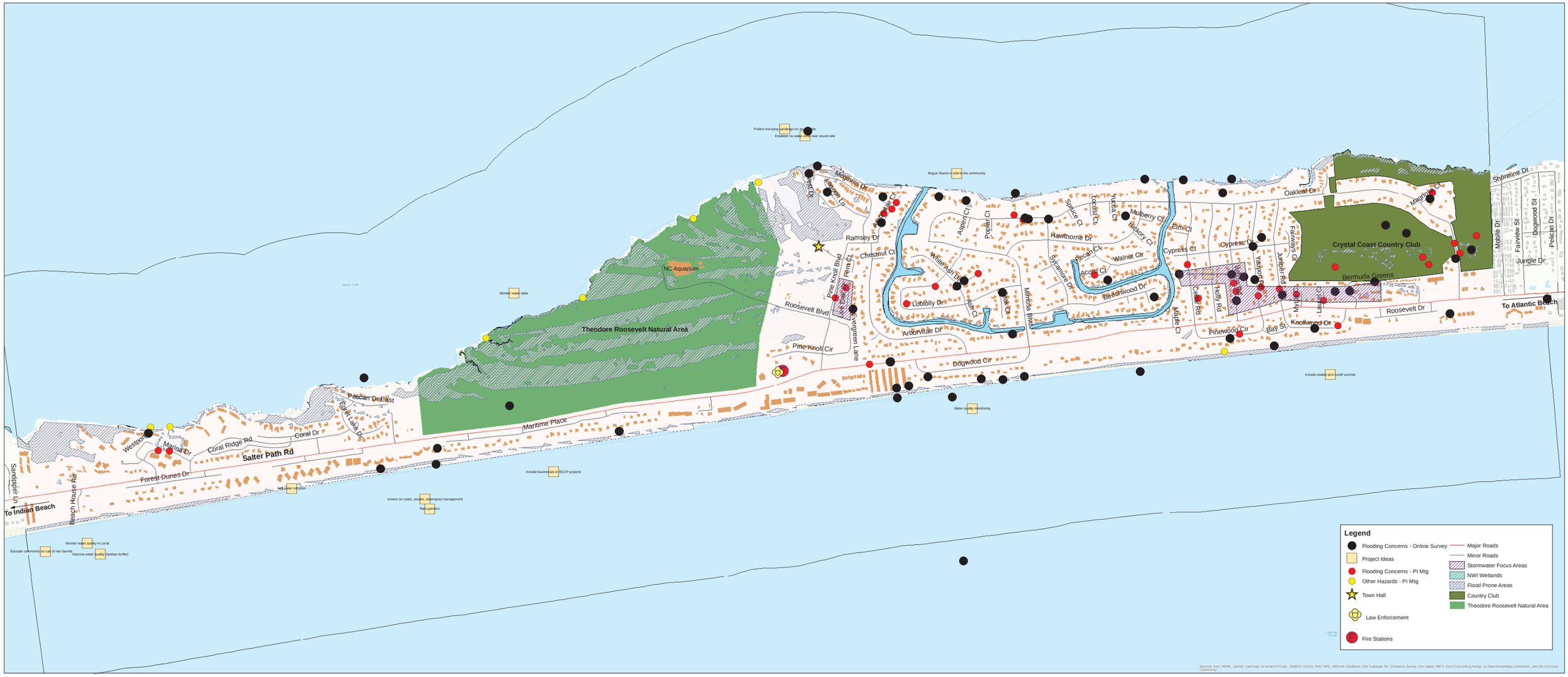
- ○ Under 18
- ○ 18 to 39
- ○ 40 to 66
- ○ Over 66

MARCH 2022 PUBLIC ENGAGEMENT PHOTOS


4


LEADER
4

Summary of Public Engagement Results - Areas of Flooding/Hazard Concern



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Prepared for

Sources: USGS, NC OneMap, Craven County

Pine Knoll Shores - Resilient Coastal Communities Program

0 0.25 0.5 1 Miles

N

Date: 5/3/2022
Drwn/Chkd: AB/ES
Prepared by
Dewberry

P:\5316278\GIS\Mxd\Pine Knoll Shores\PKS Final Survey Results.mxd

APPENDIX C

COMMUNITY PROJECT PORTFOLIO

MAY 2022

Dewberry

COMMUNITY PROJECT PORTFOLIO

A critical component of the Resilient Coastal Communities Program is the identification and prioritization of a series of projects that are intended to address community vulnerabilities to coastal hazards. The enclosed list of projects, which includes infrastructure improvements (structural, non-structural, natural or nature-based solutions, or hybrid options), policy and planning efforts, and asset management actions, has been synthesized from previous local and regional planning efforts, input from the Community Action Team, and feedback from the public.

