CURRITUCK COUNTY SOIL AND WATER CONSERVATION DISTRICT

COINJOCK BAY/CURRITUCK SOUND WATERSHED

Nine-Element Restoration Plan

February 2024

The Coinjock Bay/Currituck Sound Nine-Element Restoration Plan was developed by the Currituck County Soil and Water Conservation District (SWCD) through a grant from the NC Land and Water Fund (NCLWF).

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INTRODUCTION

The Currituck County Soil and Water Conservation District (SWCD) is working to preserve, and restore where viable, the Coinjock Bay/Currituck Sound (HUC12-030102051304) watershed via recommendations from a Nine-Element (9E) Restoration Plan. These plans often require additional quantification of pollutant loading and estimates of pollutant reductions to achieve water quality goals than standard watershed plans. Typical 9E plans require significant modeling and data gathering through the use of an approved Quality Assurance Protection Plan (QAPP). The first three elements characterize and set goals to address pollution sources. The remaining six elements determine specific resources and criteria to implement and evaluate the plan.

Summary of the nine minimum elements:

1. Identify the causes and sources of pollution in the watershed.
2. Identify the water quality target or goal and pollution reductions needed to achieve the goal.
3. Identify the best management practices (BMPs) that will help to achieve reductions needed to meet the water quality goal/target.
4. Estimate the amounts of technical and financial assistance and the relevant authorities needed to implement the plan.
5. Develop an information/education component.
6. Develop a project schedule.
7. Develop the interim, measurable milestones.
8. Identify indicators to measure progress and make adjustments.
9. Develop a monitoring component.

From the Currituck County Stormwater Manual, "Protection of water quality and the aquatic ecosystems that depend on it, particularly in Currituck Sound, is vitally important to sustaining the quality of life and the unique character of Currituck County. The Sound and its tributaries are central to Currituck County's tourism industry and continued economic growth, and Currituck County has exhibited an ongoing commitment to the protection of these valuable water resources through the Currituck County Goes Green Initiative." The Currituck County Goes Green Initiative was established by county officials and residents in 2009 as a partnership that includes NC Cooperative Extension, North Carolina Sea Grant, North Carolina State University, East Carolina

University, North Carolina Coastal Federation, the University of North Carolina Coastal Studies Institute and members of the community. The initiative has hosted water quality fairs, rain garden and wetlands restoration demonstrations, and workshops with topics including rain barrels, wildlife gardens and green development. In 2012, the county adopted a new Unified Development Ordinance containing many green policies including sustainability incentives, riparian buffers, wetland setbacks, and a requirement that stormwater management systems be treated as a site amenity instead of as a utilitarian structure.

This watershed is primarily open water (approximately 65 percent) which includes Coinjock Bay and Currituck Sound. The movement of water within the project area is primarily wind driven. Overall, the land within the project area is not densely developed. There are ocean beach cottages within the easternmost, oceanside area of the project, and within Knotts Island and Bell's Island. The overall area of Currituck Sound has been an attractive area for out-of-state visitors for over 100 years. Affluent visitors from the northeast frequented the area to hunt and fish and established several upscale, yet rustic, hunt clubs. The area back then, and to a lesser degree today, was teeming with fish and wildlife. In addition, the sound was one of the few sounds along the east coast that wasn't primarily a saltwater environment. The popularity of this area continued to grow with the construction of the Wright Memorial Bridge in 1930. Another boom occurred in the 1970s and 1980s when Highway 12 was paved. Finally, the proposed Mid-Currituck Bridge, after a challenge from environmental groups, appears positioned to move forward. This will facilitate ease of movement for residents and visitors within the area. Assuming construction of this bridge does move forward, much scientific due diligence will need to be conducted to assess the Currituck Sound and it would be one recommendation of this report that research for the bridge work in tandem with efforts to assess the project area of this report.

To help preserve, and restore where necessary and available, the land within the project area, it is the recommendation of this report that Currituck County SWCD apply for grants to establish a baseline and develop recommendations to protect and preserve the area's rich biodiversity and implement the recommendations of this report.

The Currituck Sound (which contains Coinjock Bay within the southwest portion of the project area), is a shallow, approximately 153 square mile estuary separated from the Atlantic Ocean by the

Currituck Outer Banks. The Sound has an average depth of 5 feet and maximum depth of about 13 feet. The most significant freshwater inputs to Currituck Sound include North Landing River and Northwest River (National Water Quality Monitoring Council 2006 report - https://www.waterqualitydata.us/provider/NWIS/USGS-NC/USGS-02043410/), both originating in the Great Dismal Swamp of North Carolina and Virginia. Back Bay, a 35 square mile estuary located in Virginia, also discharges water into the Sound through shallow water channels on the back side of the Outer Banks. Water level fluctuations in Currituck Sound are a function of prevailing winds and possible point source inputs of brackish water from Federal navigation canals which also influences the salinity of the sound. The Currituck Sound (which contains Coinjock Bay within the southwest portion of the project area) connects with the Albemarle Sound, which borders the central Outer Banks, at around Southern Shores, and continues north until Virginia, where it meets Norfolk and Virginia Beach's Back Bay. The sound ranges from 3-8 miles wide and is approximately 36 miles long, extending well into the state of Virginia. Because of its narrow shape and expansive length, this area provides visitors with relatively easy access to the waters of the Currituck Sound. The biggest attraction of the Currituck Sound is the wildlife. The Currituck Sound is miles away from the nearest ocean inlet, which has created a very low salinity, estuarine and quite shallow environment. In general, the sound is somewhat isolated from ocean winds and therefore sound waters usually remain generally calm. This segregation of the sound from ocean waters has also created a series of islands throughout the sound. One of the most notable of these islands (parcels of land) within the Currituck Sound is Knotts Island, which is the location of the Mackay Island National Wildlife Refuge which is managed by the US Fish and Wildlife Service (USFWS). There is also an island community on Knotts Island, with several hundred residents and an almost panoramic view of the waters of the sound. Knotts Island Ferry shuffles residents to the island.

As an essential destination along the "Atlantic Flyway," the undefined route that migrating species take along the east coast from the north to the south and back, the parcels of marshes and forests along the sound serve as temporary habitats for several migrating waterfowl, including Canada geese, ducks, swans, and even egrets and herons. The wooded portions along the Currituck Sound's borders also attract a number of full-time mammals, including otters and nutrias, which inhabit the marshy sound shorelines, as well as white tailed deer, raccoon, rabbits and even squirrels, which can be found in deeper patches of the maritime woods. Several manatees have also been spotted

recently within the sound during summer months. Populations of wild horses are also residents of the area.

The overall goals of the project are:

1. Develop a water quality baseline.
2. Evaluate SAV recovery.
3. Assess wetland acreage restoration.

Outcomes and results

- Less sedimentation in Currituck Sound.
- Greater SAV production.
- More wetland restoration and conservation.
- Stabilization of shoreline.
- Reduced local flooding.

Inasmuch as state and federal grants are currently at a generational high level, it is the strong recommendation of this report based on data gathered and conversations with researchers in the area, and resource agencies/grant administrators, that grant monies be pursued to fund the following -

- Develop a dynamic public-private partnership of local governments, local, state and federal agencies, non-profit groups, community groups, universities and high schools working to develop a plan to document baseline conditions in the project area.
- Secure grants to assess Submerged Aquatic Vegetation (SAV) within the project area and where necessary implement recommendations to improve SAV in the Currituck Sound.
- Secure grants to assess and where viable restore wetlands within the project area.
- Secure grants to assess the current condition of septic systems within the project area and if advisable develop a proposal to design and build a municipal sewer system to serve properties within the project area should assessment of existing conditions warrant this.
- Secure grants to assess shoreline condition and develop a strategy to restore and stabilize shorelines.

- Develop an effective water quality and wildlife monitoring program to measure project impacts.
- Create active public participation in conservation and restoration activities.
- Develop practical and useful communication tools for public outreach and education.
- Partner with Mid-Currituck Bridge and Commonwealth of Virginia scientific endeavors within the area.

This nine-element plan will help guide efforts to establish a baseline for water quality within the subject area and develop strategies to address any sources of point and non-point pollution that may be negatively impacting waters within the project area. An outreach and education program will be developed to increase public awareness of, and participation in, conservation and restoration of wetlands and estuarine shoreline within the project area. Additionally, a water quality and wildlife monitoring program will help strengthen state and federal monitoring programs in the watershed.

ELEMENT 1

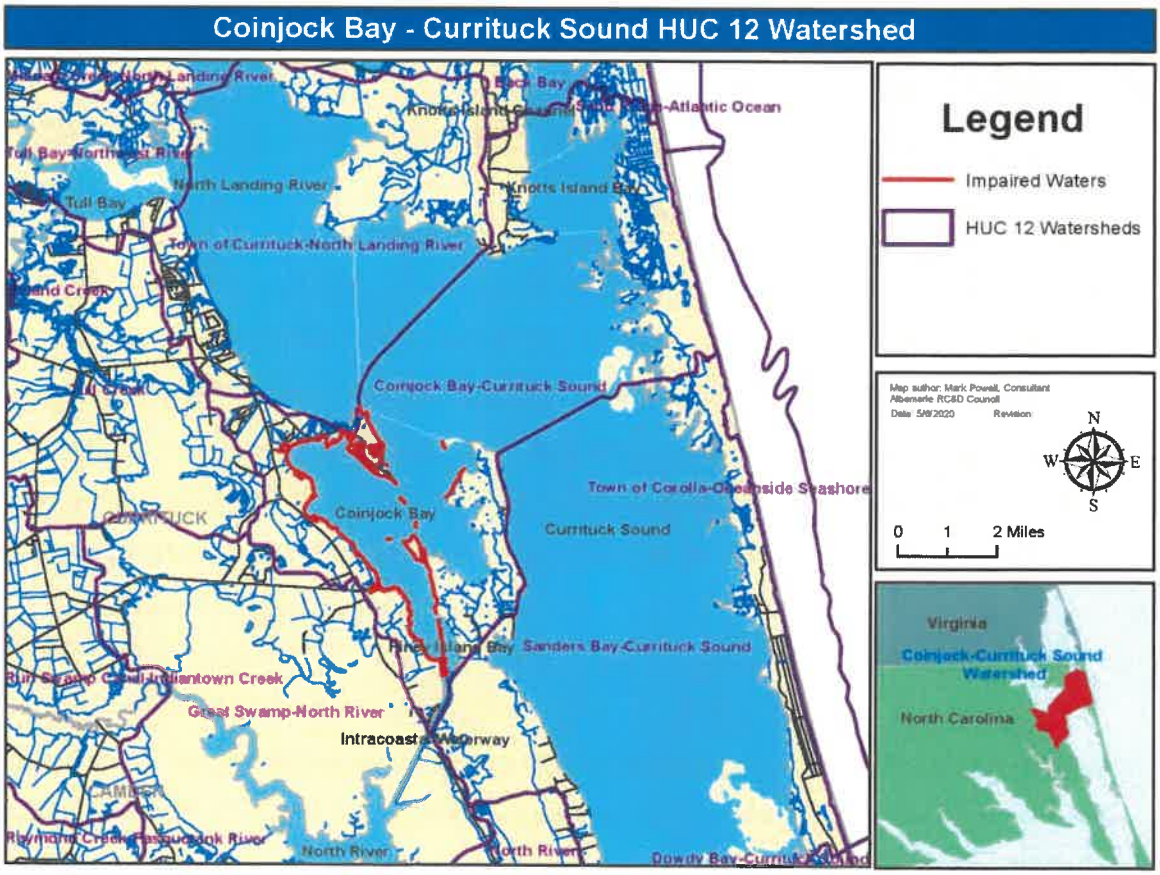
Identify the causes and sources of pollution in the watershed.

This watershed's land cover consists primarily of open water (65.2%) and wetlands (18.3%) followed by developed (7.3%), agriculture (5.8%), forest (1.8%), barren land (1.1%), grassland/shrub (0.4%). The 2012 Currituck County Stormwater Manual states, "it has been widely recognized that Currituck Sound has experienced a decline in water quality and ecological health over the past few decades. Efforts to better understand and address the problems, including a long-term study by the US Army Corps of Engineers (Patrick Dickhudt), are currently ongoing." The Division of Water Resources (DWR) does not have ambient monitoring or benthic macroinvertebrate sampling locations in this watershed.

Historically, blooms of blue-green algae (cyanophytes) have occurred throughout Currituck Sound and were confirmed during several growing seasons in the 1990s. Eighty-seven percent of samples collected by DWQ during a study conducted in the growing season of 1992-1993 contained bloom densities of algae. However, the algal assessment conducted by NCDWQ in 1999 found no evidence of algal bloom conditions in the sound (NCDWQ, 2002). The 2007

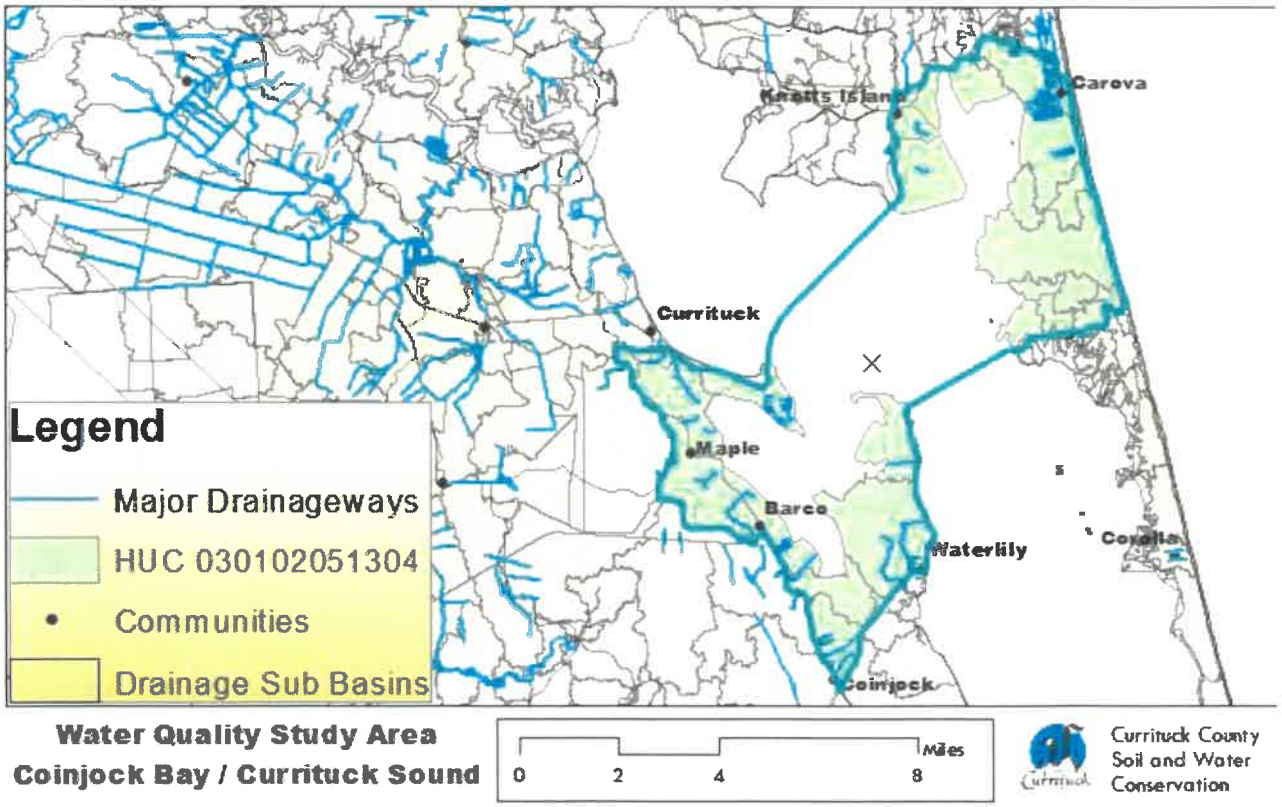
iteration of NCDWQ's report on water quality in Currituck Sound (included in the Pasquotank River Basinwide Water Quality Plan) contains no indication of further assessment of algal productivity.

