

Lower Cape Fear River and Estuary: History and Summary of the Proposed Port Deepening Issue

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Most tourists visiting southeastern North Carolina, and many locals, too, first think of our beautiful beaches when they talk about New Hanover and Brunswick counties. And though I agree our barrier islands and salt marshes are true treasures for our area with immeasurable economic, aesthetic, and cultural values, the historic and current true heart of the area is the River That Runs Through It – the Cape Fear River. From the time that the Cape Fear River (referred to by many names in the past including Rio Jordan, Charles, and Clarendon) and its tributaries were first visited by Europeans 500 years ago, it has been the, or one of the most important historical, cultural, and economic focal areas in North Carolina. The Lower Cape Fear River Estuary has been the center for naval stores industry shipments, northernmost reach of the Gullah-Geechee rice corridor, commerce center and major port area for the state, and it has had an important maritime role in wars from the Revolutionary War to the Civil War to World War II. And at the same time, the Lower Cape Fear River Estuary and surrounding ecosystems are some of the most ecologically diverse and important ecosystems in southeastern North Carolina. The North Carolina Natural Heritage Program identified the Brunswick River/Cape Fear River Marshes, which includes Eagles Island, as a significant natural area that supports high quality examples of tidal freshwater marshes. And all along the estuary are important primary nursery grounds that are critical to our finfish and shellfish and islands that are critical to multiple bird species.

But there are projects being discussed and/or planned such as **Port Deepening** and development along the river that may have far-reaching impacts on much of or parts of the Lower Cape Fear River Estuary and surroundings. Too many times it is a consideration of economics alone in project assessment. However, assessments and decisions need to consider what may be lost from, or how natural systems are impaired by actions taken or alternatives chosen. A true economic picture must consider the ecological services of our natural systems as well as the intrinsic value of these areas for our cultural and historical identity.

You may feel port deepening and/or development is essential or that neither is appropriate. But it is important to be informed of current and future changes that may result from these activities. The question is not whether we can do these projects, but whether we should do them, and if so, in what form? These projects are in sensitive environmental areas where dynamic compound flooding occurs. The following paragraphs provide some information on these two topics including links to sources of information, comments and decisions, and places where you may make your own comments.

Port Deepening. Based on current assessments, Port Deepening will exacerbate some of the flooding issues and it may put some ecosystems and their services in jeopardy. Deepening may also impact infrastructure, buildings, water sources, and more. To assess these possible impacts and others, the US Army Corps of Engineers (USACE) is in the process of gathering detailed information to prepare a mandated Environmental Impact Statement (EIS) (<https://www.saw.usace.army.mil/Missions/Navigation/Dredging/Wilmington-Harbor-403-Letter-Report-and-EIS/>) . The USACE will perform a rigorous look at three alternatives over the coming 2 years during the preliminary EIS (2024 to 2025) and in the final EIS (2025 to 2026). These include the NO Action Alternative and Alternatives to deepen to either 46 feet or 47 feet. The 47-foot alternative is preferred by the Ports Authority. You have an opportunity to submit your thoughts, concerns, and ideas to the USACE by July 22, 2024. Comments may be submitted in one of three ways:

Email: WilmingtonHarbor403@usace.army.mil

Public Comment Tool Website: <https://wilmington-harbor-usace-saw.hub.arcgis.co>

Mail: US Army Corps of Engineers, Wilmington District ATTN: Wilmington Harbor 403, 69 Darlington Ave. Wilmington, NC 28403

The Scoping and EIS process and timetable have been outlined by the USACE in the Wilmington Harbor 403 Letter and EIS Report (Figure 1). As the USACE says, their task in the Wilmington Harbor 403 study is to “contribute to national economic development by addressing transportation inefficiencies for the forecasted vessel fleet, consistent with protecting the Nation’s environment.” The latter is the real issue – What are the impacts? Listed below is a partial list of some of the environmental issues. These will be described in more detail after a short summary of the Lower Cape Fear River. The summary is to provide some background on the river’s maritime, economic, and environmental history.