Included in this Appendix is a summary list of the proposed projects, followed by an individual sheet for each project. Each project sheet summarizes the factors that were considered in the project identification and prioritization process, including:

LOCATION	The geographic location and scope of the project.
HAZARD(S) ADDRESSED	A summary of the community-specific coastal hazards that impact the project location. This can include flooding, storm surge, wind damage, or other coastal hazards.
TYPE OF SOLUTION	A description of whether the project represents infrastructure improvements, policy and planning effort, or an asset management/mapping program. A symbol is used to denote whether the project includes a natural or nature-based solution (NNBS) component.
PROJECT ESTIMATED COST	A qualitative analysis of the total project cost, including initial engineering and construction as well as future maintenance (as available). Project cost is shown symbolically ranging from $ to $$$$.
POTENTIAL FUNDING SOURCES	Recommendations on potential sources to construct or otherwise implement the project, including the Resilient Coastal Communities Program and other federal and state funding sources.
ESTIMATED PROJECT TIMELINE	An estimated timeline to complete the project, including notes on any expected delays in the timeline.
PRIORITY RATING	A qualitative ranking of the project's priority in the context of the entire Project Portfolio. Rankings of **High**, **Medium**, or **Low** are provided for each project.

Each project sheet includes a proposed map of the project area and photos of potential sites to be addressed, where available.