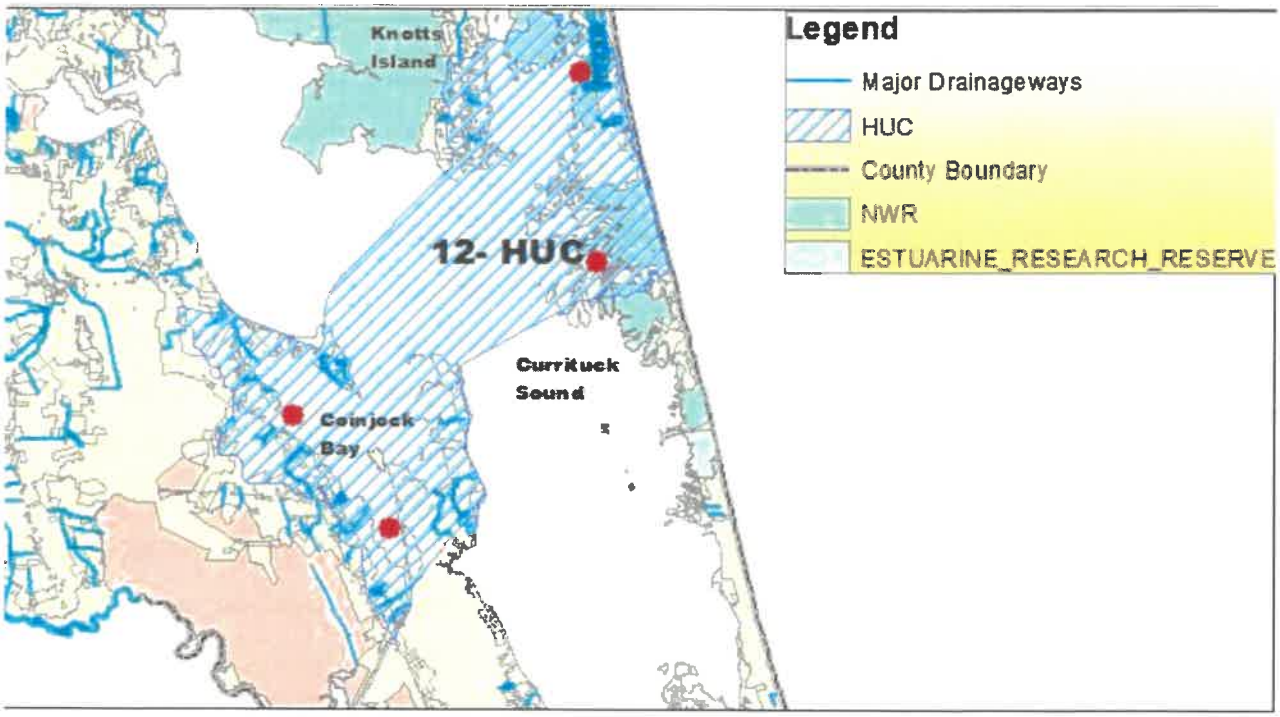
A review of available information indicates no recent evaluation of the surface water contained within the project boundary has been formally conducted, although Currituck County SWCD has performed 41 water quality tests of surface water for this study. However, there have been few investigatory efforts over the years. In 2020, Mark Powell, a consultant with Albemarle Resource Conservation and Development also conducted assessments that included a portion of the project boundary. The "Impaired Waters" shown within the project area on this map were from the 2012 303d list. These waters are no longer on the 303d list.



Water quality monitoring is conducted by the Currituck Soil and Water Conservation District (SWCD) from two sites in Coinjock Bay (see map below.) Currituck Sound HUC has moved

somewhat over time from primarily agricultural and undeveloped land to single and multi-family residential development (from DWR 2021 Pasquotank River Basin Plan – Lloyd and Rubino 2022). Currituck County projected population growth was 53.67% between 2000 and 2020 (Table 1-1), and huge development pressures are being placed on holdout farmland within a 35-45-minute commute of the Norfolk-Virginia Beach metro area (Lloyd and Rubino 2022). Between 2012 and 2020, a total of $25,952 dollars were used to fund Best Management Practices by the State Cost Share Programs in the Currituck Sound watershed (Table 5-3). Currituck County has been approved to participate in the Resilient Coastal Communities Program, created in 2019 by Governor Cooper as part of EO 80. In 2022, Currituck SWCD partnered with other stakeholders to create a Community Citizen Advisory Team and identify shovel-ready projects for coastal restoration and shoreline protection. Currituck SWCD has also identified priority areas as Coinjock Bay, Tulls Bay, Currituck Sound, and the marsh flats within 1 mile of the Outer Banks sound side where they have experienced up to 2.7% SAV loss per year (Lloyd and Rubino 2022). However, recent communication with various state and federal agencies, during development of this report, indicates SAV has rebounded this year.





Based on a phone conversation on July 5, 2023, with Kevin Carver, Soil Scientist with the Currituck County Health Department, there are no municipal sewer systems within the project boundary. Individual septic systems are inspected and when necessary, repairs are conducted. He also mentioned that the old system at Bells Island Campground had been upgraded.

According to Cam McNutt, with the Division of Water Resources, Currituck Sound was on the 303d list for enterococcus through 2018. Enterococci are typically not considered harmful to humans, but their presence in the environment may indicate that other disease-causing agents such as viruses, bacteria, and protozoa may also be present. Significant amounts of enterococci in a water body can negatively affect the recreational and economic value of the aquatic resource. Overabundance of fecal bacteria in the water can cause beach closures, swimming and boating bans and closures of fishing and shellfish areas.

Recently a submerged aquatic vegetation and water quality monitoring initiative was conducted in the project area. As protecting wetlands and riparian buffers, which in turn protect water quality and wildlife health, has been identified as a stated goal of Currituck County, the Soil and Water

Conservation Department has begun a two-year initiative to monitor and map two essential resources; our receiving waters in the Currituck Sound and the Sub-Aquatic Vegetation (SAV) contained within. NOAA Fisheries states wetlands act as "natural water purifiers" that absorb pollutants and filter sediment, even removing as much as 90% of sediments that are present (NOAA Fisheries 2022, Vermont DEC 2024). A study in the Neuse basin coastal plain of North Carolina found that 49 ft riparian buffers reduced nitrogen by 48%, but 26 ft riparian buffers reduced nitrogen by just 28% (Albemarle RCD 2016).

The intended goals of these practices and proposals are the following:

- Pursue grants with APNEP, US Army Corps of Engineers, DWR (319 and 205J) and NOAA.
- Develop a dynamic public-private partnership of local governments, local, state and federal agencies, non-profit groups,
- Develop an effective water quality and fisheries monitoring program to quantify impacts of non-point source pollution and runoff.
- Create conservation goals for interdepartmental use.
- Develop practical guidelines and metrics for land acquisition.
- Create a practical framework for enhancing public education.

Water Quality Monitoring

Water quality monitoring by means of individual controlled site analysis began in August of 2020 as part of an application for a 205J Grant with the State of North Carolina. Since then, testing has been established at 5 locations within HUC 10 comprising of Coinjock Bay and the upper sound.

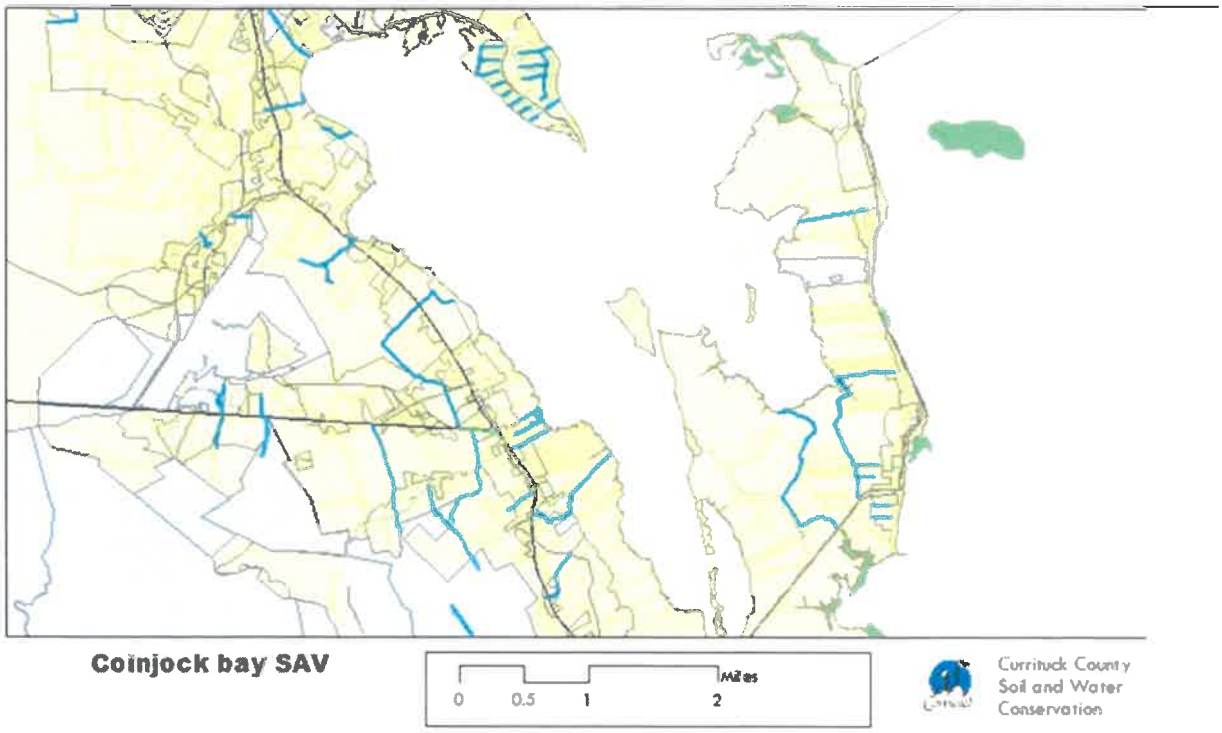
Soil and Water District SAV Surveys

In July 2022 the Soil and Water Department, led by Soil and Stormwater Manager Dylan Lloyd with assistance from Intern Melissa Gilbert, continued water quality monitoring and SAV identification in the Coinjock region of the Currituck Sound. A grant had been secured earlier in February of the same year for a 9-Element Plan in a specific localized area of the Currituck Sound watershed known as 'Coinjock Bay / Currituck Sound.' This sub-watershed, identified as HUC zone 030102051304, is comprised of 33,000 acres and stretches from Coinjock Bay to Knotts Island Bay and the marsh islands west of Carova. These water bodies contain a great deal of SAV according to previous surveys performed by APNEP in 2006-2008. As such a span of time has passed since the last surveys, Soil and Water endeavored to update maps identifying SAV, and this sub watershed was of particular interest because of the marsh island complex, the intersection of

the ICWW and the presence of native wildlife such as waterfowl and the Corolla Wild Horses. A detailed description of the surveys is included below:

8/4/2022

Dylan Lloyd and Melissa Gilbert launched from Coinjock Public Boat Ramp and surveyed 21 miles of shoreline along the eastern portion of Coinjock Bay and the Intercoastal Waterway. Piney Island Bay was the first area surveyed. Eurasian watermilfoil was identified in the north portion of Piney Island Bay at coordinates 36.3735 N, -75.9452 E ending south at coordinates 36.3705 S, -75.9444 E. The researchers then traveled north, surveying the ICWW and in between marsh islands, looking for any SAV along shorelines and channels. Eelgrass was identified at coordinate 36.3933 N, -75.9528 W where Long Point Island and Piney Island separate. Then the survey continued towards Cedar Island Bay and west of Church Island where SAV was also identified; patches of eelgrass were observed around coordinate 36.3951 N, -75.9462 W and ending at 36.3904 N, -75.9329 W. While boating through the Bay a large patch of widgeon grass was observed between Cedar Island and a smaller marsh island to the north. Just beyond that location, more watermilfoil was identified at 36.4084 W, -75.9399. Exiting Cedar Island Bay, patches of eelgrass were identified from coordinates 36.4267 N, -75.9421 W to 36.4289 N, -75.9385 as well as 36.4231 N, -75.9344 W. Traveling just north to Church Island and the west to Bell Island, SAV varieties were observed at 36.4305 N, -75.9342 W. No SAV was observed on the northern shore of Bells Island nor the central portion of Coinjock Bay between 36.4162 N, -75.9643 W and 36.4005 N, -75.9751 W. Patches of widgeon grass were found between 36.3923 N, -75.9711 W and 36.3863 N, -75.9653 W nearshore to the Barco area.



8/11/2022

Dylan Lloyd and Melissa Gilbert launched from Currituck Trading Post (3375 Caratoke Hwy) and surveyed 9 miles of shoreline along the western portions of Coinjock Bay. Traveling northwest along Bells Island shoreline marsh vegetation was surveyed at coordinate 36.4345 N, -75.9739 W. No other type of submerged aquatic vegetation was identified from 36.4250 N, -75.9748 W to 36.4144 N, -75.9612 E. Little Bell Island was surveyed where widgeon grass was identified starting at 36.4133 N, -75.9615 W and ending at 36.4113 N, -75.9570 W. After surveying Little Bell Island, the boat traveled back to the Currituck Trading Post where no other submerged aquatic vegetation was surveyed.

