

Executive Summary

White Oak River Basin Plan

Basinwide planning is a watershed-based approach to identify areas across the state where water resource concerns should be addressed. The planning process identifies areas that need additional protection, restoration, or preservation to ensure waters of the state are meeting their designated use. The 2021 White Oak River Basin Water Resources Plan (basin plan) is a reflection of this planning process and serves as a summary document for the river basin.

Basin plans are required under [North Carolina General Statute 143-215.8B](#) and are approved by the Environmental Management Commission (EMC) every 10 years ([Session Law 2012-200](#)). Updates are provided throughout the 10-year period to address changes in water resources and modeling methodology, to report changes to wastewater permits, and to share advances in scientific knowledge. While these plans are prepared by the North Carolina Department of Environmental Quality's (NCDEQ's) Division of Water Resources (DWR), their implementation and the protection of water resources entail the coordinated efforts of federal and state agencies, local governments, and stakeholder groups across the state.

The White Oak River basin is located between the southeast portion of the Cape Fear River basin and southwest portion of the Neuse River basin. The basin is bound on the southeast and east by the Atlantic Coast. Municipalities in the basin include Morehead City, Newport, Jacksonville, and the easternmost portion of Wilmington, along with portions of Onslow, Carteret, Craven, Duplin, Jones, Pender, New Hanover, and Brunswick counties.

The basin lies entirely within the Coastal Plain and is composed of four small river systems (New River, White Oak River, Newport River, and North River), which all drain south directly into the Atlantic Ocean and associated sounds (Back, Core, and Bogue sounds). The White Oak River is approximately 40 miles long and is a blackwater river. This basin encompasses 1,382 square miles, making it the smallest basin contained entirely within the State of North Carolina. There are approximately 1,570 freshwater stream miles, 3,777 acres of freshwater lakes and impoundments, and 1,641 miles of coastline in the basin. Due to the location and size of this basin, there is a relatively small amount of freshwater habitat available, but what is available has the characteristics typical of Coastal Plain streams: meandering waters associated with swamps, hardwood bottomlands, and wetland communities (NCDWQ, 2003).

The 2021 White Oak River Basin Water Resources Plan (basin plan) is the fourth document to be developed for the White Oak River basin by DWR. The plan includes eight chapters covering water quality and quantity issues in the basin. Because a hydrologic (or water supply) model has not been developed for the basin, local water use information was collected from various programs including the Central Coastal Plain Capacity Use Area (CCPCUA), Local Water Supply Plans (LWSP), Water Withdrawal & Transfer Registration (WWATR), Groundwater Management Branch (GWMB) residential well calculations, and the 2018 Agricultural Water Use Survey published by the North Carolina Department of Agriculture & Consumer Services (NCDA&CS).

The 2021 White Oak River basin plan includes the following information:

Chapter 1: Overview

Provides basic information about land use and population, nonpoint source pollution (agriculture, forestry, stormwater) and basin characteristics (aquatic habitats, wetland functions, etc.).

Chapter 2: Water Quality Assessment and Monitoring Data

Reviews how chemical, physical, and biological parameters are used to assess water quality in North Carolina and overall results for the White Oak River basin.

Chapter 3 and 4: Watersheds in the White Oak River Basin

Provides detailed information at the watershed scale. Individual stream assessments, special studies, information related to water use, and specific projects in the watersheds are included.

Chapter 5: Shellfish Industry in the White Oak River Basin

Review of the shellfish industry from the perspective of the Division of Marine Fisheries' (DMF) Shellfish Sanitation and Recreational Water Quality Program.

Chapter 6: Water Quality Initiatives and Funding Opportunities

Explores various options for protecting water resources and includes information as it relates to local initiatives, watershed planning and funding opportunities.

Chapter 7: Permitted and Registered Activities in the White Oak River Basin

Contains general information about existing programs which protect water resources. Examples include National Pollutant Discharge Elimination System (NPDES) and non-discharge wastewater management, stormwater programs, public water supply systems, and animal feeding operations.

Chapter 8: Water Use in the White Oak River Basin

Provides a summary of water use in the basin. Information related to water use was obtained from LWSPs, CCPCUA and WWATR databases, and the Ground Water Management Branch (GWMB). Information related to agricultural water use was obtained from the Agricultural Water Use Survey published by NCDA&CS.