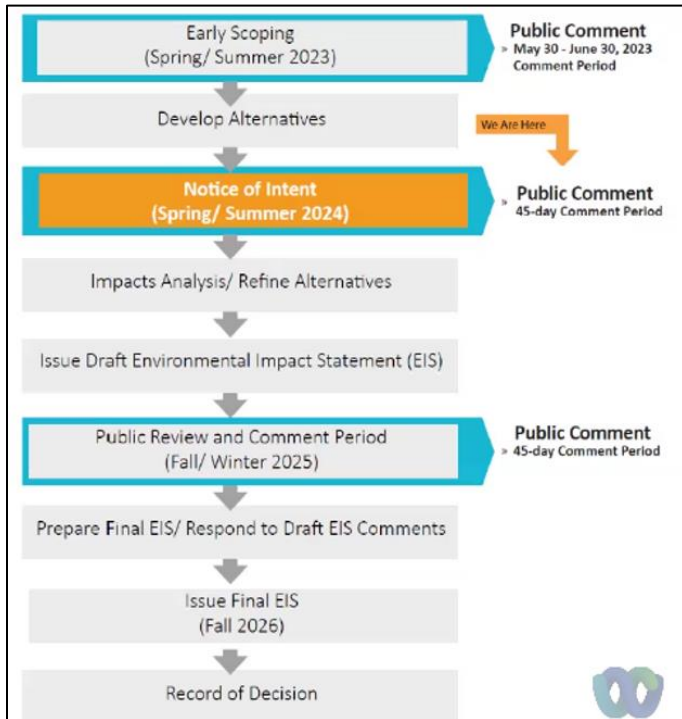


Figure 1. USACE EIS Process. It is a long process with the development of a Draft EIS by Fall of 2025 and the Final EIS by Fall 2026.

Partial List of Issues to Consider in Port Deepening

- **Economics of various alternatives**
- **Alternative sites?**
- **Tidal Increase**
- **Storm surge increase**
- **Salinity change/increase**
- **Changing ecosystems with saltwater intrusion**
- **Loss of wetlands**
- **Loss of nursery grounds**
- **Habitat loss with dredging; e.g. substrate removal of sediment and rock**
- **Amount of dredged material**
- **?Beneficial use of dredged rock and sediment for habitat restoration and storm mitigation**
- **Vessel wake and river edge erosion**
- **?Toxins in sediment**
- **Water quality: turbidity, dissolved oxygen, toxic substances**
- **Groundwater quality with ?saltwater intrusion and water levels**
- **Cultural, Historical, Societal**

Brief Description and History of the Lower Cape Fear River

The Cape Fear River is the longest river contained entirely within the boundaries of NC and it is the only river that empties directly into the Atlantic Ocean. The Cape Fear watershed is 9,164 mi² with over 6,000 miles of tributary waterways. The Haw and Deep rivers, beginning in the Piedmont, join at Moncure (just south of Jordan Lake) to form the Cape Fear. The Cape Fear watershed is the most highly industrialized in North Carolina and contains 1/5 of the population of the state. Major cities in the watershed include Greensboro, High Point, Burlington, Durham, Fayetteville and Wilmington (Figure 1).

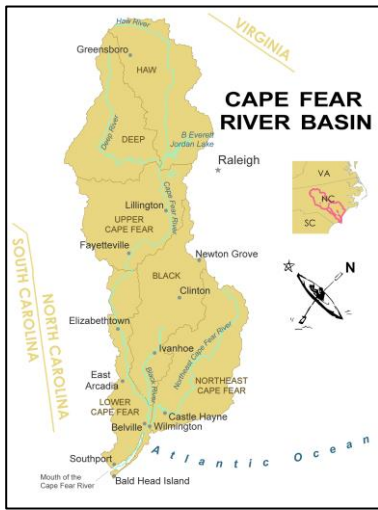


Figure 2. Location map (<https://capefearriverwatch.org/the-river/>).

The Cape Fear is a brown water river, meaning that Piedmont clay, silt, and sand are carried by runoff into the river coloring the water brown. Two other major tributaries, the Black and Northeast Cape Fear rivers, comprise ~33% of the watershed. These are blackwater rivers originating in the Coastal Plain. There is little fine clay and silt in the Coastal Plain to color the water brown but there is abundant floodplains and swamps that the rivers drain. The waters passing through the organic rich soils and vegetative litter of the bottomlands pick up tannins that impart a tea color to the water. After a rainfall event in the Piedmont, it is easy to see the difference in color of these rivers at the confluence of the Cape Fear and Northeast Cape Fear rivers at Point Peter, which is located just north of the USS North Carolina (Figure 2).