8/31/2022

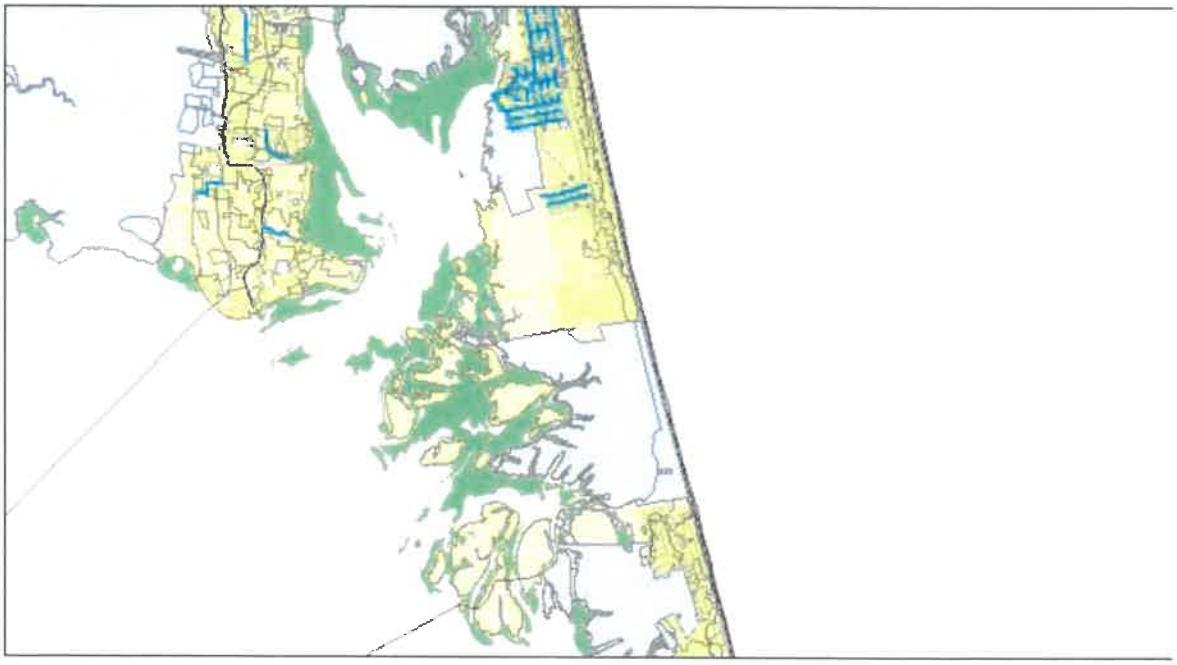
Soil and Water technician Dylan Lloyd launched from Coinjock Public boat ramp and travelled 10.2 miles to Knotts Island Bay at the west end of the HUC zone. Most of the SAV observed through this water body, of which only the lower half is included in the study area, showed similar growth locations compared to previous APNEP data (APNEP, 2008). Continuous SAV was identified from 36.4938 N, -75.9007 W to 36.4993 N, -75.9073 W within 500' of the shoreline.

Patchy SAV pockets were found further out at 36.5003 N, -75.9046 W. On the east end of the bay, watermilfoil was observed at 36.4919 N, -75.8831 W and extended roughly one-half mile south along several marsh islands. The technician then traveled due south to 36.4642 N, -75.9001 W where patchy watermilfoil clusters were found. These clusters became more prevalent as boat passed Swan Island and continued east into feature knows as Currituck Bay / Old Currituck Inlet. At 36.4704 N, -75.8828 W multi species of SAV became so heavy that technician had to turn around the boat. Widgeon grass, eelgrass and watermilfoil were observed in both inlet channels to the east of Currituck Bay. Technician circled several marsh islands and traversed channels southwestward, finding continuous SAV from 36.4400 N, -75.8885 W northward back toward Johnson Island. Channels between islands displayed isolated patches of SAV, perhaps not as pronounced due to boat traffic. Technician then crossed sound back westward, no SAV was observed in the broad section of the sound between 36.4623 W and 36.4328 W.

June, July, August and September 2023

This is the report from this effort - The northern area of Coinjock Bay between Maple and Belle Island is part of a HUC 12 zone we have been studying and performing water samples in. Recently we have gotten several complaints about SAV growth washing up and causing a stink. I took these pics today – I can confirm it is Eurasian Watermilfoil – an invasive. This particular patch is almost a mile in width – more interestingly, during surveys taken the same time last year in the exact same spot – it was not detectable even out on the boat. Our latest water sample reports (attached in Appendix 3) do not show elevated levels of N or P. We wrapped up our SAV surveys last year, but this is a concerning thing to monitor. Below are in the pictures of areas surveyed during the summer of 2023 efforts.

Note: It is recommended by this report that Currituck County SWCD apply for assistance from DWR – Aquatic Weed Control Program (https://www.deq.nc.gov/about/divisions/water-resources/water-planning/water-supply-planning/aquatic-weed-control-program) to address these issues.


Corova / Knotts Island sav
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3
Miles
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Soil and Water
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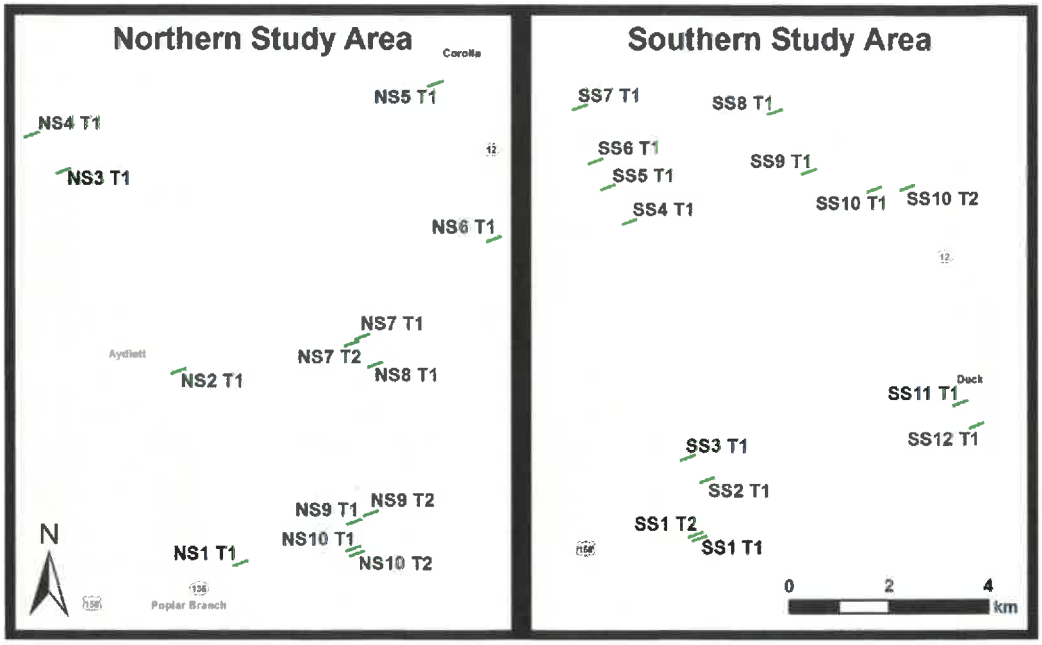
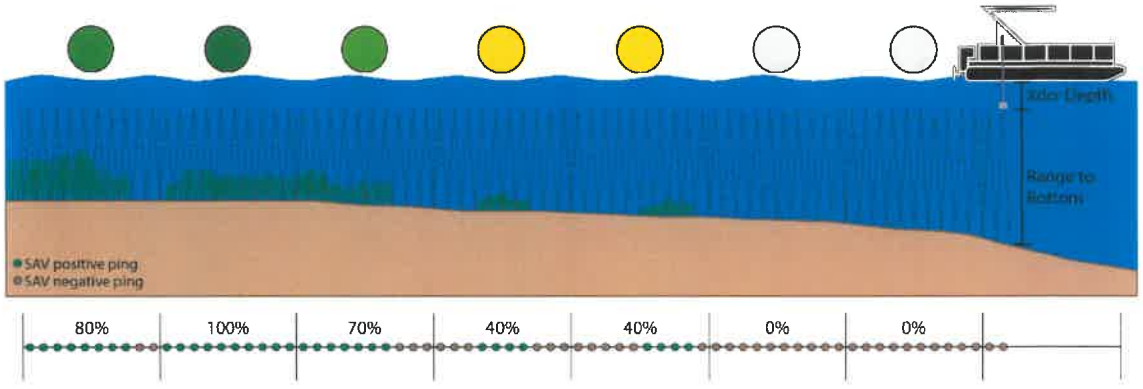
Other Recent Surveys

Hydroacoustic studies accompanied by Quadrat Surveys were recently performed at select locations in the Southern Currituck Sound over a two-year period between 2017 and 2019. The study was part of a joint effort between the Coastal Studies Institute at East Carolina University, CSA Ocean Science Inc, the Army Corps of Engineers and the NC Department of Transportation in response to environmental concerns for SAV along the footprint of the proposed Mid-Currituck Bridge project. These surveys were conducted using a BioSonics 204.8 kHz single-beam echosounder transducer mounted to the side of a boat sending signals to the sea floor. At 22 selected field sites, data was collected along two 1 km perpendicular shoreline transects connected by a shorter 120 m near-shore transect.





Historical Surveys

Historical records of SAV presence in the Currituck Sound, as currently available on the Currituck County GIS Website, include data from two surveys performed by the Albemarle-Pamlico National Estuary Program (APNEP) in 2008 and again in 2012. A previous dataset from the National Oceanographic and Atmospheric Administration (NOAA) published in 1990 involved aerial and infrared photography to locate these vegetative beds. Differences in coverage of SAV was mixed across time periods, as there was a noted increase between 1990 and 2008, but then a smaller decrease between 2008 and 2012. SAV beds in Currituck Sound covered approximately 2,132 ha in 1990, 3,659 ha in 2003, 6,294 ha in 2008, and 5,730 ha in 2012. Findings, however, showed that there was a generally shallowing of peak-depth limit for SAV from 2.6 m to 1.8 m – which was attributed as a function of declining water quality (APNEP, 2019; Corbett 2018). For the current survey, we are comparing SAV coverages as shown from the 2008 APNEP dataset to that of SWCD 2021-2022 field surveys.

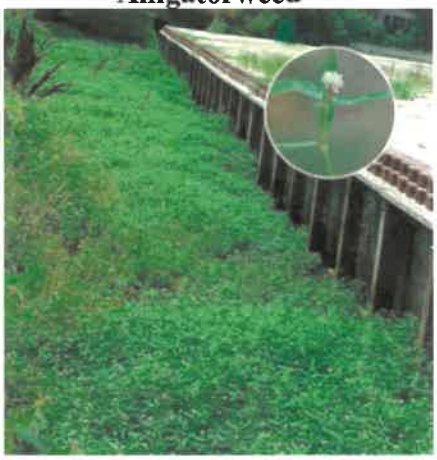
SAV Types found in Currituck

Widgeon Grass

Eurasian Watermilfoil

Parrotfeather

Alligatorweed



Division of Marine Fisheries – Shellfish Sanitation and Recreational Water Quality

Currituck Sound area I-16, which includes the project area, was permanently closed by the North Carolina Division of Marine Fisheries (DMF) in 2014 (see Figure 9). The closure was primarily due to the fact that there are no shellfish within that area and the portion of Currituck Sound that was reclassified from Approved to Prohibited in 2014 was also closed due to legislative cuts to their program that closed their northern office/lab and eliminated three of the five positions. Because of the lack of shellfish resource, this area was dropped from monitoring as DMF recalibrated what they could do with the significantly reduced manpower in that region. As previously mentioned, any areas that we are not monitoring must be classified as Prohibited. Prior to the permanent closure, the 2010 DMF report cited the following Areas of Concern – a horse farm connected with the campground on Bells Island, Hampton Lodge Campground (now a KOA campground), and the Currituck Sound Ferry.

ELEMENT 2

Identify the water quality target or goal and pollution reductions needed to achieve the goal.

The following information was selected from a USACE led multi-agency conference in 2011:
Monitoring showed current nutrient loadings to the system are not as high as previously perceived and WQ is not as degraded as historically observed, nitrogen and phosphorous values were within an acceptable range, algal levels were normal, DO levels - low at times at certain locations but were not indicative of a major problem, light penetration was reduced by the presence of solids and algae in addition to color in the water column.

The following problems were carried forward for further consideration: sediment loading from upstream during high discharge events; loss of marsh sheetflow; loss of connectivity with the ocean through inlet closures; shoreline erosion – mainland marshes and islands; decline in wetlands – freshwater and coastal; blockage of coarse sediments from entering system; decline of SAV and other important habitat; decline in species biodiversity; decline in waterfowl; increase in exotic and invasive species;

The problem statement from USACE 2011 meeting, "Alteration of the natural coastal processes in the Currituck Sound Ecosystem Restoration area has resulted in the creation of a

unique wind-tide driven oligohaline back barrier ecosystem. This ecosystem, which once supported an abundance of submerged aquatic vegetation, coastal marshes, islands and associated wildlife and fisheries, has been degraded as a result of anthropogenic activities in the Sound and surrounding watershed. Areal extent of these keystone habitats has declined, weakening their interconnectedness, and altering energy regimes throughout the Sound thereby reducing their capacity for self-repair. This facilitates a negative feedback loop that continues to destabilize the ecosystem by reinforcing change and causing continued site alteration".

From the historic review of the Currituck Sound:

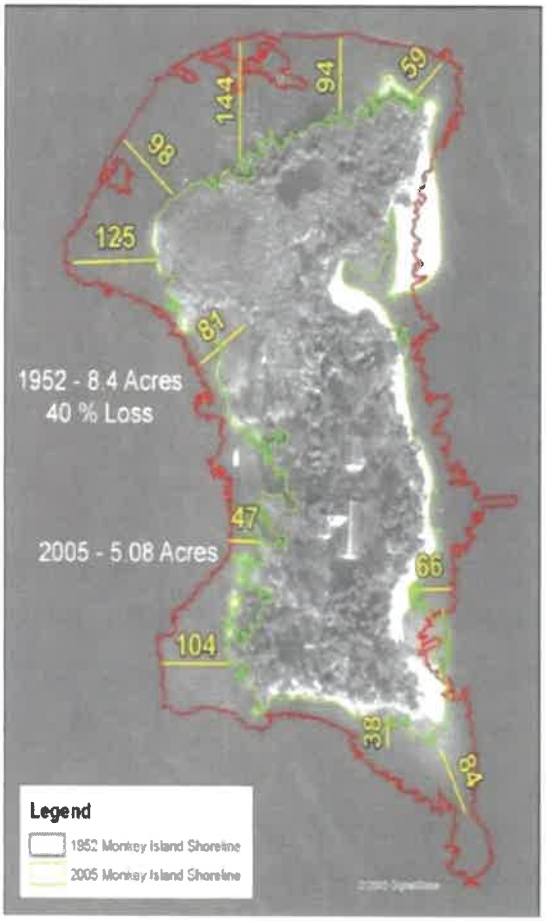
- Historically, gulls and tern nesting colonies were on natural beaches.
- Expansive beach development has degraded areas or nesting.
- New alternative estuarine island nesting sites resulted from island building for dredged material disposal.
- Most current nesting occurs in the estuary & almost half of all nesting sites are on man altered substrate since the 1970s.
- Historically most heronries in coastal swamps
- Logging has degraded or eliminated areas for nesting.
- It is believed historically - multiple wading bird nesting sites throughout Currituck Sound
- Monkey Island is currently the only remaining wading bird nesting habitat in study area. Within the study area, large areas of marsh that once provided wind breaks (which reduce fetch and calm shallow waters), bird rookeries, and aquatic habitat have eroded away.

Development, beach driving, and associated disturbance factors on Currituck Banks have eliminated the piping plover and American oystercatcher from the study area and significant declines in least tern numbers are also evident • In 1992 – 4 least tern colonies existed with 3-6 nests at each site; 2004 – 2 nests; and in 2010 – 1 nest.