Story Map

Using online tools available through ESRI, a Story Map will be developed specifically for the White Oak River basin. The interactive components of the Story Map will provide a better view of where monitoring locations, permits, and streams are located in the basin.

Water Quality Monitoring

The 2021 White Oak River basin plan covers water quality monitoring data collected between 2004 to 2019. A summary of the freshwater and saltwater miles and acres that were assessed are in Table 1. As of 2020, there were 11.2 freshwater miles identified as impaired on the state's 303(d) list of impaired waters, down from 12.4 in 2018. Impaired acres of saltwater are up from 34,713.8 acres in 2018 to 41,535.6 acres in 2020. The majority of the waters in the basin are impaired because of their shellfish growing area classification.

Table 1: Summary of Use Support in the White Oak River Basin (2018 and 2020)

Integrated Report Year	Units of Measure/ Classification	Category 1 (Meeting Criteria)	Category 3 (Data Inconclusive)	Category 4 (Exceeding Criteria)	Category 5 (Exceeding Criteria - 303(d))	Total Assessed
2018	Freshwater Miles	52.6	257.0	0	12.4	322.0
	Freshwater Acres	3,765.0	45.9	0	0	3,810.9
	Saltwater Acres	81,280.8	9,916.1	10,039.3	34,713.8	135,949.9
	Atlantic Coast	131.6	0	0	0.6	132.2
2020	Freshwater Miles	52.6	262.4	0	11.2	326.2
	Freshwater Acres	0	3,810.9	0	0	3,810.9
	Saltwater Acres	82,684.0	5,321.5	8,728.3	41,535.6	138,269.4
	Atlantic Coast	128.4	0	3.8	0	132.2

Ambient Water Quality

Monthly chemical and physical samples are taken by DWR through the Ambient Monitoring System (AMS) stations. Many of the ambient stations are associated with waterbody locations where potential pollution could occur from either point and nonpoint sources of pollution. Parameters collected depend on the waterbody classification, but typically include conductivity, dissolved oxygen, pH, temperature, turbidity, nutrients, and fecal coliform. Each classification has an associated set of standards the parameters must meet in order to be considered supporting the waterbody's designated uses. Ambient stations are listed in Table 2, and their locations are found in Figure 1.

Table 2: Ambient Stations in the White Oak River Basin

HUC	Station ID	Waterbody & Location	Surface Water Classification*
03020301	P6400000	White Oak River	SA, HQW
03020301	P7300000	Newport River	C
03020301	P8750000	Calico Creek (SR1243 @ Morehead City)	SC, HQW

HUC	Station ID	Waterbody & Location	Surface Water Classification*
03020301	P8800000	Calico Creek (SR1176 @ Morehead City)	SC, HQW
03020301	P8975000	North River	SA, HQW
03020302	P0600000	New River (near Gum Branch)	C, NSW
03020302	P1200000	New River (US 17 @ Jacksonville)	SB, HQW, NSW
03020302	P2105000	Brinson Creek	SC, NSW
03020302	P2113000	New River (Wilson Bay @ Center Point)	SC, HQW, NSW
03020302	P3100000	Little Northeast	C, NSW
03020302	P3700000	Northeast	SC, HQW, NSW
03020302	P4100000	Southwest Creek	SC, HQW, NSW
03020302	P4600000	New River (upstream of Frenchs Creek)	SC, NSW

*C: Aquatic life, Secondary Recreation, Fresh Water, HQW: High Quality Waters, NSW: Nutrient Sensitive Waters, SB: Primary Recreation, Salt Water, and SC: Aquatic Life, Secondary Recreation, Salt Water.

Biological Monitoring Data

Biological communities are highly sensitive to changes in water quality and can reflect both long and short-term environmental conditions. The Water Sciences Section (WSS) [Biological Assessment Branch \(BAB\)](#) evaluates water quality of North Carolina's rivers and streams using biocriteria, also called Indices of Biotic Integrity (IBIs). Benthic and fish community survey information is collected, as well as chemical and physical parameters. Survey results and the presence of pollution indicator species are used to calculate an IBI score. The IBI score is then assigned a descriptive rating, or bioclassification.

Benthic Macroinvertebrate Monitoring Data

A total of 6 benthic macroinvertebrate communities were sampled during the 2009 cycle; 4 sites were sampled during the 2014 cycle; and 5 sites were sampled sites during the 2019 cycle. Most of the sites sampled rated Moderate, followed by Good-Fair and Natural with two sites receiving a Not Rated bioclassification in 2019. Overall trends for the basin indicate water quality is meeting criteria for benthic macroinvertebrate communicates (Tables 3 and 4).