Figure 3. Note the brown water of the Cape Fear and black water of the Northeast Cape Fear in this Google image. The rivers join at Point Peter.

The area from Point Peter to the mouth of the river (~30 miles) is usually referred to as the Lower Cape Fear River Estuary. The estuary is a zone of tidal mixing of fresh and saline waters. Tidal influences extend well beyond Wilmington in the Cape Fear and Northeast Cape Fear rivers. In fact, some tidal flux, but not brackish water, extends to Lock and Dam #1, a distance of 65 miles. Our tides include two high and two low tides daily of approximately the same magnitude; this is termed semi-diurnal tides. The mean tidal range is 4.2 ft.

The Cape Fear River is, and was, a major transportation corridor from the Atlantic all the way to Fayetteville and beyond. Prior to ~1800, much of the larger ship traffic was restricted to the Port of Brunswick near the mouth of the river. The Port of Brunswick exported more naval stores in the 1760s than any other colonial port. It represented 70% of the world's naval supply stores, which was the major economic driver for our area. Examples of shipments from the port highlighted the importance of naval stores, lumber, and rice to the economy of the day. In one account from 1789, shipments included "606 barrels of tar, 163 casks of turpentine, and 10,164-barrel staves shipped to England" and on another ship "70,000 feet of boards, 298,000 cypress shingles, 38 barrels of tar, and 6 tierces (casks) of rice shipped to Kingston, Jamaica" (Crittendon, 1931; NC Historical Review).

However, by 1800, most commerce had shifted upriver to Wilmington because of war damage and sickness in Brunswick Town. Wilmington became the naval stores export capital until the Civil War. Or more appropriately, much of the naval stores was processed and shipped from the east bank of Eagles Island. As at Brunswick Town, naval stores, lumber, and rice were three of the most important commodities shipped from Wilmington. Wilmington was the commerce center for NC for over 100 years. On a side note, early vessels used ballast stones to help with ship stability in the ocean. As ships came up the river, stones were removed to "lighten" the ship to navigate into shallower waters. Campbell Island, in the Cape Fear River south of Wilmington, was the site of the offloading of numerous ballast stones but they were also removed in other locations. Some of them have been used to make the walls in downtown Wilmington near the river.

One of the problems with commercial trade to Wilmington and areas upstream was that ships would often be stranded, perhaps for days, during low water levels. Therefore, two efforts were initiated to ensure more reliable river commerce. One was dredging, which also included tree/debris removal, and the other was lock and dam construction. Dredging primarily benefited the Lower Cape Fear Estuary that includes the river south of Navassa and the locks and dams allowed for barge traffic to Fayetteville.

Although parts of the river were much deeper than 12 feet, early dredging, beginning in 1871, was done to ensure a river depth of 12 feet for passage of ships during dryer times. Further incremental deepening continued through the 1900s as larger and deeper draft ships came to the Port of Wilmington. The river was last deepened in 2000-2002 to its current depth of 42 feet from the Cape Fear Memorial Bridge to the mouth of the river where it was deepened to 44 feet. The 44-foot dredged depth extends well into the ocean to allow ships to enter the river. Dredge material was piled on the riverbank or piled within the margins of the river creating dredge spoil islands. But there are two other sites for dredge spoil disposal. One of those is the southern ½ of Eagles Island where the USACE stores sediment from the major dredging episodes as well as from maintenance dredging that is required to keep the river at depth. The other site includes dredge spoil islands in the Lower Cape Fear River Estuary that are important bird sanctuaries.

Increasing commercial traffic between Wilmington and Fayetteville was often at risk of "running aground" during low water levels. To provide reliable barge transport to Fayetteville, three locks and dams were constructed from 1915 to 1935; all are in Bladen County. Lock and Dam #1, the most downstream of the three, is located 39 miles upstream of Wilmington. Although the locks and dams are no longer used for commercial

traffic, they provide another service. The dams ensure that adequate water storage is available, even during drought conditions. Water from this location supplies >400,000 people in Brunswick, New Hanover, and Pender counties. The water intake pipes are just upstream of Lock and Dam #1. Waters upstream of Lock and Dam #3 are the water source for Fayetteville.