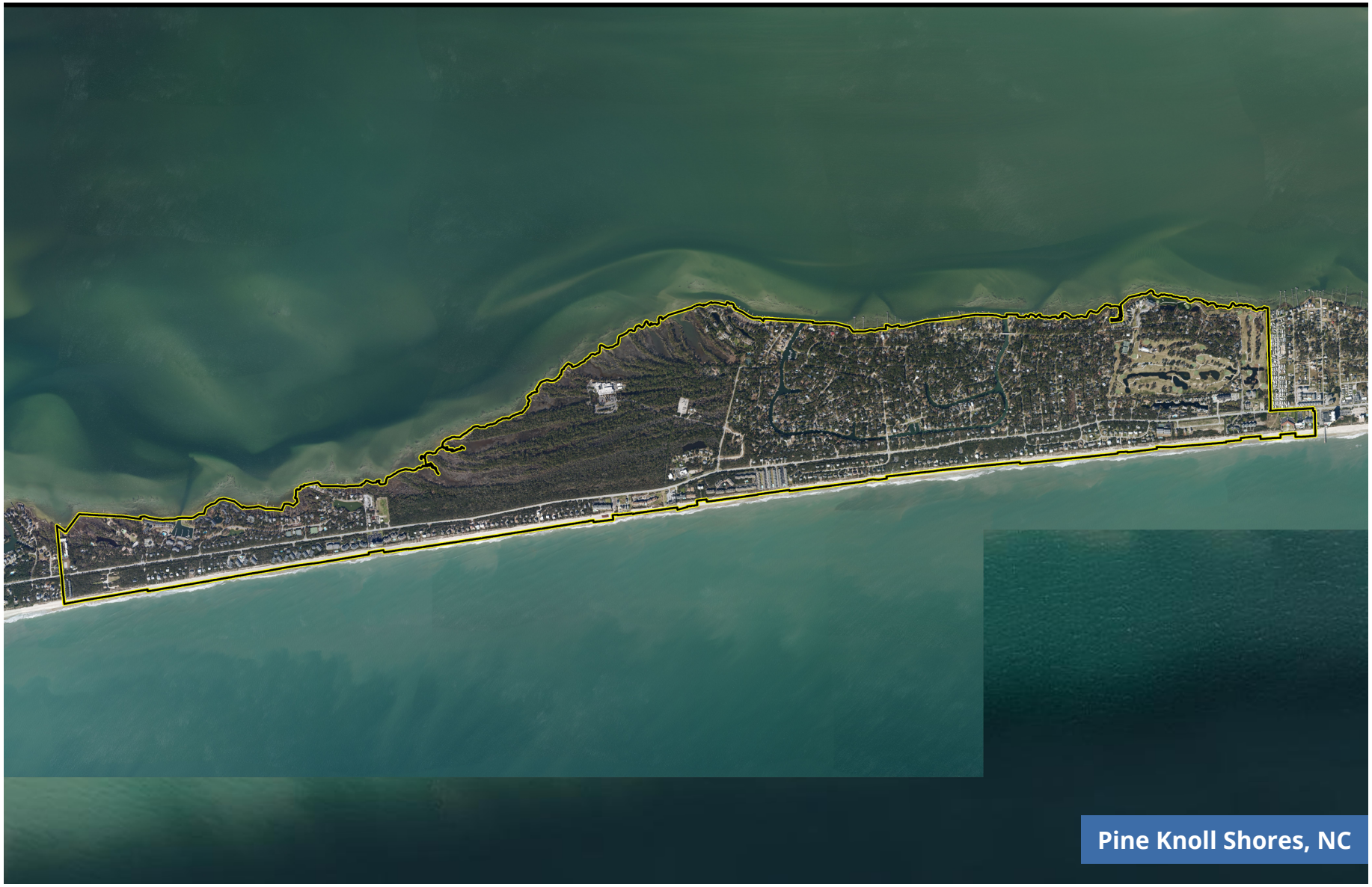
Proposed Project Summary

TOWN OF PINE KNOLL SHORES			RESILIENT COASTAL COMMUNITIES PROGRAM PROJECT PORTFOLIO							UPDATED MAY 2022
Project (Priority #)	Project Title	Description	Location	Anticipated Cost	Funding Status	Needs Addressed	NNBS Opportunity	Source Document	Timeline	Notes/ Project Status
1	Nature-based or Hybrid Stormwater Solutions	Implement nature-based solutions (including infiltration swales, wetland restoration, and other options) to address stormwater issues on Town streets to decrease flooding risk.	Townwide	Varies based on location needs and solution to be implemented.	Not currently funded.	Stormwater Management, Flooding	Yes	Pine Knoll Shores CAT; identified as top priority.	Schedule varies based on individual site needs and solutions to be implemented. Intended as ongoing program.	This project includes the identification and implementation of stormwater improvements and is intended as an on- going effort. The location details for the initial effort to be determined by Town staff but will likely focus on the "tree streets" and other areas not previously covered in the previous East End Stormwater Improvements Project. Where practicable, water table monitoring equipment will be installed as part of a larger (town-wide) monitoring effort.
2	Water Table Monitoring	Purchase and install automated water level gauge(s) to monitor drinking water capacity and water quality.	Townwide; locations TBD	Typical water level gauges range from $300-$1300 (each) in cost.	Not currently funded.	Infrastructure Deficiency or Capacity, Climate Change		Pine Knoll Shores CAT; included on public survey.	Schedule to be determined, but intent is to implement as funds are available.	Monitoring gauges may be installed in conjunction with stormwater and other infrastructure improvements as project budgets allow. A comprehensive monitoring program is recommended to coordinate these efforts, monitor the resulting data, and ultimately identify solutions to address system needs.
3	Saltwater Intrusion Monitoring	Install gauges or other equipment to monitor Town drinking water sources for saltwater intrusion.	Townwide; locations TBD	Limited cost expected.	Not currently funded.	Infrastructure Deficiency or Capacity, Climate Change		Pine Knoll Shores CAT; included on public survey.	Schedule to be determined, but intent is to implement as funds are available.	Monitoring gauges may be installed in conjunction with stormwater and other infrastructure improvements as project budgets allow. A comprehensive monitoring program to assess groundwater salinity/saltwater intrusion is recommended to coordinate these efforts, monitor the resulting data, and ultimately identify solutions to address system needs.
4	Comprehensive Shoreline Management Plan	Develop a comprehensive management plan, detailed to the property/parcel level, to determine appropriate solutions that address erosion and decrease the impact of storm surge and wave activity. The plan should consider the construction of tidal breaks or living shorelines along sections of the Bogue Sound as part of the analysis.	Bogue Sound	Cost expected to be low-medium scale and dependent upon level of detail to be provided.	Not currently funded.	Stormwater Management, Flooding, Climate Change	Yes	Pine Knoll Shores CAT; included on public survey.	Long-term need, but can build upon prior efforts.	While the Town has conducted prior living shoreline projects, this effort is intended as a comprehensive look to identify a suite of potential options and the impacts/costs of each. As part of this effort, the Town should facilitate continued cooperation with private property owners and partners such as the NC Coastal Federation to identify solutions and funding sources.