Figure 1: Ambient Monitoring System and Random Ambient Monitoring System Stations in the White Oak Basin.

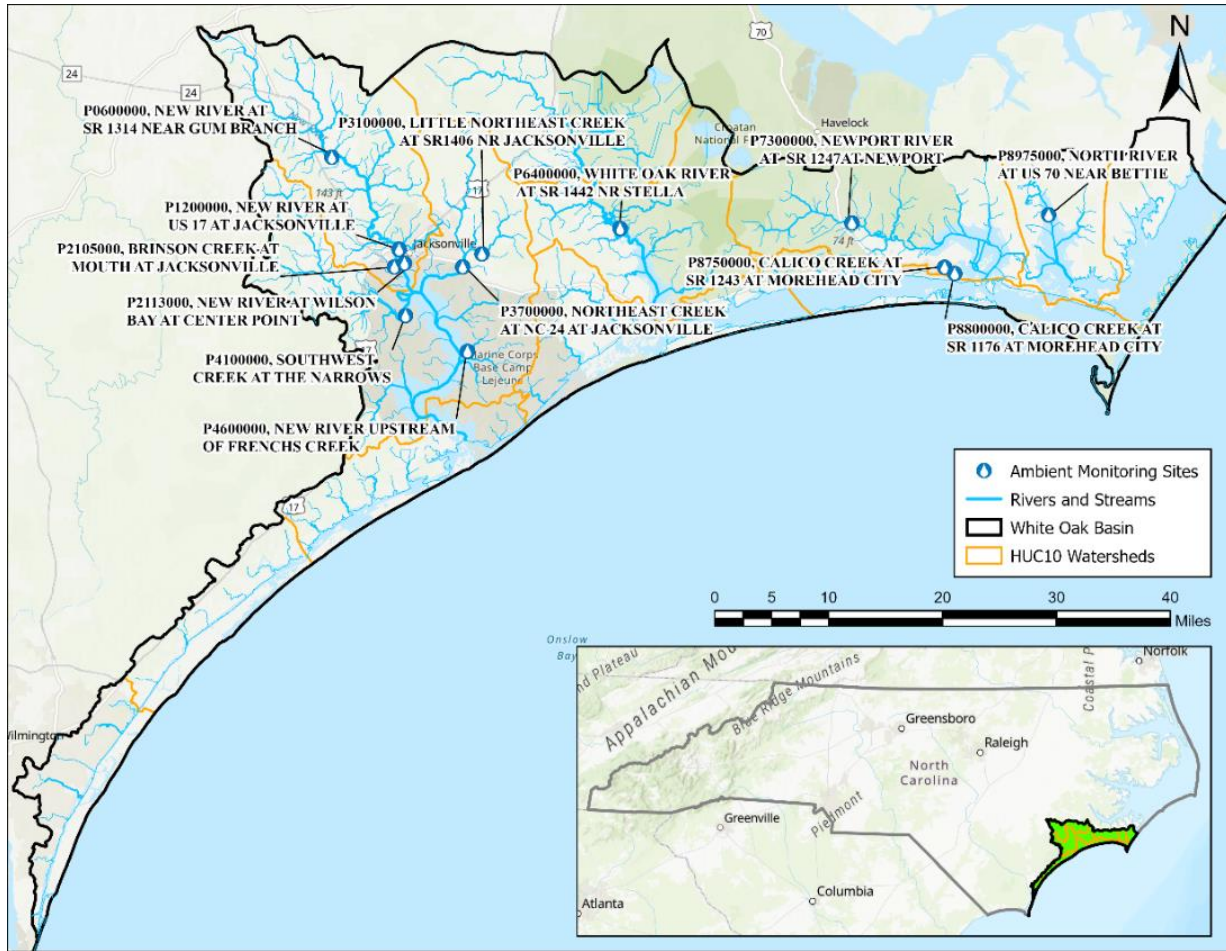


Table 3: Biological Monitoring Data Results – Benthic Macroinvertebrates - White Oak Subbasin