Of course, there is an issue with the presence of these dams on the Cape Fear River. They are barriers to the migration of anadromous fish species (American shad, blueback herring, Atlantic sturgeon, striped bass) that want to migrate up the river to spawn in their historic spawning grounds and catadromous American eels that want to migrate down river to spawn in the ocean. A project, funded in part by mitigation monies associated with deepening/widening the Cape Fear River at the Ports in Wilmington, was initiated to improve fish passage. The structure is a nature-based rock arch that was constructed on the downstream side of Lock and Dam #1 in 2013 at a cost of \$13 million to promote migration over the dam. There have been successes in fish passage over the rock arch for several species including American shad, but striped bass passage has not been as successful. Modifications to the rock arch were completed in 2021. Larger pools and flow were incorporated to encourage striped bass passage. Assessments using acoustic telemetry to monitor movement of tagged fish will help determine if the modifications were successful or if additional modifications are necessary (Figure 3) to encourage fish passage. Assessments of the other two locks and dams are currently underway.

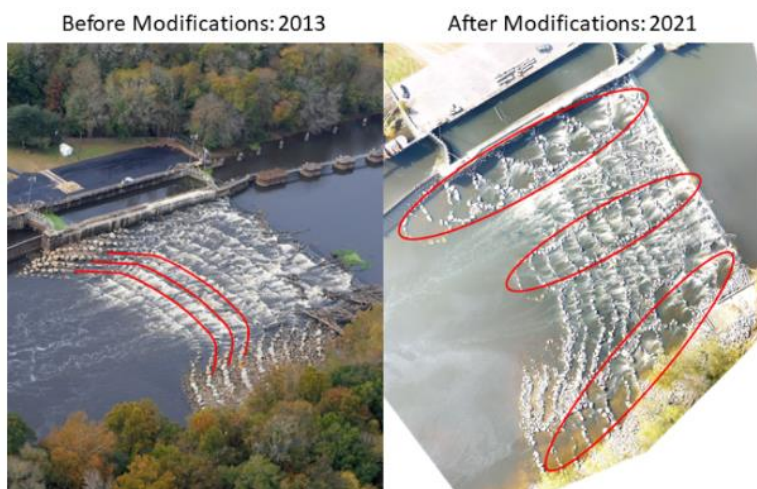


Figure 4. Rock Arch Rapids at Lock and Dam #1 was constructed in 2013. Modifications to the structure in 2021 were to further enhance fish passage (<https://www.fisheries.noaa.gov/feature-story/fish-passage-inspired-nature-cape-fear-river-north-carolina>).

The average discharge of the Cape Fear River at Lock and Dam #1 is ~3.5 billion gallons per day. However, the range includes extremely low waters at 170 million gallons during the 2007 drought all the way to the record high associated with Hurricane Florence of 51 billion gallons per day in 2018. Imagine 51 million one-gallon water jugs flowing over the dam in one day! There is a reason there was so much flooding during Florence and flooding from upstream is one of the compound flood issues in the Lower Cape Fear Estuary. The other compound flood issues include local rain events, storm surge, sea level rise, and high tide flooding, which is exacerbated by higher sea levels. Water levels are obviously critical for ecological flow and water supplies, but monitoring of these river levels is critical for flood warnings, too.

The Cape Fear, Black, and Northeast Cape Fear rivers, as well as the surrounding bottomlands, provide numerous ecosystem services to the region in addition to the historic uses and current port economy. Among these are sediment and floodwater management, habitat and forage in the bottomlands, important primary

nursery waters, carbon sequestration, and of course recreational and aesthetic benefits. There are also concerns for the quality of our water that jeopardizes best use. The best definition of water pollution, in my opinion, is when water does not safely meet its intended usage. And unfortunately, we have chemical contaminants, nutrient loading, fecal bacteria, and more that continue to be factors that lead to impaired waters that are harmful to humans and the environment. These contaminants occur in the primary rivers as well as smaller streams and tidal creek tributaries to the main stem. A discussion of these issues is critically important to a reliable and safe water supply, but they are beyond the scope of this article. However, consideration of some of these contaminants is pertinent to aspects of the Port Deepening project as the sediments, not just the river waters, contain contaminants, too.