TOWN OF PINE KNOLL SHORES			RESILIENT COASTAL COMMUNITIES PROGRAM PROJECT PORTFOLIO							UPDATED MAY 2022
Project (Priority #)	Project Title	Description	Location	Anticipated Cost	Funding Status	Needs Addressed	NNBS Opportunity	Source Document	Timeline	Notes/ Project Status
5	Proactive Dune Stabilization and Protection Program	Develop a Town-wide dune stabilization program, including the use of fencing and/or plantings.	Ocean shoreline	Cost expected to be low-medium scale and dependent upon level of detail to be provided.	Similar effort underway; proactive program is not currently funded.	Stormwater Management, Flooding, Climate Change	Yes	Pine Knoll Shores CAT; included on public survey.	Long-term need, but can build upon prior efforts.	A similar effort is underway as part of the Town's new Strategic Plan. This effort may include a detailed dune system survey to identify gaps in the dune system and appropriate stabilization methods.
6	Operational Continuity	Explore options to increase data security and to ensure continuity of Town operations in the event that Town facilities are damaged during a storm.	Town Hall, EOC	Dependent upon the scope of the proposed improvements.	Not currently funded.	Disaster Recovery		Pine Knoll Shores CAT; included on public survey.	Long-term need.	
7	Asset Mapping	Evaluate existing Town infrastructure mapping/datasets and update as needed. Identify service needs and opportunities to provide system redundancy in the event of primary system damage.	Townwide	Expected to be low cost, depending upon level of survey effort.	Not currently funded.	Infrastructure Deficiency or Capacity, Disaster Recovery		Pine Knoll Shores CAT; included on public survey.	Long-term need.	Existing mapping is likely adequate for current needs, but a program to incorporate based on future condition assessments and improvements should be considered.