Site ID	Water Body	Assessment Unit #	Drainage Area (mi ²)	Assessment Method	Sample Date	Bioclassification
PB1	White Oak River	20-(1)	66.7	Full Scale	6/30/2004	Good-Fair
					6/9/2010	Good
				Not Available	2019	Not Available
PB2	Starkeys Creek	20-10	15.7	Swamp	3/2/2004	Moderate
PB3	Pettiford Creek	20-29-1	3.5	Swamp	3/2/2004	Natural
					2/20/2008	Natural
					2/27/2019	Not Rated

Table 4: Biological Monitoring Data Results – Benthic Macroinvertebrates - New River Subbasin

Station ID	Waterbody Name	Assessment Unit #	Drainage Area (mi ²)	Assessment Method	Sampling Date	Bioclassification
PB7	Northwest Prong Newport River	21-2	9.7	Swamp	3/2/2004	Natural
					2/20/2008	Natural
					2/27/2019	Not Rated
PB30*	Unnamed Tributary	-	5.9	Swamp	3/6/2017	Moderate
				EPT	6/26/2019	Good-Fair
PB4	New River	19-(1)	86.3	Full Scale	6/30/2004	Good-Fair
					6/9/2010	Good-Fair
					7/27/2015	Good-Fair
PB6	Harris Creek	19-17-3	9.5	Swamp	3/1/2004	Moderate
					2/11/2008	Moderate
					3/10/2015	Moderate
PB5	Little Northeast Creek	19-16-(0.5)	8.3	Swamp	3/1/2004	Moderate
					2/11/2008	Moderate
					3/11/2015	Not Rated
					2/27/2019	Moderate
BB299	Hewletts Creek	18-87-26	4.46	Swamp	2/26/2003	Moderate
				Swamp	3/13/2013	Natural

*Special Study monitoring not part of 5-year Basin Cycle Monitoring

Lakes Assessment

The [WSS Intensive Survey Branch \(ISB\)](#) tests and reports on the water quality of lakes and reservoirs. Catfish Lake and Great Lake are natural lakes found in the White Oak River basin. Both of these lakes are classified as Carolina Bay Lakes and are notable for their elliptical shape, shallow depth, tea-colored water and low pH values.

Both lakes were sampled in 2014. In 2019 Great Lake was not sampled due to access problems caused by Hurricane Florence. Data from the 2014 and 2019 sampling indicate that there have not been any substantial changes in the nutrient and physical data in either lake and both continue to maintain the same water quality as observed when the lakes were first sampling by DWR in 1981. Due to the dystrophic nature of these lakes, an accurate North Carolina Trophic State Score cannot be accurately determined.

Algae and Aquatic Plants

The [WSS Algae and Aquatic Plants Assessment Program](#) provides two types of evaluations: episodic and routine. Samples for episodic evaluations are collected in response to specific events such as fish kills, algal blooms, and nuisance aquatic plant and algal growth. Routine evaluations are targeted studies of specific waterbodies of interest and are generally performed in cooperation with other DWR programs. Routine evaluations are conducted to assess changes in algal assemblages over time and are often focused on estuarine systems where there are known issues of nutrient enrichment and have had frequent algal