The above summary was just to highlight some of the history and the value of the river and to provide a little context to the discussion of the proposed Lower Cape Fear River Estuary Port Deepening.

Cape Fear River Deepening for the Port of Wilmington, NC Navigation Project

River deepening for commerce has occurred since 1871, when the river was dredged to ~12 feet (Table 1). The last dredging event occurred in 2000 – 2002 when the river was deepened to 42 feet from the ports toward the mouth of the river where it was then deepened to 44 feet for miles into the ocean. The North Carolina State Ports Authority (NCSPA)

(<https://www.saw.usace.army.mil/Portals/59/siteimages/Public%20Affairs/WHNIP%20Sec%202003%20%20-%20%20Integrated%20Main%20Report%20FEB%202020.pdf>) has now stated that the Cape Fear River has *“Inadequate channel capacity currently that impacts transportation efficiency at the Port of Wilmington and is projected to have a greater detrimental impact in the future”*. The report, though covering multiple deepening alternatives, highlighted the 47-foot deepening as the plan that would best contribute to the national economic development while also protecting the nation’s environment. These are the two overarching criteria required for project assessment, and they will be the assessment goals of the USACE Environmental Impact Statement (EIS).

Table 1. Cape Fear River Deepening – Year and Depth.

Year of Deepening	Depth (ft) of Deepening
1871	12
1881	20
1890	24
1912	26
1930	30
1946	32
1950	34
1970	38
2000	42

The NCSPA’s goal is to accommodate larger, deeper draft container vessels that would allow Wilmington to “compete” with some of the larger, deeper ports on the East Coast including Norfolk at ~50 ft, Savannah at 47 ft, and Charleston at 52 ft, which is the deepest port on the East Coast. The New-Panamax container ships are >1,200 feet in length with a beam of ~160 feet and a draft of >49 feet when loaded. At the present time,

Wilmington has some limitations to receiving the larger, more fully loaded ships. To access Wilmington Harbor, the ships are often not fully loaded and/or the ships may need to enter the river at high tide. Large ships have visited the Wilmington ports though, such as the Yang Ming at approximately 1200 ft in length. The turning basin/anchorage basin was expanded to accommodate these larger ships.

The State Port Authority proposal is to deepen the river to 47 ft from the ports to Battery Island near the mouth of the river and to deepen the river to 49 ft from Battery Island to >8 miles into the ocean. The USACE's goal is to assess the economic and environmental impacts of any project as required by the National Environmental Policy Act (NEPA) that stipulates an EIS must be prepared. The EIS must look at all alternatives including the NO Action Alternative. The other two Alternatives to be investigated are deepening the river to 46 feet and 47 feet, with an additional 2 feet added to each of these depths from Battery Island into the ocean for ~8 miles. The USACE will perform a rigorous look at the three alternatives over the coming 2 years during the preliminary EIS (2024 to 2025) and in the final EIS (2025 to 2026).

There are multiple factors that are critical to determining the need for and value of port deepening. The two largest factors are economics (costs versus value of the port to Wilmington and NC) and biologic/physical changes to the Cape Fear River and surroundings. The latter may include impacts to marshes and primary nursery grounds, threatened and endangered species, aquifers, shorelines with wake and erosion effects, and dredging and disposal of large volumes of sediment and rock.

There are multiple considerations in economics. Though the project, if done, will be years in the making, it is important to review information from the Wilmington Harbor Navigation Improvement Project Document: Section 203 Study (2020) that was referenced previously. This report is the basis of the review that the USACE is undertaking with their EIS process. The 203 Study's stated project cost is >\$880 million. The largest part of that cost is the dredging and removal of 4.2 million cubic yards of rock and 22.7 million cubic yards of sediment that is estimated to cost >\$665 million. The second largest cost of the project is mitigation for damages at >\$89 million.