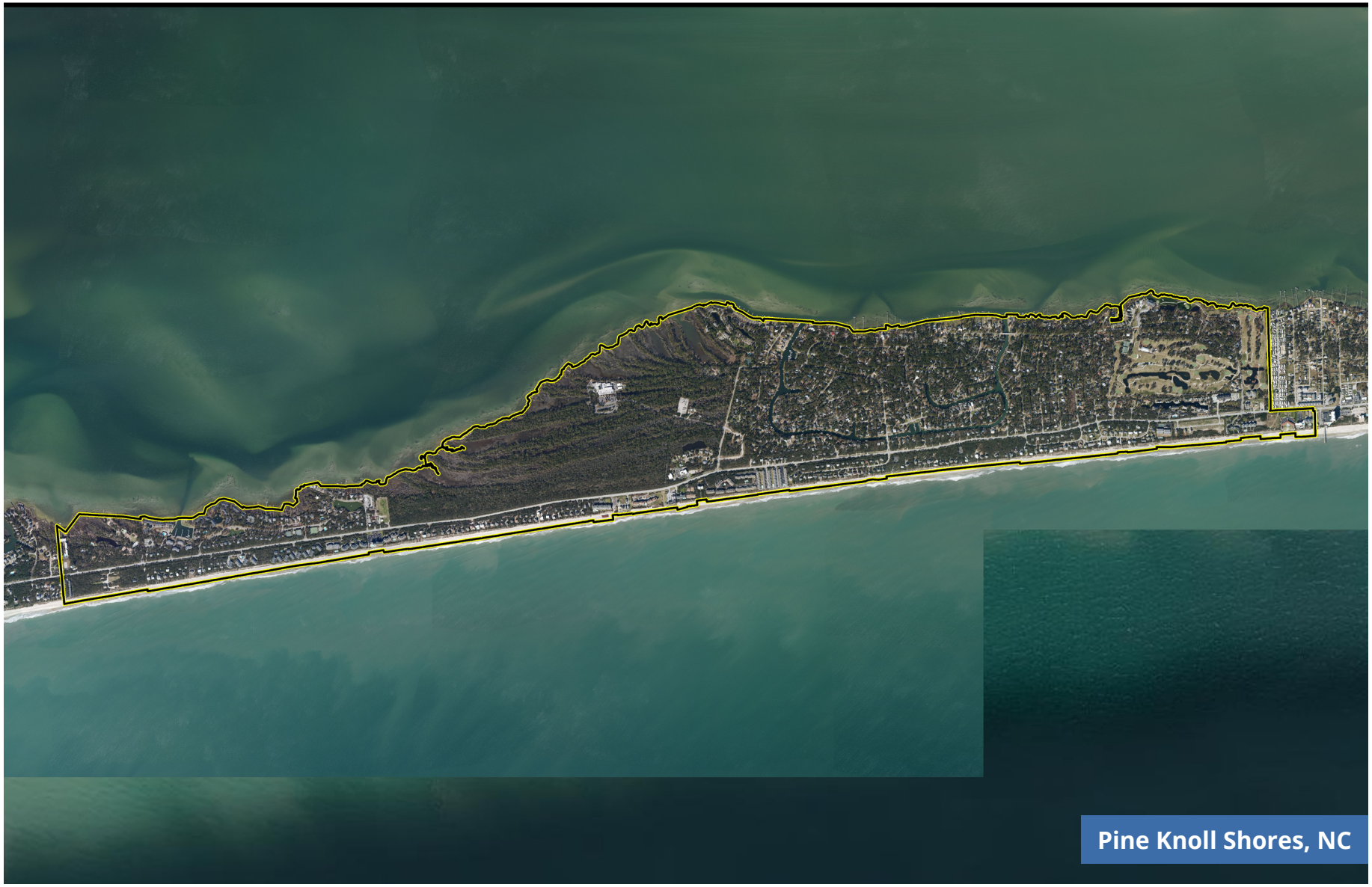
1	NATURE-BASED OR HYBRID STORMWATER SOLUTIONS
PROJECT DESCRIPTION	Implement nature-based solutions (including infiltrations swales, wetland restoration, and other options) to address stormwater issues on Town streets to decrease flooding risk. The project includes the identification and implementation of stormwater improvements and is intended as an on-going effort. The location details for the initial effort will be determined by Town staff but will likely focus on the "tree streets" and other areas not previously covered by the previous East End Stormwater Improvements Project. Where practicable, water table monitoring equipment will be installed as part of a larger (town-wide) monitoring effort.
LOCATION	Townwide; specific locations to be determined
HAZARD(S) ADDRESSED BY PROJECT	Stormwater Management/Flooding. Existing stormwater infrastructure is impacted by coastal flooding events, including coastal storms and rainfall events. The community experiences storm surge from both the ocean-side and sound-side directions, which can exacerbate flooding issues.
TYPE OF SOLUTION	Infrastructure Improvements - Construction/replacement of stormwater infrastructure at key locations throughout the community. NNBS options will be implemented as practicable.
PROJECT ESTIMATED COST	Cost varies based on solution implemented and location needs. **Cost Level: $**
POTENTIAL IMPLEMENTATION FUNDING SOURCES	These projects are not currently funded or listed on the Town CIP. Project is eligible for funding under Phases 3 and 4 of the Resilient Coastal Communities Program. Other Potential funding sources: Federal sources may include NOAA - National Coastal Resilience Fund (NCRF), National Wildlife Federation, and USFWS – National Coastal Resilience Fund. State sources may include NCDEQ Clean Water State Revolving Fund, NCDWR – Water Resources Development Project Grants, NCDEQ American Rescue Plan Act (ARPA), NCDEQ Asset Inventory and Assessment Grant Program, and the Golden Leaf Foundation Flood Mitigation Program.
PROJECT ESTIMATED TIMELINE	Timeline varies based on solution implemented and location needs. Design and construction timeline expected to vary between 3 months and 1 year per site.
PRIORITY RATING	**High.** Project has been identified as the top priority under the Resilient Coastal Communities Program Phase 2 effort.