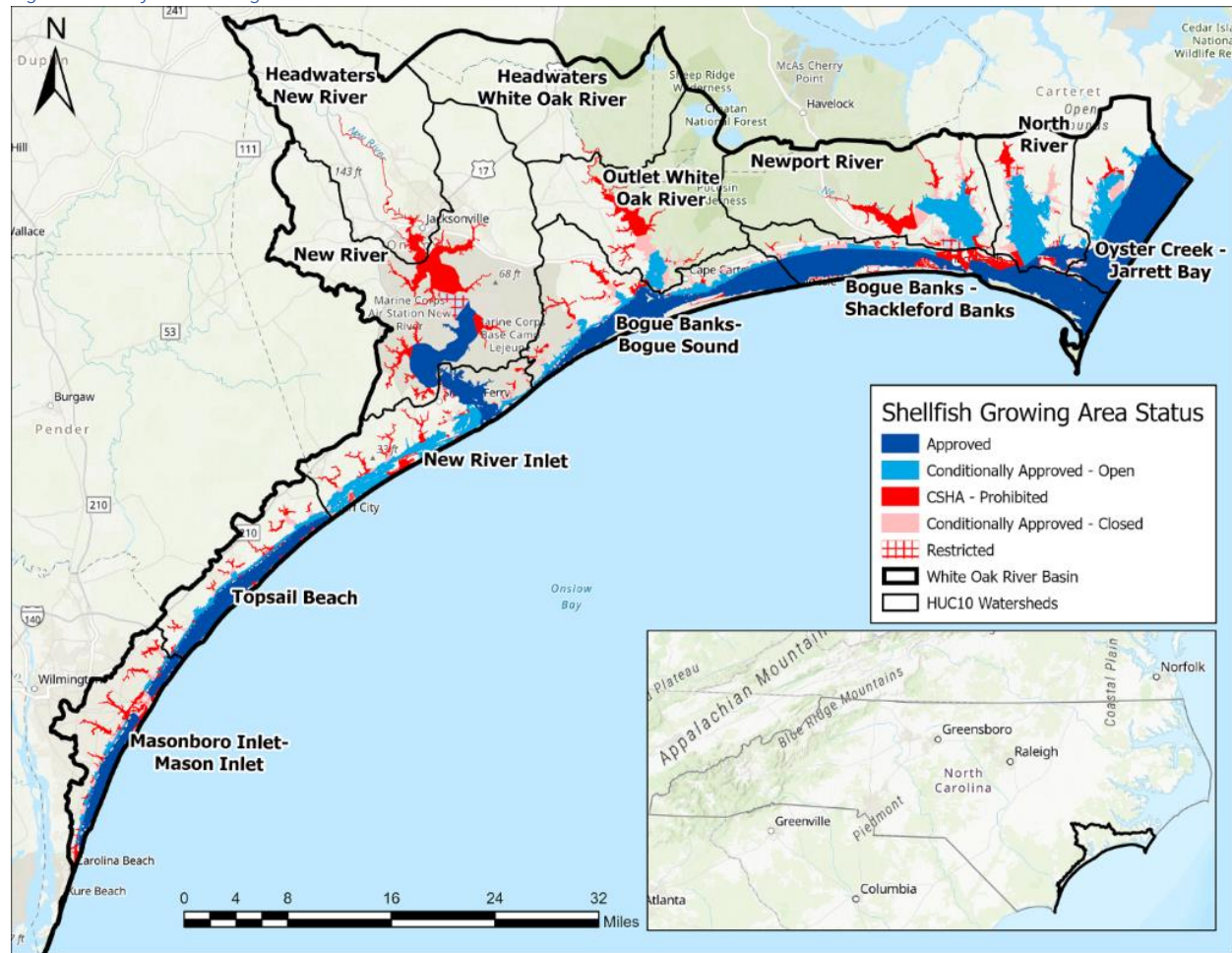
blooms or fish kills. This program also maintains the NC DWR [Algal Bloom Map](#) which displays locations analyzed by DWR for algal bloom activity. Episodic algal blooms were sampled between 2012 and 2016 and again in 2018 and 2019. Two of the blooms in the New River sub-basin were identified as potentially harmful algal blooms (cyanobacteria algal blooms). Routine algal monitoring also revealed four records of potentially harmful algal blooms at a lake in the New River sub-basin in the summer and fall of 2013. Nutrients continue to be a contributing factor to algal blooms in the New River estuary despite management strategies implemented as part of the New River Nutrient Sensitive Waters (NSW) Strategy in 1991 and recommendations presented in the 1997 and 2001 White Oak River basin plans.

Shellfish Harvesting

The [Shellfish Sanitation and Recreational Water Quality Section](#) of the DEQ's [Division of Marine Fisheries \(DMF\)](#) is responsible for monitoring and classifying coastal waters as to their suitability for shellfish harvesting for human consumption. Shellfish growing areas are classified as Approved, Conditionally Approved, Restricted, or Prohibited. Approved areas are consistently open, while Prohibited areas are permanently closed. Conditionally Approved areas can be open to harvest under certain conditions, such as during dry weather events when stormwater runoff is not having an impact on surrounding water quality. Restricted waters can be used for harvest at certain times as long as the shellfish are subjected to further cleansing before they are made available for consumption. The [Shellfish Sanitation Program](#) maintains a [map](#) that shows which shellfish growing areas are currently open or closed. Shellfish growing areas and their classification in the White Oak River basin are shown in Figure 4.