Notes on Monkey Island

- Monkey Island supports herons, egrets, and ibis

- Often holds the largest little blue heron colony in the state
- Continued erosion of Monkey Island is currently decreasing the amount of available nesting habitat
- Nest crowding is apparent and is increasing
- Increased accumulation bird feces could kill vegetation through soil acidification reducing appropriate nesting trees
- Monkey Island supports tidal wetlands and shelters about 3 acres of SAV from wind and wave attack



- Monkey Island - 1952 - 8.4 ac, 2005 - 5.1 ac 2010 - 4.4 ac; The envisioned future without the implementation or the panel's recommendations is:
  - "Based on coastal land loss tends ~ 430 ac of estuarine marsh could be lost in the Currituck Sound Study Area every 6 years, or 3,600 acres over a 50-year period of analysis.
  - The possibility of submergence and marsh loss due to increased sea level and/or land

subsidence has been identified as a concern for the marshes of the project area as well as the lower meso-tidal and microtidal marsh environments of the surrounding region.

- In Currituck Sound and Back Bay wind and wave erosion is causing extensive wetland shoreline and marsh island loss which is expected to worsen with continued sea level rise.
- In Back Bay the SLAMM model suggests that due to the effects of increased salinity water depth, and wind fetch 2000 ac of estuarine marsh could be lost by 2050 (USFWS).
- Continuation of current SAV population trend of relatively stable populations well below historic potential.
- Without an increased and /or sustainable "native" SAV population throughout the Sound, future Eurasian watermilfoil events could cause significant disruption to the system due to its boom/bust habit.
- Assuming a continued erosion rate of 0.14 ac/year and 2015 project construction date, Monkey Island would be expected to be less than 4 acres at the beginning of a federal project and under a no action scenario the island could be gone within the 50-year period of analysis.
- Continued erosion of Monkey Island will decrease the amount of available nesting habitat for wading birds.
- Without action to stop island loss, impacts would be expected to result initially in fewer nests and eventually in rookery abandonment, when potential tree nesting site were no longer available."

PROBLEM	OPPORTUNITY
Loss of Submerged Aquatic Vegetation / Coastal Marsh and Shallow Water Habitat Complexes	Re-establish native SAV bed by planting and/or seeding Reclamation of lost acres of back barrier and mainland marsh and marsh islands within the Sound or the creation of new marsh habitat Protect the shorelines of existing, restored, and created marshes Establish multi-functional habitats and dredged material disposal islands that allow proper maintenance of the AIWW and provide protected areas to establish SAV Control and manage the invasive species, *Phragmites australis* and *Myriophyllum spicatum* (Eurasian Watermilfoil), in order to sustain a diverse native habitat
Loss of Estuarine Islands and Waterbird Nesting Habitat	Protect and restore existing significant wading bird nesting habitats (i.e. Monkey Island). Reclaim lost acres of back barrier and mainland marsh or create new marsh shorebird habitat
Historic Decline in Water Quality and Clarity	Restore native SAV beds and stabilize sediment and cycle nutrients Create riparian buffers to help improve water quality by reducing turbidity, suspended solids, and nutrient loading Create/restore marsh island and back barrier marsh features to help reduce fetch and minimize wave induced re-suspension of sediment

Recommended Restoration Measures

Nonstructural:

- Habitat restoration
- Control of Phragmites
- Vegetative Plantings

Structural:

- Sediment Supply and Distribution (Marsh, Sand Island, Nesting Island)
  - Channel Dredging and Placement
  - Sediment Delivery from Distant Sources
- Shore Protection
  - Breakwaters
  - Marsh toe protection structures
  - Sills

Hydrologic Restoration/Connectivity:

- Removal of existing impediments to sheetflow
- Removal of existing impediments to overwash

- Reestablish tidal exchange through the creation of inlets
- Culverts

Therefore, we recommend a survey of this area to establish baselines for water quality. Historically, the Albemarle Pamlico National Estuary Program has conducted sampling and research within the project boundary and nearby areas, primarily to assess submerged aquatic vegetation (SAV) in the sound.

In correspondence with Jason Glazener with the Wilmington District - U.S. Army Corps of Engineers Aquatic Ecosystem Restoration, on July 7, 2023, the aforementioned plan was never implemented due to scope creep and diminished support.

Past Currituck Bay Scientific Assessments

- APNEP - 1990 - A Survey of Submerged Aquatic Vegetation In The Currituck Sound And The Western Albemarle-Pamlico Estuarine System – This report addressed results of a survey of a SAV in the Currituck Sound, Back Bay and western Albemarle-Pamlico estuarine system. Surveys were also conducted by APNEP in 2008 and 2012.
- USGS South Atlantic Water Science Center – 2012 report Currituck Sound Water Quality Monitoring – This report was developed to address water quality and biological health issues (high nutrient concentrations and chronic algal blooms) within the Currituck Sound. "As development in the Currituck Sound watershed continues at a rapid pace, management strategies are needed to protect and enhance the quality of this resource (U.S. Army Corps of Engineers, 2001)." In 1980, Currituck Sound Task Committee (North Carolina Department of Natural Resources and Community Development, 1980) recommended that State agencies "request the U.S. Geological Survey to assist in an evaluation of the hydrology of the Sound." The Corps of Engineers also recognizes the need for a hydrodynamic model of Currituck Sound to characterize inflows to and outflows from the Sound, as well as circulation within the Sound (U.S. Army Corps of Engineers, 2001). Such a model can be used to evaluate the effects of both existing and possibly future hydrologic modifications on circulation and salinity in the Sound. Please NOTE: Most recently in a conversation with Patrick Dickhudt (July 26, 2023), of the USACE, also recommends development of a hydrodynamic model to best understand

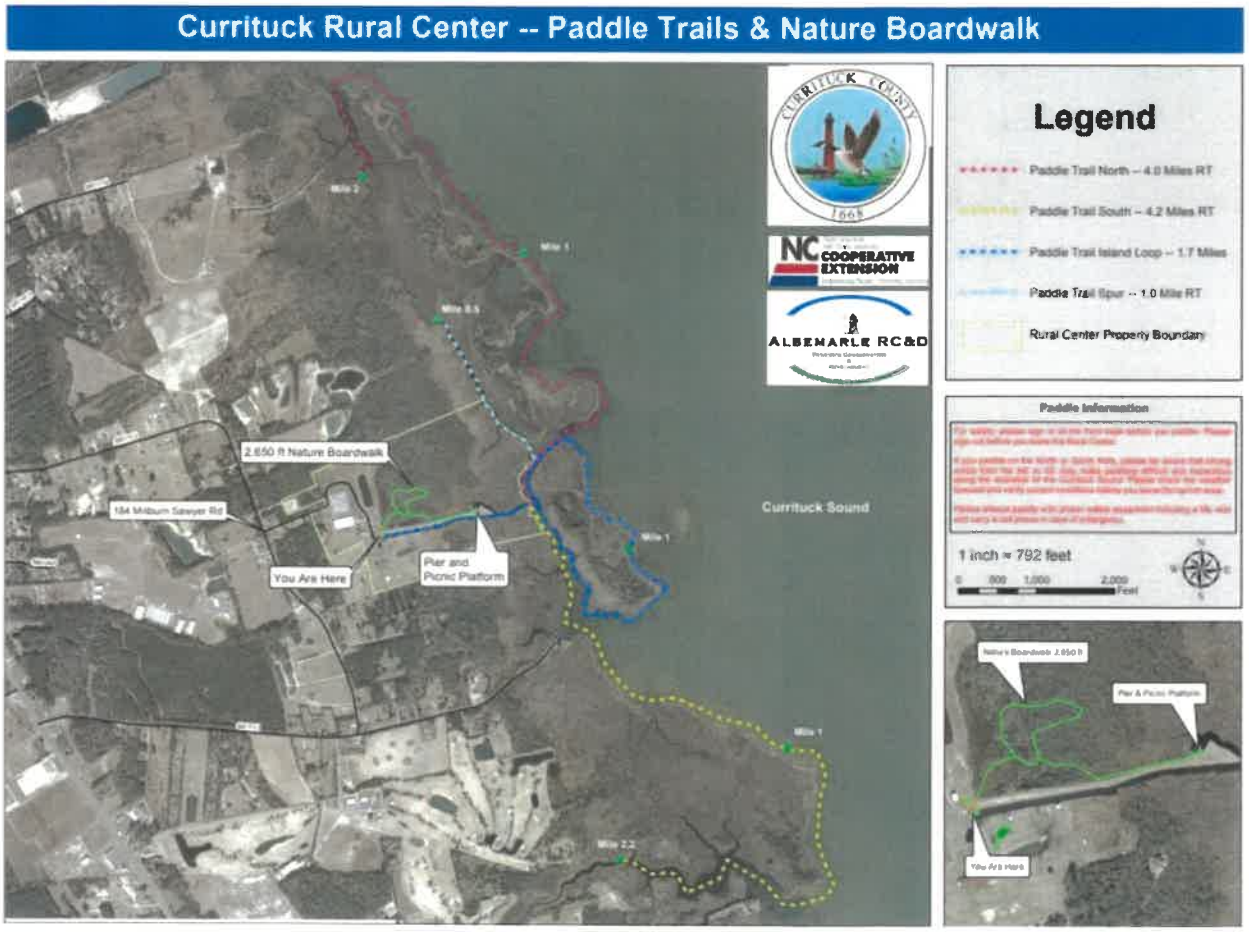
the systems of the sound and how best to protect them. A final report for this effort was not available.

- Previously discussed Currituck Sound SAV Ecosystem Restoration Study Partners' Meeting, Spring, 2011. Attendees were:
  - North Carolina Department of Environmental and Natural Resources - Division of Water Resources (NCDWR) (non-federal Sponsor), North Carolina Division of Marine Fisheries (NCDMF), North Carolina Division of Water Quality (NCDWQ), North Carolina Wildlife Resources Commission (NCWRC), North Carolina Division Coastal Management (NCDCM)
  - North Carolina National Estuarine Research Reserve (NCNERR)
  - North Carolina Coastal Federation (NCCF) Elizabeth City State University (ECSU)
  - US Fish and Wildlife Service (USFWS) US Geological Survey (USGS) Currituck County
  - Pasquotank River Basin Regional Council Hampton Roads Planning District Commission
  - The Nature Conservancy (TNC)
  - Virginia Department of Environmental Quality Virginia Department of Conservation & Recreation
  - National Audubon Society National Oceanic and Atmospheric Administration (NOAA)
  - Local environmentalists and sportsmen Albemarle Pamlico National Estuary Program
  - North Carolina Coastal Land Trust (NCCL)
  - Back Bay National Wildlife Refuge (BBNWR) Mackay National Wildlife Refuge
  - Cape May Plant Materials Center Virginia Department of Game and Inland Fisheries(VDGIF)
  - US Department of Agriculture
- Currituck Sound Coalition Marsh Conservation Plan, December 2021
  - Currituck Sound Coalition members:
    - Albemarle-Pamlico Natural Estuary Partnership
    - Audubon North Carolina
    - Chowan University
    - Coastal Studies Institute

- Currituck County
- Ducks Unlimited
- National Wildlife Refuge Association
- North Carolina Coastal Federation
- North Carolina Coastal Reserve and National Estuarine Research Reserve
- North Carolina Sea Grant
- North Carolina Wildlife Resources Commission
- The Nature Conservancy
- Town of Duck
- US Fish and Wildlife Service

Nature Tourism

- The Currituck Rural Center - Paddle Trails and Nature Boardwalk the Albemarle Regional Paddle Trail System. The restoration plan will include a strategy for removing trash and debris from the Little River and creeks and improving paddler access and recreational opportunities throughout the watershed. Information on the Albemarle Regional Paddle Trail System may be found on the Albemarle RC&D Council's website: www.albemarlercd.org



- North Carolina Resilient Coastal Communities Program (RCCP) Phase I and II, Currituck County April 2022 – Prepared by WithersRavenel
  - Community Action Team met December 3, 2021
    - Funding opportunities identified for proposed coastal investments in Congress:
    - $207 million for grants to States and Territories to implement coastal and Great Lakes habitat restoration projects which will provide ecosystem and community resilience benefits.
    - $160 million to address working waterfront infrastructure.

- $845 million for National Estuaries Programs and other EPA Geographic programs to help coastal communities protect and restore habitat and make on-the-ground improvements for clean and safe water.
- $1 billion for FEMA Pre-disaster Hazard Mitigation Assistance to help communities—both coastal and non-coastal—adapt to changing conditions and reduce their vulnerabilities so they can withstand and rapidly recover from hazards.
- $500 million for the FEMA Hazard Mitigation Revolving Loan Fund to help communities to mitigate the impacts of future hazard events.
- $492 million for competitive grants for coastal natural infrastructure projects under the National Oceans and Coastal Security Fund to benefit fish and wildlife and to reduce the impacts of coastal flooding.
- $491 million for competitive grants for Community-Based Habitat Restoration projects that restore marine, estuarine, coastal, and Great Lakes or protect or construct features that protect coastal communities from flooding or coastal storms.
- $465 million for USACE projects for streambank and shoreline protection, sediment management, small flood control project, and other purposes.
- $9.5 billion to NOAA to provide funding and technical assistance for the purposes of restoring a marine, estuarine, coastal, or Great Lake habitat; or providing adaptation to climate change, including by protecting, restoring, or establishing ecological features that protect coastal communities from sea-level rise, coastal storms, or flooding; or designing or implementing blue carbon projects.
- $500M to address coastal flooding and sea-level rise. xi. $50M for insular coastal hazards.
- Total = $14.2 Billion

Community Action Team (CAT) Members:

Name	Organization	Position
Dylan Lloyd	Currituck County	Soil and Stormwater Manager
Steven Pyle	Currituck County	Deputy Emergency Management Coordinator
Laurie LoCicero	Currituck County	Planner
Mary "Kitty" Etheridge	Currituck County	County Commissioner
Manly West*	Soil and Water Conservation	Chairman
Wendy Shannon	Moyock Service District	Advisory Board Member
David Shepherd	Eagle Creek HOA	Vice President
Ronald Powell*	Samuel Chapel Holiness Church - Sligo	Church Leader
Jerry Wright*	Chamber of Commerce	Local Businessowner & Farmer

Stressors (causes of impairment). Physical, chemical and/or biological sources degrading the watershed function.

Based on EPA's Pollutant Load Estimation Tool (PLET) with current data from 2018, the following were noted within the project area:

State	County	FIPS	Watershed Name	HUC12	Watershed Total Area (acres)			
NC	CURRITUCK	37053	030102051304 - Coinjock Bay-Currituck Sound	30102051304	33, 352.06			
Watershed Name	HUC12	Urban	Cropland	Pastureland	Forest	Feedlots	Water	Other
030102051304 - Coinjock Bay-Currituck Sound	30102051304	1374.39 acres	3042.58 acres	230.62 acres	9032.56 acres	0.0025	19158.62 acres	513.29
Watershed Name	HUC12	Beef Cattle	Dairy Cattle	Swine	Horse	Chicken	Turkey	Duck
030102051304 - Coinjock Bay-Currituck Sound	30102051304	0	0	0	2	14	0	1
Watershed Name	HUC12	Septic Systems	Population per Septic System	% Septic Failure Rate				
030102051304 - Coinjock Bay-Currituck Sound	30102051304	736	2	0.59				
Watershed Name	HUC12	Hydrological Soil Group						
030102051304 - Coinjock Bay-Currituck Sound	30102051304	C						

Seasonal residential and seasonal commercial activity have had an impact on the watershed. The Agricultural operations footprint is not large enough within the project area to have had significant negative impact to the watershed. Some residential and limited commercial developments have increased pollution from stormwater runoff and indirectly contributed to shoreline erosion. Marshes and wetlands within the project area are candidates for restoration and protection.