1 NATURE-BASED OR HYBRID STORMWATER SOLUTIONS



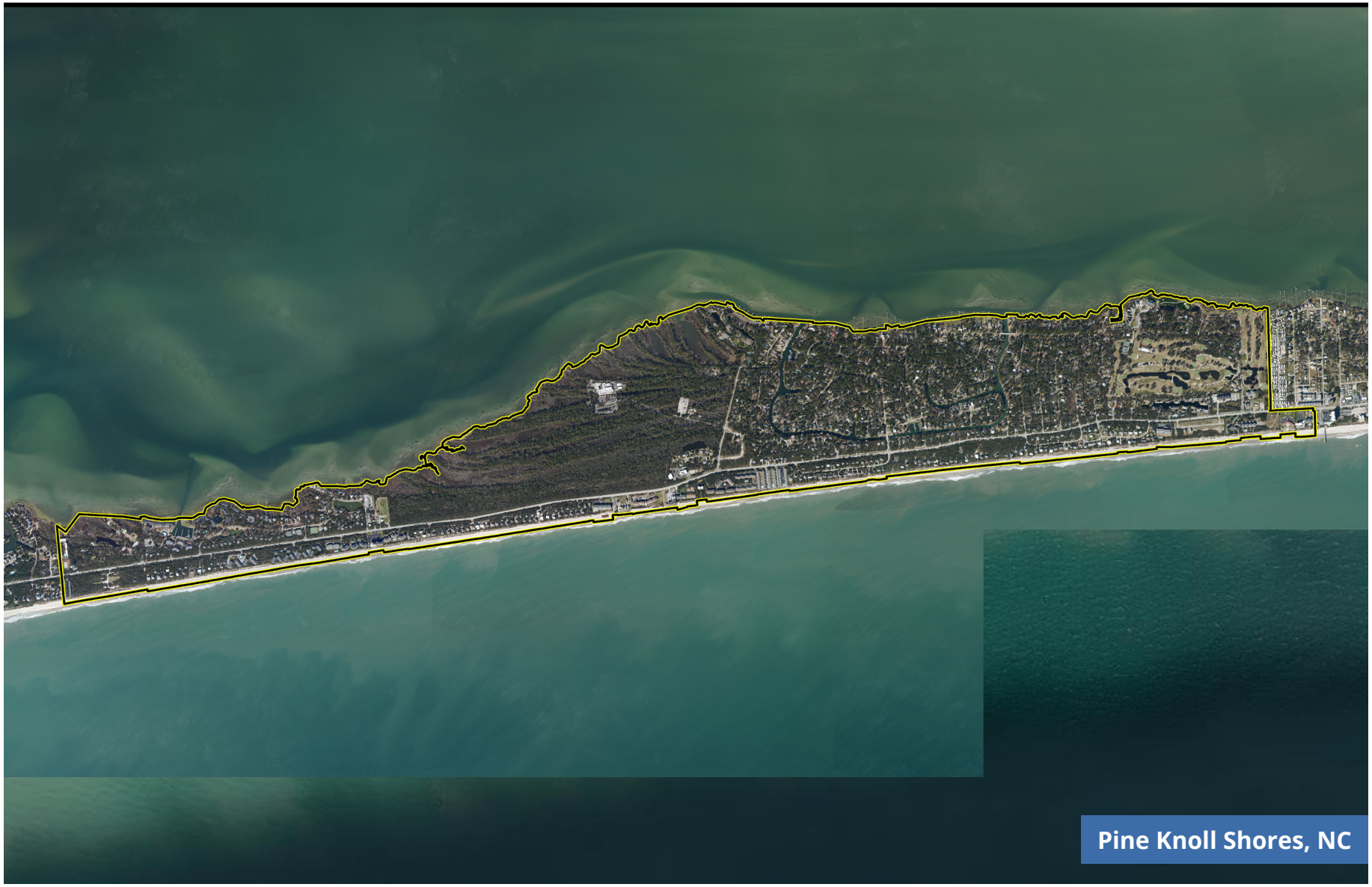
2	WATER TABLE MONITORING
PROJECT DESCRIPTION	Purchase and install automated water level gauge(s) to monitor drinking water capacity and water quality. Monitoring gauges may be installed in conjunction with stormwater and other infrastructure improvements as project budgets allow. A comprehensive monitoring program is recommended to coordinate these efforts, monitor the resulting data, and ultimately identify solutions to address system needs.
LOCATION	Townwide; locations to be determined
HAZARD(S) ADDRESSED BY PROJECT	Stormwater Management/Flooding, Infrastructure Deficiency/Capacity. The installation of gauges will enable the Town to identify drinking water capacity and water quality issues and potential infrastructure improvements to address these issues. Previous monitoring efforts have not provided enough data to identify infrastructure needs.
TYPE OF SOLUTION	Monitoring program
PROJECT ESTIMATED COST	Total cost dependent on the number of monitoring gauges to be installed. **Cost Level: $**
POTENTIAL IMPLEMENTATION FUNDING SOURCES	These projects are not currently funded or listed on the Town CIP. Potential funding sources: Partnerships with non-governmental organizations or university studies may provide opportunities to fund the implementation and short-term monitoring of water level gauges. State sources may include several NCDEQ programs - American Rescue Plan Act (ARPA), Drinking Water State Revolving Fund, Clean Water State Revolving Fund, and Asset Inventory and Assessment Grant Program.
PROJECT ESTIMATED TIMELINE	There is currently no proposed timeframe for the initial installation of gauges but is recommended in the next year in order to begin monitoring. Monitoring would be an ongoing effort.
PRIORITY RATING	**High.** Project has been identified as the second project priority under the Resilient Coastal Communities Program Phase 2 effort.