The growth of the shellfish industry will depend on regulatory, societal, and economic forces. To this end, in 2016 and 2017, the North Carolina General Assembly passed various legislation in support of assessing and growing the shellfish industry ([S.L. 2016-94](#), [S.L. 2017-57](#) and [S.L. 2017-197](#)). This legislation was the catalyst for the formation of the Shellfish Mariculture Advisory Committee (SMAC). The SMAC was organized by the North Carolina Policy Collaboratory to fulfill the requirements of the 2016 and 2017 legislation. The SMAC is comprised of over 100 members from the areas of academia, law, business, industry, regulatory agencies, and non-government organizations (NGOs). The members were tasked with developing a Shellfish Mariculture Plan for the General Assembly. The final plan was [presented](#) to the North Carolina General Assembly and North Carolina Policy Collaboratory on January 2019. It represents the findings and recommendations to grow North Carolina's shellfish industry over the next ten years (2020-2030), with a goal of developing a \$100 million industry.

Figure 4: Shellfish Growing Area Status in the White Oak River basin.



Water Use and Availability

The NCDEQ plays a critical role in providing information about how much water is being used in North Carolina. The information presented in Chapter 8 about water use and availability in the White Oak River basin is based on best available data, and includes information about geology and groundwater, water availability, water use and demand, and stream flow. The chapter concludes with future considerations to better understand statewide water use.

Protecting Water Resources in the White Oak River Basin

The Upper New River Estuary was designated as a Nutrient Sensitive Water (NSW) in 1991. Management strategies were put into place to minimize impacts from point sources of pollution. Despite these efforts, chlorophyll *a* (a proxy used to indicate nutrients in a waterbody) have remained relatively constant over the past 20 years. Exceptions can be found during high flow or higher than normal rainfall years. Nutrients will continue to impact water quality in the estuary until potential sources are identified and managed. Identifying potential pollutions sources and reducing impacts to water quality and shellfish growing areas will require an increase in financial support to improve or upgrade wastewater and stormwater infrastructure, implement voluntary BMPs, initiate watershed planning efforts, and provide support for outreach and education related to nutrient management.

Working collaboratively with state and local agencies and stakeholders throughout the basin, DWR supports the following recommendations to protect water resources. Many of these recommendations can be found in DEQ's 2016 [Coastal Habitat Protection Plan \(CHPP\)](#), which is reviewed and approved by the NC Marine Fisheries, Environmental Management, and Coastal Resources Commissions every five years.

- Continue to improve strategies to reduce nonpoint source pollution and minimize cumulative losses. This can be done through voluntary programs, actions, and assistance, and includes reevaluating the existing NSW strategy for the New River watershed and improving methods to control stormwater runoff from agriculture, forestry, and urban areas.
- To prevent additional shellfish closures and swimming advisories, conduct targeted water quality restoration activities.
- Maintain adequate water quality conducive to the support of present and future mariculture in public trust waters.
- Reduce nonpoint source pollution from large-scale animal operations by ensuring proper oversight and management of animal waste management systems, and certified operator compliance with permit and operator requirements and management plan for animal waste management systems.
- Increase financial support for the implementation of voluntary BMPs throughout the basin. Several voluntary programs exist through the local Soil and Water Conservation District (SWCD) and Natural Resource Conservation Service (NRCS). The SWCD, NRCS and the Cooperative Extension Offices (CES) can also provide guidance on managing agricultural lands, forests, riparian buffers, and stormwater runoff.
- Encourage local governments to develop watershed restoration plans to reduce stormwater runoff, implement living shorelines and soft erosion control structures, and encourage nature-based stormwater strategies to foster water and habitat protection.
- Identify ways to work collaboratively with the Onslow County Cooperative Extension Service (CES) to utilize data collected through the Onslow County Water Quality Monitoring Program to understand where nutrients may be originating in the New River watershed.
- Continue to work collaboratively with federal, state and local resource agencies to understand water resource issues (quality and quantity).

The 2021 CHPP Amendment is slated to be approved by the commission in the fourth quarter of 2021 and will include additional recommended actions for five priority habitat issues including:

1. Submerged Aquatic Vegetation Protection and Restoration through Water Quality Improvements

2. Wetland Protection and Restoration through Nature-Based Solutions
3. Environmental Rule Compliance to Protect Coastal Habitats
4. Wastewater Infrastructure Solutions for Water Quality Improvement
5. Coastal Habitat Mapping and Monitoring to Assess Status and Trends

Additional Information

More information about each of the topics highlighted in this executive summary and recommendations can be found in the 2021 White Oak River Basin Water Resources Plan.