ELEMENT 3

Identify the best management practices (BMPs) that will help to achieve reductions needed to meet the water quality goal/target.

A **description of the management measures** that will need to be implemented to accomplish restoration and conservation/preservation goals as well as other selected watershed goals identified in the April 2022 North Carolina Resilient Coastal Communities Program (RCCP) plan, 2021 Currituck Sound Coalition Marsh Conservation Plan recommendations and 2011 Currituck Sound SAV Ecosystem Restoration Study recommendations, are discussed below.

The NPS management measures will focus initially on these strategies:

1. Marsh sill and shoreline restoration in Coinjock Bay
2. Bells Island Road Shoreline Protection
3. Bells Island Road Improvements Study
4. Knotts Island marsh causeway improvements study
5. Waterlily Road improvements study
6. Study area wetland restoration

NPS Issue or Problem

1. **Shoreline erosion** - Shoreline restoration uses techniques such as installation of marsh sills, plantings, and oyster bags or rock to stabilize the shoreline. This project includes design and installation of approximately 770 LF or shoreline restoration at 3581 Caratoke Hwy. A marsh sill and shoreline restoration at this location serves to protect the roadway and has the potential to be developed as a public water access. This project was identified in the Draft Narrative Water Quality Monitoring and Remediation - Currituck Sounds

Watersheds. Additionally, shoreline stabilization and marsh restoration are identified as Outer Banks Hazard Mitigation Plan actions #CUR11 and #CUR12; to pursue shoreline stabilization projects and regular shoreline monitoring and prioritization of marsh restoration planning and design for storm surge mitigation benefits.

2. **Shoreline erosion** - Living shorelines use plantings and other natural elements such as oyster bags or rock to stabilize the shoreline. This project proposes to design and install living shorelines along a 4,500 LF stretch of Bells Island Rd. A living shoreline at this location serves to protect the roadway which was identified as a hot spot in the citizen survey. This project was identified in the Draft Narrative Water Quality Monitoring and Remediation - Currituck Sounds Watersheds. Additionally, shoreline stabilization and marsh restoration are identified as Outer banks Hazard Mitigation Plan actions #CUR11 and #CUR12; to pursue shoreline stabilization projects and regular shoreline monitoring and prioritization of marsh restoration planning and design for storm surge mitigation benefits.
3. **Reduce nonpoint source pollution from flooding on Bells Island Road** - Drainage/road improvement study and implementation of recommended improvements for Bells Island Rd. This project would be funding for a study to evaluate alternatives for elevating Bells Island Road to reduce risk of being inundated during flood events. Bells Island Rd is the only land access to the Bells Island area, so inundation of the roadway can cut off access or create unsafe driving conditions for individuals who attempt to drive the road anyway. This could be done in conjunction with, or in place of, the Bells Island Road Shoreline Protection project. This project was identified in the Currituck County Resilient Redevelopment Plan as Infrastructure Action 4. Additionally, the project area was identified as a hot spot in the citizen survey. For optimal project success this study should be done in coordination with NCDOT.
4. **Reduce nonpoint source pollution from flooding on Knotts Island marsh causeway** - Drainage/road improvement study and implementation of recommended improvements for the Knotts Island Marsh Causeway. This project would provide funding for a study to evaluate alternatives for elevating Marsh Causeway to reduce risk of being inundated during flood events. The Knotts Island Marsh Causeway is the only land access to Knotts Island, so inundation of the roadway can severely limit access, requiring use of the ferry or

create unsafe driving conditions for individuals who attempt to drive the road anyway. This project was identified in the Currituck County Resilient Redevelopment Plan as Infrastructure Action 4. Additionally, the project area was identified as a hot spot in the citizen survey. For optimal project success this project should be completed in coordination with NCDOT.

5. **Reduce nonpoint source pollution from flooding on Waterlily Road -** Drainage/road improvement study and implementation of recommended improvements for the Waterlily Road. This project would provide funding for a study to evaluate alternatives for elevating Waterlily Road to reduce risk of being inundated during flood events. Waterlily Rd is the only land access to the Piney Island and Church Island Area, so inundation of the roadway can cut off access or create unsafe driving conditions for individuals who attempt to drive the road anyway. This project was identified in the Currituck County Resilient Redevelopment Plan as Infrastructure Action 3. Additionally, the project area was identified as a hot spot in the citizen survey. For optimal project success this project should be completed in coordination with NCDOT.
6. **Project area wetland restoration –** wetland restoration is the manipulation of degraded wetlands so that they may function as they did previously. Restoration typically includes rebuilding as well as rehabilitating a wetland. Wetlands play a significant role in mitigating flooding and acting as sinks for carbon sequestration. Additionally, wetlands serve as critical wildlife habitat, help meet and maintain watershed goals and contribute to economic well-being. A key question for this effort will be to what extent can wetlands accrete vertically and keep pace with rising sea level? Part of the answer will be addressed by identifying which wetlands within the project area will be considered for restoration efforts. This will include an assessment of the biogeomorphic properties of the wetlands and will include a determination of species present, productivity, decomposition, above-ground and below-ground biomass, surface accretion, compaction, and local subsidence.

The Audubon of North Carolina published their Currituck Sound Coalition Marsh Conservation Plan in December of 2021 (https://nc.audubon.org/sites/default/files/static_pages/attachments/currituck_sound_marsh_conservation_plan_202109_final_2.pdf) . The marshes of Currituck Sound are important on many levels.

They provide important habitat for many terrestrial and aquatic species. These immensely productive wetlands also provide ecosystem services that benefit people. They act as buffers that protect communities along Currituck Sound from erosion caused by wind and waves and reduce the impacts of flooding by slowing runoff and filtering stormwater as it moves through the wetland system. They also act as carbon sinks to address climate change issues through the process of sequestration. Lastly, they are natural places of beauty and recreation and part of what makes this area of the state so unique and special.

According to the NOAA Coastal Change Analysis Program (C-CAP), the net extent of all wetlands within the Currituck Sound declined by 13.31 km2 (3,289 acres) from 1996 to 2010. Although certain types of wetlands (such as those dominated by shrubs) experienced measurable increases during that time, the decrease in forested wetlands was larger than any gains. Upland migration may offset marsh loss in the coming decades, but this process will likely have implications for other wetland types in the region.

The survival of these coastal wetlands threatened with sea level rise will depend on their ability to stay above water so to speak. This will only happen through some combination of organic matter accumulation and mineral sediment deposition. Unfortunately, Currituck Sound lacks a significant source of mineral sediment due to the absence of a major stream system delivering sediment to the sound and development that has altered the natural coastal sediment dynamics of the area.

An area's hydroperiod (the frequency and duration of flooding) is the single most important factor in determining wetland function (Mitsch and Gosselink, 2015). It controls the growth and species composition of wetlands (Todd et al. 2010), as well as directly affecting ecological processes such as productivity, germination, decomposition, nutrient dynamics, and vegetative reproduction. Changes in land use, and therefore hydrology, can negatively impact wetland function.

As previously stated, one of the major benefits of wetlands is their ability to absorb and breakdown pollutants. However, there is a finite limit to their capacity to provide this service. Going beyond this threshold can degrade a wetland/marsh. Examples of pollutants that at high levels can negatively impact wetlands include: sediment, fertilizer, human sewage, animal waste, road

chemicals, pesticides, and heavy metals (EPA 2001).

As sea levels rise, saltwater moves inland through a process called saltwater intrusion (White and Kaplan 2017). Freshwater wetlands are usually the first to experience saltwater intrusion. Wetlands respond by either adapting to the higher salinity, losing out to invasive species or the entire wetland vegetation dies out and due to the height of sea level rise and overwhelming salinity.

Coastal wetlands are valued for their ability to mitigate the severity of storm events. However, these wetlands are often adversely affected by the sheer number and intensity of the storm events. During the 20-year period from 1999 through 2018, the National Center for Environmental Information recorded 57 hurricane and tropical storms across 27 separate days which impacted the Outer Banks with extreme winds (Outer Banks Regional Hazard Mitigation Plan 2020). The aforementioned 2020 North Carolina Risk Assessment and Resilience Plan concluded that rising sea levels coupled with more intense coastal storms will almost certainly increase storm surge, flooding, and erosion in the state.

As previously mentioned, the survival of these wetlands vis a vie sea level rise is directly tied to their ability to accrete vertically. Research is needed to define bio geomorphic characteristics specific to Currituck Sound marshes. These properties include species present, productivity, decomposition, above-ground and below-ground biomass, surface accretion, compaction, and local subsidence. The U.S. Army Corps of Engineers is developing a protocol to place thin layers of dredged material on wetlands to help them remain viable in a sea level rise scenario.

The marshes in Currituck Sound provide a range of ecosystem services that support and maintain ecological processes as well as an important tourism economy and a growing year-round population. Providing quantitative economic data on the value of these marshes could bolster support and funding for efforts to protect, conserve, and restore them.

Marsh management includes prescribed burning, water-level control, and removal of invasive species. These necessary activities promote plant diversity and habitat. Non-native Phragmites australis is prevalent in Currituck Sound, but clear guidance on the ecological impact and

management of this species is not available. Further research is needed to determine the most appropriate marsh management practices for specific sites and to adapt our management practices to address climate change and sea level rise.

Physical parameters and processes in Currituck Sound have been poorly documented. A bathymetric study, wind-wave-current interactions, and baseline water quality data are necessary to understanding the systems of the Currituck Sound to facilitate better management of the health, stability, and persistence of these wetlands.

Marsh loss observed in the Currituck Sound is largely due to lateral erosion occurring at the marsh-sound boundary (USACE 2011) and marsh breakup due to insufficient accretion with rising sea level (Cahoon et al 2019). Potential actions to address these processes involve a combination of living shorelines (Currin 2019), submerged sills (Gittman et al. 2011), and thin-layer placement of sediment (VanZomeren and Piercy 2020). Although these techniques have been successfully used in other ecosystems, research is needed to determine the efficacy and most appropriate sites in Currituck Sound.

The conservation strategies identified in the Currituck Sound plan are:

1. Conserve and expand the wetland/marsh migration corridors;
2. Restore and enhance degraded marshes;
3. Address knowledge gaps through research and monitoring to inform adaptive marsh management;
4. Strengthen community use and appreciation of natural areas, especially marshes; and
5. Enhance marsh habitat connectivity and ecosystem function.

In conclusion, the Currituck Sound Coalition partners are actively collaborating to secure funding for implementation of projects, research, and other initiatives that advance the strategies in this plan. As of the date of their report, the coalition partners had identified 14 relevant conservation projects and research initiatives that reduce the impacts of threats to marshes in Currituck Sound, while also benefiting multiple conservation targets.

ELEMENT 4

Estimate the amounts of technical and financial assistance and the relevant authorities needed to implement the plan.

- The North Carolina Resilient Coastal Communities Program (RCCP) Phase I and II, Currituck County April 2022 – Prepared by WithersRavenel. As previously noted in this plant, this report recommended the following dollar amounts to fund their project recommendations.
  - Community Action Team met December 3, 2021
    - Funding opportunities identified for proposed coastal investments in Congress:
    - $207 million for grants to States and Territories to implement coastal and Great Lakes habitat restoration projects which will provide ecosystem and community resilience benefits.
    - $160 million to address working waterfront infrastructure.
    - $845 million for National Estuaries Programs and other EPA Geographic programs to help coastal communities protect and restore habitat and make on-the-ground improvements for clean and safe water.
    - $1 billion for FEMA Pre-disaster Hazard Mitigation Assistance to help communities—both coastal and non-coastal—adapt to changing conditions and reduce their vulnerabilities so they can withstand and rapidly recover from hazards.
    - $500 million for the FEMA Hazard Mitigation Revolving Loan Fund to help communities to mitigate the impacts of future hazard events.
    - $492 million for competitive grants for coastal natural infrastructure projects under the National Oceans and Coastal Security Fund to benefit fish and wildlife and to reduce the impacts of coastal flooding.
    - $491 million for competitive grants for Community-Based Habitat Restoration projects that restore marine, estuarine, coastal, and Great Lakes or protect or construct features that protect coastal communities from flooding or coastal storms.
    - $465 million for USACE projects for streambank and shoreline protection, sediment management, small flood control project, and other purposes.
    - $9.5 billion to NOAA to provide funding and technical assistance for the purposes of

restoring a marine, estuarine, coastal, or Great Lake habitat; or providing adaptation to climate change, including by protecting, restoring, or establishing ecological features that protect coastal communities from sea-level rise, coastal storms, or flooding; or designing or implementing blue carbon projects.

- $500M to address coastal flooding and sea-level rise. xi. $50M for insular coastal hazards.
- Total = $14.2 Billion

Grant sources for watershed and community development projects are listed below.

National Oceanic and Atmospheric Administration (NOAA)
NOAA has several grants that would be appropriate for addressing the goals of this report.
https://cpo.noaa.gov/Funding-Opportunities

NC Sea Grant
Provide grants that support research on important topics to NOAA and North Carolina coastal stakeholders.
https://ncseagrant.ncsu.edu/funding-opps/

USACE Aquatic Ecosystem Restoration Cost/Share Program
65%35% Fed/Non-Fed
https://www.sas.usace.army.mil/Missions/CAP/Section-206-Aquatic-Ecosystem-Restoration/

Golden Leaf Foundation Grants
May be used as a match with a federal grant
https://goldenleaf.org/opengrants/

USEPA 319
Announcement in late February or Early March.
Proposals due late May
http://portal.ncdenr.org/web/wq/ps/nps/319program

USEPA Wetland Development Grants
Announcement usually in Summer
http://water.epa.gov/grants_funding/wetlands/grantguidelines/index.cfm

North Carolina Land and Water Fund
Announcement in November
Proposals due February 1 and July 1.
https://nclwf.nc.gov/

DMF Coastal Recreational Fishing License Program

Announcement in early June
Proposals due end of July. http://portal.ncdenr.org/web/mf/crfl-program

CAMA Planning and Public Access
Announcement usually in late February
Proposals due mid-April
http://portal.ncdenr.org/web/cm/grants

Z Smith Reynolds
Proposals due February 1.
http://www.zsr.org/

NCDENR Water Resources
Proposals due July 1 and January 1.
http://www.ncwater.org/?page=7

NC Rec Trails
Pre-application due November 1
Application due January 31.
http://www.ncparks.gov/About/trails_RTP.php

Adopt-A-Trail
Announcement in October
Proposals due January 31.
http://www.ncparks.gov/About/trails_AAT.php

Environmental Enhancement Grants (EEG)
Letter of Intent August 10
Proposals September 14.
http://www.ncdoj.gov/EEG.aspx

APNEP:
Usually Spring announcement.
http://portal.ncdenr.org/web/apnep/grants#APNEP

USEPA and NCDWQ 205(j) Grants
Usually May announcement.
Proposals through regional council of government (Albemarle Commission)
http://portal.ncdenr.org/web/wq/ps/bpu/205j

ELEMENT 5

Develop an information/education component.