2 WATER TABLE MONITORING



3	SALTWATER INTRUSION MONITORING
PROJECT DESCRIPTION	Install gauges or other equipment to monitor Town drinking water sources for saltwater intrusion. Monitoring gauges may be installed in conjunction with stormwater and other infrastructure improvements as project budgets allow. A comprehensive monitoring program to assess groundwater salinity/saltwater intrusion is recommended to coordinate these efforts, monitor the resulting data, and ultimately identify solutions to address system needs.
LOCATION	Townwide; locations to be determined
HAZARD(S) ADDRESSED BY PROJECT	Infrastructure Capacity/Deficiency, Climate Change. The installation of gauges and monitoring equipment will enable the Town to determine whether groundwater is experiencing saltwater intrusion and the potential infrastructure improvements that would be needed if salinity intrusion is detected. Previous monitoring efforts have not provided enough data to identify infrastructure needs.
TYPE OF SOLUTION	Monitoring program
PROJECT ESTIMATED COST	Total cost dependent on the extent of monitoring equipment and sampling protocol to be implemented. **Cost Level: $$$**
POTENTIAL IMPLEMENTATION FUNDING SOURCES	This effort is not currently funded or listed on the Town CIP. Potential funding sources: Partnerships with non-governmental organizations or university studies may provide opportunities to fund the implementation and short-term monitoring of equipment. State sources may include several NCDEQ programs - American Rescue Plan Act (ARPA), Drinking Water State Revolving Fund, Clean Water State Revolving Fund, and Asset Inventory and Assessment Grant Program.
PROJECT ESTIMATED TIMELINE	There is currently no proposed timeframe for the initial installation of gauges but is recommended in the next year in order to begin monitoring. Monitoring would be an ongoing effort.
PRIORITY RATING	**High.**

3 SALTWATER INTRUSION MONITORING



4	COMPREHENSIVE SHORELINE MANAGEMENT PLAN
PROJECT DESCRIPTION	Develop a comprehensive management plan, detailed to the property/parcel level, to determine appropriate solutions that address erosion and decrease the impact of storm surge and wave activity. The plan should consider the construction of tidal breaks or living shorelines along sections of the Bogue Sound as part of the analysis. While the Town has conducted prior living shoreline projects, this effort is intended as a comprehensive look to identify a suite of potential options and the impacts/costs of each. As part of this effort, the Town should facilitate continued cooperation with private property owners and partners such as the NC Coastal Federation to identify solutions and funding sources.
LOCATION	Bogue Sound shoreline within Town limits
HAZARD(S) ADDRESSED BY PROJECT	Shoreline/Beach Erosion, Flooding, Climate Change. The program is intended to address flooding due to coastal storm events and storm surge.
TYPE OF SOLUTION	Plan development. Plan to develop comprehensive list of projects for implementation along the Bogue Sound shoreline.
PROJECT ESTIMATED COST	Project cost dependent upon the scope of effort (public engagement methodology, level of design detail). **Cost Level: $$**
POTENTIAL IMPLEMENTATION FUNDING SOURCES	This effort is not currently funded or listed on the Town CIP. Potential funding sources: Federal sources may include NOAA – National Coastal Resilience Fund (NCRF), National Wildlife Federation, DOI National Coastal Wetlands Conservation, and USFWS National Coastal Wetlands Conservation Grants. State sources may include NCDCM Planning and Management Grants, NCDEQ Clean Water State Revolving Fund, Golden Leaf Foundation Flood Mitigation Program, and NCDEQ American Rescue Plan Act (ARPA).
PROJECT ESTIMATED TIMELINE	There is currently no proposed timeframe for this plan, and it is considered a long-term need. However, the planning effort can build upon prior efforts.
PRIORITY RATING	**Medium.**

4 COMPREHENSIVE SHORELINE MANAGEMENT PLAN

Pine Knoll Shores, NC

Wetlands – Bogue Sound Shoreline

5	PROACTIVE DUNE STABILIZATION AND PROTECTION PROGRAM
PROJECT DESCRIPTION	Develop a Town-wide dune stabilization program, including the use of fencing and/or plantings. A similar effort is underway as part of the Town's new Strategic Plan. This effort may include a detailed dune system survey to identify gaps in the dune system and appropriate stabilization methods.
LOCATION	Ocean shoreline within Town limits
HAZARD(S) ADDRESSED BY PROJECT	Stormwater Management/Flooding, Beach Erosion, Climate Change. The program is intended to address flooding due to coastal storm events and storm surge.
TYPE OF SOLUTION 	Plan development. Plan to develop dune protection strategies for implementation along the ocean shoreline.
PROJECT ESTIMATED COST	Project cost dependent upon the scope of effort (survey methodology, level of design detail). **Cost Level: $$**
POTENTIAL IMPLEMENTATION FUNDING SOURCES	This effort is not currently funded or listed on the Town CIP, though a similar study effort is underway. Potential funding sources: Federal sources may include NOAA – National Coastal Resilience Fund (NCRF), National Wildlife Federation, DOI National Coastal Wetlands Conservation, and USFWS National Coastal Wetlands Conservation Grants. State sources may include NCDCM Planning and Management Grants, NCDEQ Clean Water State Revolving Fund, and NCDEQ American Rescue Plan Act (ARPA).
PROJECT ESTIMATED TIMELINE	There is currently no proposed timeframe for this plan, and it is considered a long-term need. However, the planning effort can build upon prior efforts.
PRIORITY RATING	**Medium.**

5 PROACTIVE DUNE STABILIZATION AND PROTECTION PROGRAM

Pine Knoll Shores, NC

6	OPERATIONAL CONTINUITY
PROJECT DESCRIPTION	Explore options to increase data security and to ensure continuity of Town operations in the event that Town facilities are damaged during a storm.
LOCATION	Town Hall, Emergency Operations Center
HAZARD(S) ADDRESSED BY PROJECT	Disaster Recovery. The project is intended to address the Town's ability to recover as efficiently as possible from storms and other disaster events.
TYPE OF SOLUTION	Planning effort that may lead to infrastructure improvements and/or policy updates.
PROJECT ESTIMATED COST	Initial planning effort is expected to be low cost. **Cost Level: $**
POTENTIAL IMPLEMENTATION FUNDING SOURCES	This effort is not currently funded or listed on the Town CIP. Potential funding sources: Federal sources may include FEMA – BRIC, NOAA's National Coastal Zone Enhancement Program, and EDA – Economic Development and Planning Assistance Program. State sources may include the Rural Grant Programs and the Golden Leaf Foundation. May also be eligible for Federal and State disaster recovery funds.
PROJECT ESTIMATED TIMELINE	There is currently no proposed timeframe for this plan, and it is considered a long-term need.
PRIORITY RATING	**Low.**

6 OPERATIONAL CONTINUITY

7	ASSET MAPPING
PROJECT DESCRIPTION	Evaluate existing Town infrastructure mapping/datasets and update as needed. Identify service needs and opportunities to provide system redundancy in the event of primary system damage. While existing Town mapping is likely adequate for current needs, a program to update it based on future condition assessments and improvements should be considered.
LOCATION	Townwide
HAZARD(S) ADDRESSED BY PROJECT	Stormwater Management/Flooding, Infrastructure Capacity/Deficiency, Climate Change. The project is intended to identify and address infrastructure deficiency issues and to enable the Town to recover as efficiently as possible from storms and other disaster events.
TYPE OF SOLUTION	Mapping effort that is intended to lead to future infrastructure improvements.
PROJECT ESTIMATED COST	Mapping effort is expected to be low cost. **Cost Level: $**
POTENTIAL IMPLEMENTATION FUNDING SOURCES	This effort is not currently funded or listed on the Town CIP. Potential funding sources: Federal sources may include EDA - Investment for Public Works and Economic Development Facilities and FEMA – BRIC. State sources may include the Rural Grant Programs, NCDEQ Clean Water State Revolving Fund, NCDEQ American Rescue Plan Act (ARPA), NCDEQ Asset Inventory and Assessment Grant Program, and Golden Leaf Foundation Flood Mitigation Program.
PROJECT ESTIMATED TIMELINE	There is currently no proposed timeframe for this plan, and it is considered a long-term need.
PRIORITY RATING	**Low.**

7 ASSET MAPPING