Public education and outreach will be a major component throughout this watershed planning process. Key stakeholders will be identified and included in the development and

implementation of the watershed plan. Local, state, and federal programs will also be included in the planning process to tie in financial and technical assistance. Examples of information and education activities include:

- Develop a project web site for public access to information and activities for conservation and restoration. Also access to monitoring data.
- Develop informational brochures and materials for public meetings and educational events.
- Conduct public meetings for landowners in Currituck County.
- Implement BMPs in areas visible to the public.
- Conduct educational workshops for local high school, middle school, and elementary school students.
- Install information kiosks and signage at river access sites, along accessible shoreline areas and at BMPs to highlight project activities in watershed restoration, conservation and preservation.

Through this 9-Element process we have identified and spoken with many individuals who would like to be participants and champions of the efforts identified in this report. We envision these people to have practical roles such as performing identified tasks through grant funding or assisting local students and residents to better understand the ecology of the Currituck Sound, as well as mentor students and others on college and career opportunities in science. Project personnel will contribute information on the success of Currituck Sound restoration, preservation and conservation efforts.

Some of the individuals contacted include:

- Elizabeth Allen Bryant – Director, Albemarle Resource Conservation & Development Council
- Cat Bowler - Coastal Resilience Program Manager at National Audubon Society
- Dr. Reide Corbett – Dean and Executive Director Coastal Studies Institute - ECU
- Lora Eddy – Coastal Geologist – Coastal Engagement Coordinator - TNC
- Dr. Bo Dame – Professor of Biology and Physical Science – Chowan University
- Patrick Dickhudt – Research Oceanographer – USACE Field Research Facility
- Heather Jennings – Program Manager – Albemarle Pamlico National Estuary Partnership
- Mike Hoff – USFWS – Mackay Island National Wildlife Rescue

ELEMENT 6

Develop a project schedule.

The following sections describe a reasonable, hypothetical schedule for implementing the NPS related and other management measures outlined in Element 3.

Sample Task Schedule for Wetland Assessment and Restoration Recommendations:

TASK	November 2023 to June 2025																							
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	A	M	J
Submittal of Coinjock Bay/Currituck Sound 9-Element Plan.																								
Discussion of appropriate grants to pursue and identifying the ones to apply for with project partners.																								
Approval of 9-Element Plan.																								
Identify grant partner roles and activities																								
Establish grant timelines.																								
Apply for grants.																								
Partner1* activities																								
Partner2* activities																								
Partner3* activities.																								

*Partners TBD

As identified previously in Element 3, NPS related and other management measures are listed again below. The strategy and approach to implementing these actions will be fleshed out through the iterative process with the potentially identified partners.

The NPS related and other management measures will focus initially on these strategies:

1. Marsh sill and shoreline restoration in Coinjock Bay
2. Bells Island Road Shoreline Protection
3. Bells Island Road Improvements Study
4. Knotts Island marsh causeway improvements study
5. Waterlily Road improvements study
6. Study area wetland restoration

Explore potential partnerships with scientists conducting research for Mid-Currituck Bridge

- Although, the U.S. Court of Appeals for the 4th Circuit upheld a lower court finding on February 23, 2023, in favor of NCDOT and the Mid-Currituck Bridge, it's still unclear when or even if the much-delayed toll bridge will be built. Current plans call for construction to begin in 2024 on the $500 million-plus project. If the project does move forward there will be additional research which will need to be conducted in the Currituck Sound. Ideally, proposed research for this 9-Element Plan may be woven in with other research in the sound.

Data collection

Purpose and objectives.

- Collect water quality data throughout project area and other adjacent areas as warranted, to establish a baseline for the project.
- Data collection teams and protocols will be established after securing grants for Currituck Soil and Water Conservation District.

Outcomes, results, and products.

- General approach for monitoring and evaluation program. Baseline water samples will be taken throughout the project area. Ideally, a hydrodynamic model will be developed to provide insight into how systems function within the watershed and nearby areas.

Data evaluation

Purpose and objectives.

Upon assessment of baseline data, proposed NPS management measures will be evaluated

and installed where deemed appropriate. These are:

1. Marsh sill and shoreline restoration in Coinjock Bay
2. Bells Island Road Shoreline Protection
3. Bells Island Road Improvements Study
4. Knotts Island marsh causeway improvements study
5. Waterlily Road improvements study
6. Study area wetland restoration

Report preparation

Purpose and objectives.

Status reporting will be conducted for a predetermined schedule.

Activities to be conducted.

- Evaluate project data for reductions in Chlorophyll *a*, N, P and sediment.
- Evaluate SAV recovery.
- Assess wetland acreage restoration.

Outcomes and results

- Less sedimentation in Currituck Sound.
- Greater SAV production.
- More wetland restoration and conservation
- Stabilization of shoreline
- Reduced local flooding

Task Schedule for Water Quality Monitoring and Public Awareness and Education:

TASK	Year 1, July 1, 2015 to July 1, 2016											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Design water quality and wildlife monitoring program.												
Install 6 YSI water quality monitoring stations.												
Collect baseline wildlife data.												
Develop and maintain project web site.												
Develop conservation tax structure.												
Develop informational brochures and materials.												
Conduct public meetings.												
Collect water quality data.												
Conduct educational workshops for local high school students.												
TASK	Year 1, July 1, 2016 to July 1, 2017											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Collect water quality data.												
Collect wildlife data.												
Update project web site.												
Conduct public meetings.												
Install six information kiosks.												
Conduct educational workshop for local high school students.												
Prepare final report.												

ELEMENT 7

Develop the interim, measurable milestones.

Project milestones will be developed through an iterative process after grant money has been captured, objectives determined, and teams work assignments identified. In general, milestones will measure watershed improvement by setting:

- Short-term goals (1 – 2 years)

- Completing the baseline watershed physical, biological and chemical water quality, comprehensive shoreline assessment, comprehensive SAV evaluation and comprehensive wetlands evaluation. This will drive the next phase of restoration, conservation and if possible, preservation.
- Obtain commitments from local governments, universities and state and federal agencies to provide technical and financial assistance either as written in the grants or otherwise.

- Mid-term goals (2 – 5 years)
  - Implementation of recommendations identified in Element 3 or others that organically emerged from fieldwork conducted in the first 2 years.
  - Revisit commitments from local governments, universities and state and federal agencies to provide technical and financial assistance.
- Long-term goals (5 – 10 years)
  - Establish the project area and adjoining areas as one of the most pristine areas of the state and nation through the following:
    - Habitat restoration
    - SAV stabilization
    - Vegetative Plantings
    - Channel dredging spoil to increase wetlands vertical height
    - Create multi-agency regional land use plan
    - Create multi-agency regional conservation plan
    - Reestablish tidal exchange through the creation of inlets
    - Work in conjunction with Mid-Currituck Sound Bridge efforts

ELEMENT 8

Identify indicators to measure progress and make adjustments.

Ultimately, the chosen project areas and issues to address will drive the grants that are pursued. Additionally, collection and assessment of baseline data for the project area will also inform how the restoration, conservation and preservation will unfold. The restoration plan will provide a time estimate and criteria by which the pollutant controls will result in water quality standard attainment for Chlorophyll a ($\mu g\ liter^{-1}$).

The EPA's recommended narrative for chlorophyll criteria include:

- Reducing N and P (lbs/yr)
- Increasing DO (mg/L)
- Reducing TSS and Turbidity
- Increasing SAV density and health
- Increasing wetland areal measurements and accretion.

Chlorophyll a in the Chesapeake Bay (2003) may be a good guide for the Currituck Sound watershed: *Concentrations of chlorophyll a in free-floating microscopic aquatic plants (algae) shall not exceed levels that result in ecologically undesirable consequences—such as reduced water clarity, low dissolved oxygen, food supply imbalances, proliferation of species deemed potentially harmful to aquatic life or humans or aesthetically objectionable conditions—or otherwise render tidal waters unsuitable for designated uses.*

The following water quality standards are summarized from the NC DENR – Division of Water Quality "Redbook" Surface Waters and Wetlands Standards (NC ADMINISTRATIVE CODE 15A NCAC 02B .0100 & .0200) AMENDED EFFECTIVE: APR 1, 2003. REVISED 2007.

- Chlorophyll *a* (corrected): not greater than 40 μg/l for lakes, reservoirs, and other waters subject to growths of macroscopic or microscopic vegetation not designated as trout waters.
- Dissolved oxygen for swamp waters: not less than a daily average of 5.0 mg/l with a minimum instantaneous value of not less than 4.0 mg/l.
- pH for swamp waters: as low as 4.3 if it is the result of natural conditions.
- Temperature: not to exceed 2.8 degrees C (5.04 degrees F) above the natural water temperature, and in no case to exceed 32 degrees C (89.6 degrees F) for lower piedmont and coastal plain waters.
- Turbidity: the turbidity in the receiving water shall not exceed 50 Nephelometric Turbidity Units (NTU) in streams not designated as trout waters.

ELEMENT 9

Develop a monitoring component.

The final project monitoring plan will address the following NPS related and other management measures:

1. Develop a Quality Assurance Project Plan (QAPP).

2. Marsh sill and shoreline restoration in Coinjock Bay
3. Bells Island Road Shoreline Protection
4. Bells Island Road Improvements Study
5. Knotts Island marsh causeway improvements study
6. Waterlily Road improvements study
7. Study area wetland restoration

Water Quality Monitoring and Analysis

Ideally, professors in the ECSU Integrated Coastal Programs/Coastal Studies Institute and Chowan University Department of Biology and Physical Science graduate and undergraduate students will help design and implement a water quality monitoring program using both autonomous monitoring stations (Yellow Springs Instruments [YSI], Sonde 6600 Series) and discreet sampling (fluorometrically determined nitrogen and phosphorus, Turner Designs, Trilogy model). Data will be submitted following the DMF Data Dictionary format. Six autonomous water quality monitoring stations of YSI Sondes will be deployed along the Currituck Sound at locations to be determined by the research team.

It is also anticipated that the research team will work in tandem with and perhaps additionally be a member of the team tasked with researching waters for the Mid-Currituck bridge. This will provide a far more comprehensive assessment of this region.

Each YSI water quality station will be equipped with sensors to continuously measure the following water quality parameters: temperature, conductivity/salinity, pH/ORP, DO, Chlorophyll *a*, and turbidity. These stations will be serviced monthly. Chlorophyll is especially important to measure since this chemical indicator of algal abundance is closely associated with stream nutrient and sediment loading issues.

Additionally, water samples will be collected at each station monthly and as soon as practicable after major named storm events for the specific purpose of analyzing N and P levels. It is important to measure these specific elements since they are associated with stream eutrophication largely by their contribution to excess algal growth The effectiveness of changes in land owner behavior in regard to riparian protections should become apparent notably as

reductions in nitrogen, phosphorus and chlorophyll levels. Total N and total and dissolved P will be determined using fluorometric instrumentation (Turner Designs, Trilogy Model). Samples for N and P will be collected and preserved streamside according to Section 2.22.2 of the Intensive Survey Branch Standard Operating Procedures Manual: Physical and Chemical Monitoring, version 2.1 (ISB SOP)(December 2013). Additionally, samples to determine dissolved N and P will be filtered at the time of collection according to section 2.22.3 and Appendix 6 of the ISB SOP (December 2013).

Furthermore, when water is collected for N and P analyses, hand-held meters (YSI) will be used to measure: pH, salinity, temperature, DO and conductivity. The project will purchase for ECSU a Turner Designs Trilogy Model fluorometer with accessory modules to confirm Chlorophyll *a* and determine at least total and soluble N and P.

The following DWR water quality standards are targets for measuring improvements from watershed restoration activities (in-stream wetlands, conservation and restoration of swamp buffers, public education, etc).

- Chlorophyll *a* (corrected): not greater than 40 μg/l.
- Dissolved oxygen for swamp waters: not less than a daily average of 5.0 mg/l with a minimum instantaneous value of not less than 4.0 mg/l.
- pH for swamp waters: as low as 4.3 if it is the result of natural conditions.
- Temperature: not to exceed 2.8 degrees C (5.04 degrees F) above the natural water temperature, and in no case to exceed 32 degrees C (89.6 degrees F).
- Turbidity: the turbidity in the receiving water shall not exceed 50 Nephelometric Turbidity Units (NTU).

The following tasks will be conducted during monthly service: sensors cleaning, battery replacement, data download, on-site measurement, and water sample collection. Project volunteers from the ARCD will work with ECSU staff and students on collecting monthly samples and data from water quality monitoring stations.

Data Delivery Plan for Research Projects

ECSU staff and graduate students will design and implement a water quality and fisheries monitoring program in the watershed. They will collect data once per month and after major storm events, and process the data per DWQ data format requirements. They will also summarize the data for presentation on the project's web site and in communication media including flyers and electronic newsletters.

Resources for Watershed Planning

EPA's ***Healthy Watersheds*** web site provides information on Healthy Watersheds, including:

Concept, Approach and Benefits: Approaches and benefits of conserving and protecting healthy watersheds.
Assessment Framework: A systems approach to watershed assessment.
Examples of Assessments: Current assessment approaches being used by regions, states, and communities.
Conservation Approaches & Tools: Conservation and protection approaches used by states and communities for ensuring healthy watersheds remain intact.
Outreach Tools: Strategies and resources for watershed managers to encourage stakeholder engagement in conservation and protection of healthy watersheds.

http://water.epa.gov/polwaste/nps/watershed/index.cfm

EnviroAtlas combines hundreds of data layers developed through collaboration between EPA; US Geological Survey; US Forest Service; other federal, state, and non-profit organizations; and several universities. Using powerful web application tools, it lets users generate customized maps and images that show the condition of their local community's air, water, and landscape; as well as population density and other demographic data. Users can investigate land cover patterns, see how ecosystem services reduce pollution, and view closer-to-true-scale data to compare them across selected communities. http://enviroatlas.epa.gov/enviroatlas/

EPA ***How's My Waterway***: http://watersgeo.epa.gov/mywaterway/

EPA ***Watershed Education and Training Resources***: http://water.epa.gov/learn/

High-Resolution Global Maps of 21st-Century Forest Cover Change. Data available on-line from: http://earthenginepartners.appspot.com/science-2013-global-forest.

NC Coastal Federation ***Watershed Restoration Planning Guidebook***
http://www.nccoast.org/content.aspx?key=a7f021ae-cb38-49d7-9862-d2b9c1793ebb&title=Introduction

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Pasquotank County, Elizabeth City, North Carolina, 2004 North Carolina, Coastal Area Management Act (CAMA) *Advanced Core Land Use Plan* Revised March 25, 2008; August 11, 2009; August 30,2010; September 2011; December 2012. Adopted by the Pasquotank County Board of Commissioners: January 9. 2012. Adopted by the Elizabeth City Council: January 9, 2012.

Appendices

IPaC U.S. Fish & Wildlife Service

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Currituck County, North Carolina

Local office

Raleigh Ecological Services Field Office

(919) 856-4520
(919) 856-4556

NC DEPARTMENT OF
NATURAL AND CULTURAL RESOURCES

Roy Cooper, Governor
D. Reid Wilson, Secretary
Kelly Burkhimer
Deputy Director, Natural Heritage Program

NCNHDE-23262

September 8, 2023

Rick Trone
Withers & Ravenel
115 MacKenan Drive
Cary, NC 27511
RE: Currituck 9 Element Plan; 02220937

Dear Rick Trone:

The North Carolina Natural Heritage Program (NCNHP) appreciates the opportunity to provide information about natural heritage resources for the project referenced above.

A query of the NCNHP database indicates that there are records for rare species, important natural communities, natural areas, and/or conservation/managed areas within the proposed project boundary. These results are presented in the attached 'Documented Occurrences' tables and map.

The attached 'Potential Occurrences' table summarizes rare species and natural communities that have been documented within a one-mile radius of the property boundary. The proximity of these records suggests that these natural heritage elements may potentially be present in the project area if suitable habitat exists. Tables of natural areas and conservation/managed areas within a one-mile radius of the project area, if any, are also included in this report.

If a Federally-listed species is documented within the project area or indicated within a one-mile radius of the project area, the NCNHP recommends contacting the US Fish and Wildlife Service (USFWS) for guidance. Contact information for USFWS offices in North Carolina is found here: https://www.fws.gov/offices/Directory/ListOffices.cfm?statecode=37.

Please note that natural heritage element data are maintained for the purposes of conservation planning, project review, and scientific research, and are not intended for use as the primary criteria for regulatory decisions. Information provided by the NCNHP database may not be published without prior written notification to the NCNHP, and the NCNHP must be credited as an information source in these publications. Maps of NCNHP data may not be redistributed without permission.

Also please note that the NC Natural Heritage Program may follow this letter with additional correspondence if a Dedicated Nature Preserve, Registered Heritage Area, Land and Water Fund easement, or an occurrence of a Federally-listed species is documented near the project area.

If you have questions regarding the information provided in this letter or need additional assistance, please contact Rodney A. Butler at rodney.butler@ncdcr.gov or 919-707-8603.

Sincerely,
NC Natural Heritage Program

Appendix 2 – NCNHP Elemental Occurrence Report

NCDA&CS Agronomic Division Phone: (919) 664-1688 Website: www.ncagr.gov/agronomi/ Report No. FY24-S000041

Predictive

Solution Report

Links to Helpful Information

Client: Dylan Lloyd
153 Courthouse Dr
Currituck, NC 27929

Advisor:

Sampled County :
Currituck

Sampled: 06/30/2023
Received: 07/18/2023
Completed: 07/19/2023

Farm: Not Provided

PALS #: 511477

PALS #:

Sample Information
ID: 001
Code: QS
Description: Surface Water

Grower Comments: Tulls Bay

Nutrient Measurements are given in units of parts per million (ppm), unless otherwise specified.

Nitrogen (N)		P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo
Inorganic:	1.20	0.08	31.3	48.4	100	82.0	0.03	0.01	0.00	0.00	0.34	-
NH4-N	0.95											
NO3-N	0.25											
Organic:												
Urea	-											

Other Results

Al	Na	Cl
0.00	912	1530

Other Results

SS (10^3 S/cm)	EC (mS/cm)	pH (Unitless)	CO_3 (meq/L)	HCO_3 (meq/L)	Total Alkalinity (ppm $CaCO_3$)	Acid Requirement (oz/100 gal)	Hardness (ppm $CaCO_3$)	SAR (Unitless)
521	5.21	8.79	0.00	0.80	40.0	-	527	17.3

Agronomist's Comments: Note the extremely high sodium (Na) and chloride (Cl) levels in the water samples. No intended purpose was specified, but water is not suitable for crop irrigation. Kristin A. Hicks (919) 664-1603, kristin.hicks@ncagr.gov 7/19/2023 5:08 PM

Sample Information
ID: 002
Code: QS
Description: Surface Water

Grower Comments: Coinjock Bay

Nutrient Measurements are given in units of parts per million (ppm), unless otherwise specified.

Nitrogen (N)		P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo
Inorganic:	1.14	0.03	52.2	63.7	164	114	0.03	0.01	0.00	0.00	0.60	-
NH4-N	0.95											
NO3-N	0.19											
Organic:												
Urea	-											

Other Results

Al	Na	Cl
0.00	1480	2650

Other Results

SS (10^3 S/cm)	EC (mS/cm)	pH (Unitless)	CO_3 (meq/L)	HCO_3 (meq/L)	Total Alkalinity (ppm $CaCO_3$)	Acid Requirement (oz/100 gal)	Hardness (ppm $CaCO_3$)	SAR (Unitless)
878	8.79	7.10	0.00	0.85	42.5	-	833	22.3

North Carolina Tobacco Trust Fund Commission

Reprogramming of the laboratory-information-management system that makes this report possible is being funded through a grant from the North Carolina Tobacco Trust Fund Commission.

Thank you for using agronomic services to manage nutrients and safeguard environmental quality.
- Steve Troxler, Commissioner of Agriculture.

Appendix 3 – SWCD Water Sample Report (June 2023)

NCDA&CS Agronomic Division | Phone: (919) 664-1600 | Website: www.ncagr.gov/agronomi/ | Report No. FY23-S000887

Predictive

Solution Report

Links to Helpful Information

Client: Dylan Lloyd
153 Courthouse Dr
Currituck, NC 27929

Advisor:

Sampled County :
Currituck

Sampled: 05/31/2023
Received: 06/08/2023
Completed: 06/09/2023

Farm: Not Provided

PALS #: 511477

PALS #:

Sample Information
ID: 001
Code: QS
Description: Surface Water

Grower Comments: Coinjock Bay N

Nutrient Measurements are given in units of parts per million (ppm), unless otherwise specified.

Nitrogen (N)		P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo
Inorganic:	1.49	0.00	45.1	62.4	149	119	0.02	0.01	0.00	0.00	0.56	-
NH4-N	1.16											
NO3-N	0.33											
Organic:												
Urea	-											

Other Results

Al	Na	Cl
0.00	1320	2340

Other Results

SS (10^6 S/cm)	EC (mS/cm)	pH (Unitless)	CO3 (meq/L)	HCO3 (meq/L)	Total Alkalinity (ppm CaCO3)	Acid Requirement (oz/100 gal)	Hardness (ppm CaCO3)	SAR (Unitless)
800	8.00	7.22	0.00	0.82	41.0	-	765	20.8

Agronomist's Comments: Don Edralin 6/9/2023 4:50 PM

Sample Information
ID: 002
Code: QS
Description: Surface Water

Grower Comments: Coinjock Bay / ICWW

Nutrient Measurements are given in units of parts per million (ppm), unless otherwise specified.

Nitrogen (N)		P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo
Inorganic:	1.20	0.00	53.1	61.4	175	140	0.03	0.02	0.00	0.00	0.67	-
NH4-N	1.01											
NO3-N	0.19											
Organic:												
Urea	-											

Other Results

Al	Na	Cl
0.00	1600	2890

Other Results

SS (10^6 S/cm)	EC (mS/cm)	pH (Unitless)	CO3 (meq/L)	HCO3 (meq/L)	Total Alkalinity (ppm CaCO3)	Acid Requirement (oz/100 gal)	Hardness (ppm CaCO3)	SAR (Unitless)
928	9.28	7.01	0.00	0.56	28.0	-	870	23.6

North Carolina Tobacco Trust Fund Commission

Reprogramming of the laboratory-information-management system that makes this report possible is being funded through a grant from the North Carolina Tobacco Trust Fund Commission.

Thank you for using agronomic services to manage nutrients and safeguard environmental quality.
- Steve Troxler, Commissioner of Agriculture.

Appendix 4 – SWCD Water Sample Report (July 2023)

NCDA&CS Agronomic Division Phone: (919) 664-1699 Website: www.ncagr.gov/agronomi/ Report No. FY24-S000088

Predictive

Solution Report

Links to Helpful Information

Client: Dylan Lloyd
153 Courthouse Dr
Currituck, NC 27929

Advisor:

Sampled County :
Currituck

Sampled: 07/31/2023
Received: 09/04/2023
Completed: 09/08/2023

Farm: Not Provided

PALS #: 511477

PALS #:

Sample Information
ID: 002
Code: QS
Description: Surface Water

Grower Comments: COINJOCK BAY

Nutrient Measurements are given in units of parts per million (ppm), unless otherwise specified.

Nitrogen (N)		P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo
Inorganic:	1.57	0.02	54.6	67.9	175	125	0.03	0.02	0.00	0.00	0.63	-
NH4-N	1.10											
NOs-N	0.47											
Organic:												
Urea	-											

Other Results

Al	Na	Cl
0.00	1620	2700

Other Results

SS (10^6 S/cm)	EC (mS/cm)	pH (Unitless)	CO3 (meq/L)	HCO3 (meq/L)	Total Alkalinity (ppm CaCO3)	Acid Requirement (oz/100 gal)	Hardness (ppm CaCO3)	SAR (Unitless)
912	9.12	8.07	0.00	0.94	47.0	-	886	23.7

Agronomist's Comments: Don Edrain 9/8/2023 9:44 AM

Sample Information
ID: 003
Code: QS
Description: Surface Water

Grower Comments: COUJOCK BAY ICWW

Nutrient Measurements are given in units of parts per million (ppm), unless otherwise specified.

Nitrogen (N)		P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo
Inorganic:	1.08	0.02	55.3	69.4	175	113	0.07	0.06	0.00	0.00	0.60	-
NH4-N	0.72											
NOs-N	0.36											
Organic:												
Urea	-											

Other Results

Al	Na	Cl
0.00	1610	2740

Other Results

SS (10^6 S/cm)	EC (mS/cm)	pH (Unitless)	CO3 (meq/L)	HCO3 (meq/L)	Total Alkalinity (ppm CaCO3)	Acid Requirement (oz/100 gal)	Hardness (ppm CaCO3)	SAR (Unitless)
926	9.28	8.62	0.00	1.03	51.5	-	892	23.4

North Carolina

Reprogramming of the laboratory-information-management system that makes this report possible is being funded through a grant from the North Carolina Tobacco Trust Fund Commission.

Thank you for using agronomic services to manage nutrients and safeguard environmental quality.
- Steve Troxler, Commissioner of Agriculture.

Appendix 5 – SWCD Water Sample Report (August 2023)

NCDA&CS Agronomic Division Phone: (919) 664-1600 Website: www.ncagr.gov/agronomi/ Report No. FY24-S000161

Predictive

Solution Report

Links to Helpful Information

Client: Dylan Lloyd
153 Courthouse Dr
Currituck, NC 27929

Advisor:

Sampled County :
Currituck

Sampled: 09/31/2023
Received: 09/18/2023
Completed: 09/20/2023

Farm: Not Provided

PALS #: 511477

PALS #:

Sample Information
ID: 001
Code: QS
Description: Surface Water

Grower Comments: Coinjock Bay

Nutrient Measurements are given in units of parts per million (ppm), unless otherwise specified.

Nitrogen (N)		P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo
Inorganic:	0.76	0.00	49.3	59.9	157	119	0.03	0.04	0.00	0.00	0.56	-
NH4-N	0.61											
NOs-N	0.15											
Organic:												
Urea	-											

Other Results

Al	Na	Cl
0.00	1430	2770

Other Results

SS (10^6 S/cm)	EC (mS/cm)	pH (Unitless)	CO3 (meq/L)	HCO3 (meq/L)	Total Alkalinity (ppm CaCO3)	Acid Requirement (oz/100 gal)	Hardness (ppm CaCO3)	SAR (Unitless)
870	8.70	8.93	0.00	0.84	42.0	-	795	22.1

Agronomist's Comments: Don Edralin 9/20/2023 1:20 PM

Sample Information
ID: 002
Code: QS
Description: Surface Water

Grower Comments: Coinjock Bay ICWW

Nutrient Measurements are given in units of parts per million (ppm), unless otherwise specified.

Nitrogen (N)		P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo
Inorganic:	0.75	0.00	60.0	89.4	193	149	0.01	0.01	0.00	0.00	0.72	-
NH4-N	0.55											
NOs-N	0.20											
Organic:												
Urea	-											

Other Results

Al	Na	Cl
0.00	1780	3330

Other Results

SS (10^6 S/cm)	EC (mS/cm)	pH (Unitless)	CO3 (meq/L)	HCO3 (meq/L)	Total Alkalinity (ppm CaCO3)	Acid Requirement (oz/100 gal)	Hardness (ppm CaCO3)	SAR (Unitless)
1040	10.38	7.06	0.00	0.98	49.0	-	983	24.9

North Carolina Tobacco Trust Fund Commission

Reprogramming of the laboratory-information-management system that makes this report possible is being funded through a grant from the North Carolina Tobacco Trust Fund Commission.

Thank you for using agronomic services to manage nutrients and safeguard environmental quality.
- Steve Troxler, Commissioner of Agriculture.

Appendix 6 – SWCD Water Sample Report (September 2023)

Figures

Figure 1. HUC Project Map

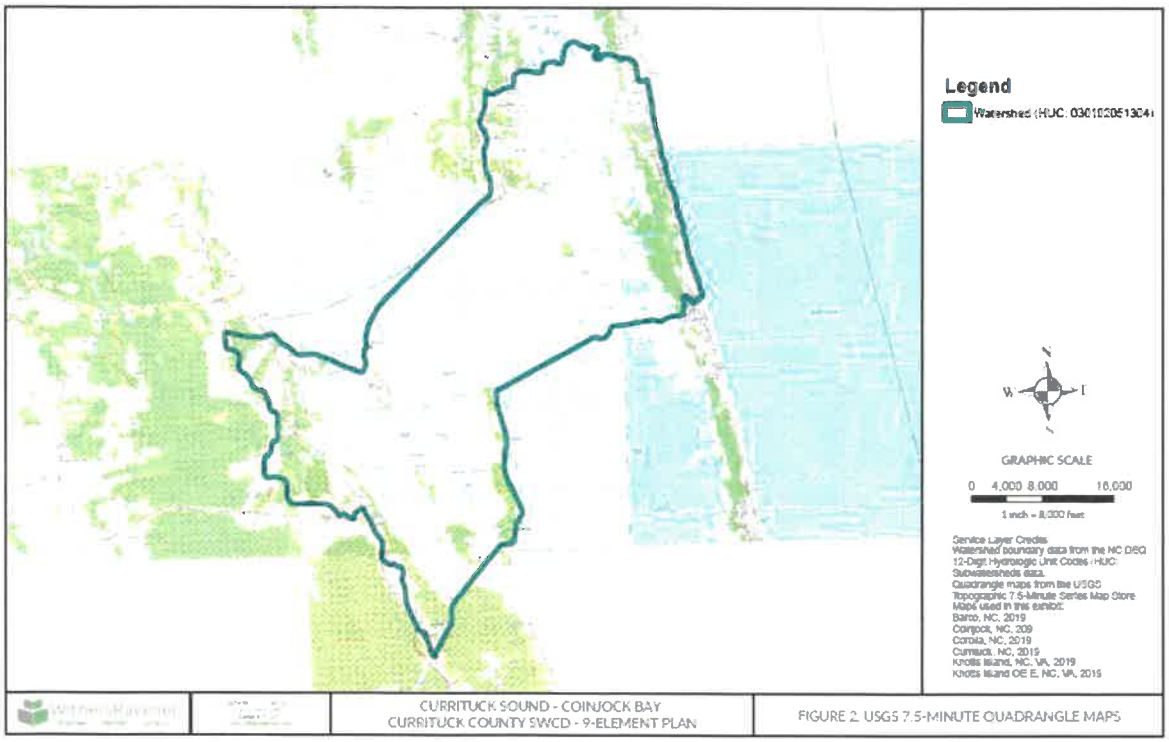

Figure 2. USGS Map

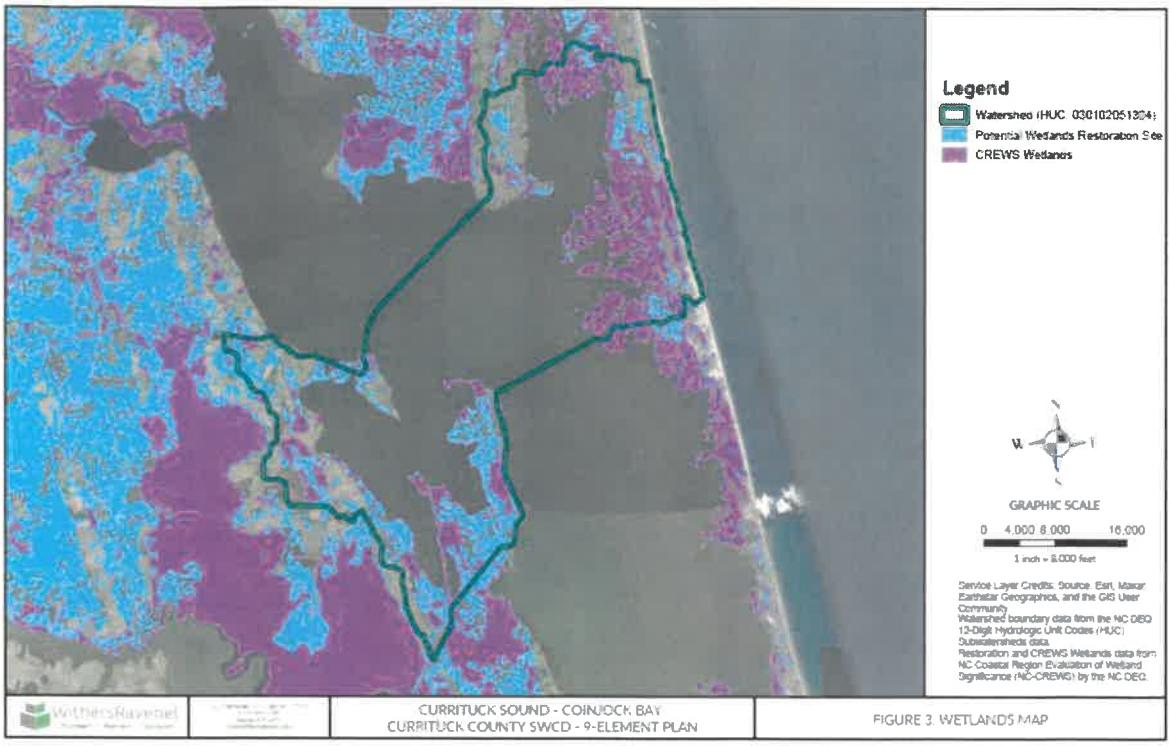

Figure 3. Wetland Map

Figure 4. Impervious Land Map

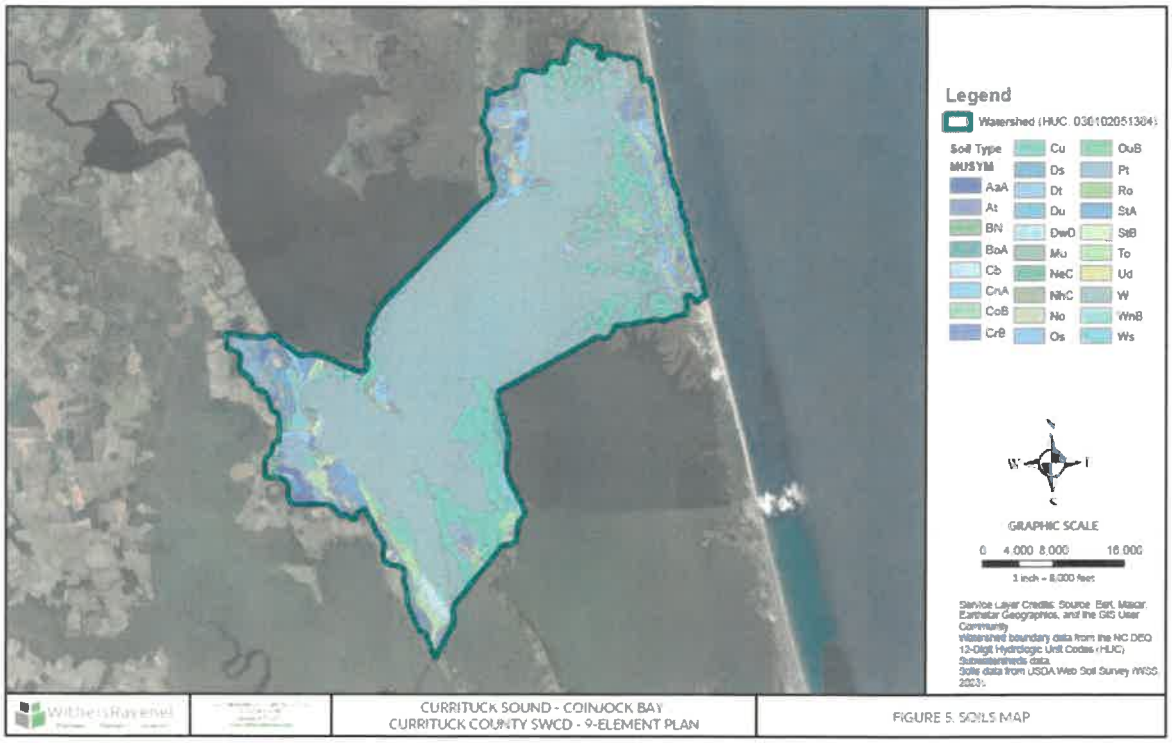

Figure 5. Soils Map

Figure 6. Parcels Map

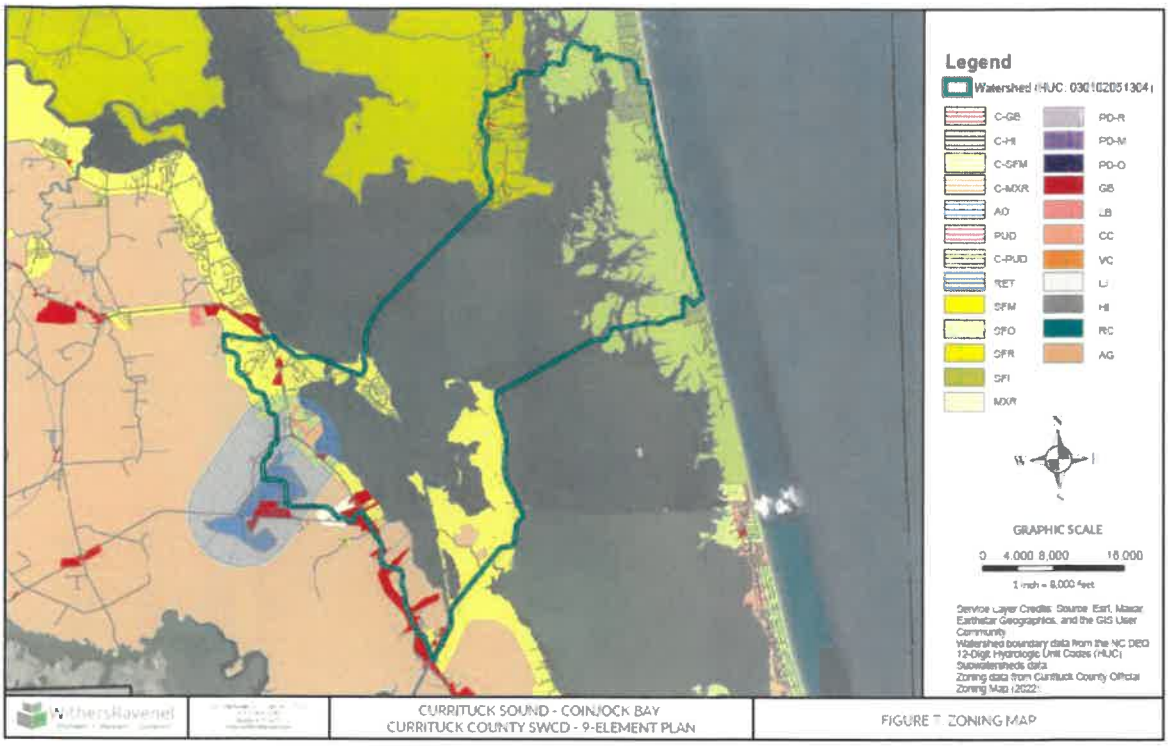

Figure 7. Zoning Map

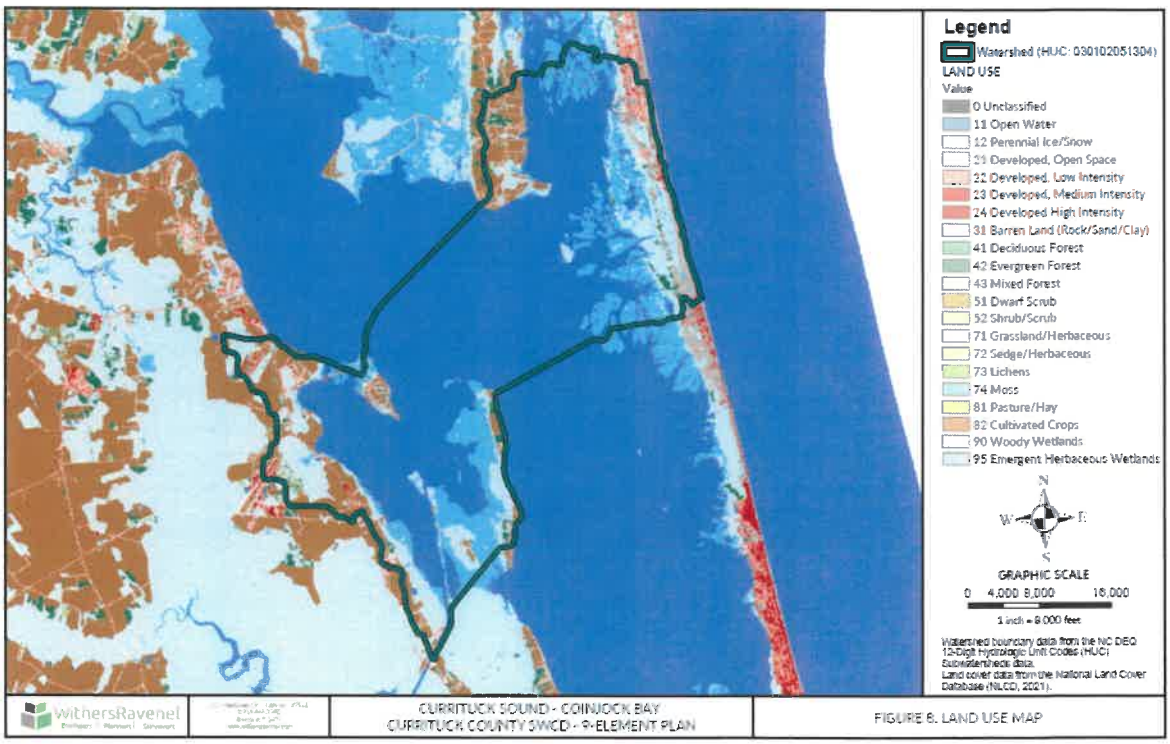

Figure 8. Land Use Map

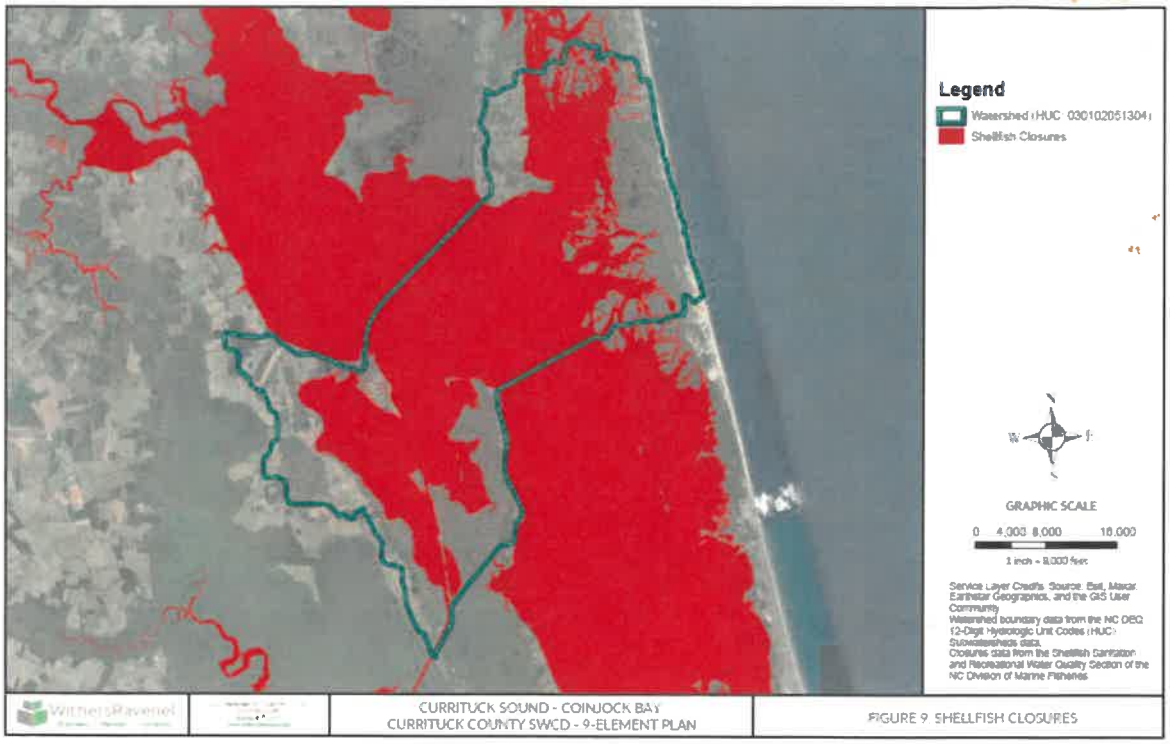

Figure 9. DMF Shellfish Closures Map