Though costly, several studies, including the 2018 Economic Impact Study of North Carolina's ports, said that goods moving through the port were annually worth \$12.9 billion with many jobs, large local and state tax revenues, and large property taxes for New Hanover County. However, it is critical that the EIS assess the incremental increases in revenue with the suggested increases in port traffic over the current tonnage moving through the port. This is part of the evaluation of the EIS Alternatives. However, we need to determine if there are other alternatives, too, which is what an EIS will do under NEPA. These alternatives should be seriously considered as there are economic questions such as:

1. Do we need to keep up with the other ports through deepening of the Cape Fear River to keep Wilmington as a viable port or is it viable as it is? This is what the No Action Alternative should investigate. The 203 study did not fully address rail and truck traffic and other cost factors in their alternatives. This is a must. There are also comments from USACE that commercial traffic will continue and grow. A deeper port may be more efficient but will it be more economic?
2. And thinking outside of the box, would it be possible to establish just the deeper water port closer to the ocean and remove the need to further dredge the river? This was considered in 2008 to 2010 for undeveloped lands just upriver from Southport. The Ports still own the 600 acres that were looked at as a port site. There are a few benefits to using this area such as limiting impacts to the upriver area that will be described below as well

as avoiding rail relocations that are planned for the Wilmington area and port access (<https://www.wilmingtonnc.gov/Government/Major-Projects/Rail-Realignment-Project#:~:text=About%20the%20Project,and%20most%20densely%20populated%20areas>). But there are also a lot of concerns about this area. Some may remember the “No Port Southport” arguments. The Ports abandoned consideration of this area as there was community pushback and no real support in Raleigh. But the point is, all alternatives should be considered. That is the job of an EIS.

The reason alternatives need to be seriously considered is also based on the knowledge that there will be impacts to the environment from the ocean to the Ports and beyond but there may also be impacts to infrastructure and to historical and cultural features such as our maritime history and Gullah Geechee rice history.

The preliminary environmental study indicated that dredging is impactful for several reasons including alteration of the river bottom, increasing sediment suspension, and loss of marsh with straightening some stretches of the river. This removal of sediment and rock will lead to alterations of the substrate that will change habitats, communities, and potential nursery and forage areas. It is very significant that so much sediment and rock will be removed. In particular, some of the current soft bottom will likely be converted to rock substrate in parts of the river with 5 feet of deepening. But the deepening of the estuary also reduces hydraulic drag within the river leading to changes in tides, storm surge, and salinity. These impacts, as described below, have the potential to exacerbate flooding along the river while also having the potential to change the ecosystems with saline waters moving further upriver. The Estuary acts as a funnel with waters moving up the Cape Fear more freely with deepening and straightening and widening of the river. Listed below are some of the effects that have been posited to occur with deepening of the river to 47 and 49 feet. This is not an exhaustive look at all of the potential impacts, but it is intended to illustrate changes will occur and these need to be considered fully, just as the economics are, because ecological services also have a value, as does our history and culture.

Summary Impacts of Port Deepening

The Wilmington Harbor 403 EIS purpose, as stated by the USACE, is to “contribute to national economic development by addressing transportation inefficiencies for the forecasted vessel fleet, consistent with protecting the Nation’s environment.” The latter means that studies must fully address all environmental impacts in all the alternatives and that mitigation measures must also be formulated. The following are some of the important impacts that may occur with deepening as well as in some parts of the river where the river will be widened and straightened. All of these factors lead to reduced hydraulic drag that makes it easier for waters to move into and out of the river. The 203-study highlighted some of these likely changes that the USACE is more fully exploring.

Tides. We know that tides have approximately doubled in Wilmington since 1870 with the deepening of the river. We know this as Wilmington tides have increased while those in Southport have only increased slightly (Famalkhalili and Talke, 2016). Estimates with deepening to 47 feet is that the tidal range will increase by another 4 inches, which includes 2 inches of higher high tide and 2 inches of lower low tides.

Storm Surge. There is likely to be an approximate 1-inch storm surge increase. Storm surge occurs when onshore winds “push” waters into and up the river. These may occur in storms or with onshore winds from frontal passages. The onshore winds also hold the water in the river leading to rising water levels.

Although these tidal and storm surge increases sound small, they are dramatic. Consider adding 2 or 3 inches of water onto already low areas that are impacted by compound flooding such as Eagles Island, Point Peter, and downtown Wilmington. And as sea level rise is accelerating, with Wilmington having one of the larger rises in sea level on the East Coast since 2000, this will have even more impact in the future.

Salinity. Saltwater intrusion into the estuary is more pronounced with deepening. Saltwater is denser than freshwater and deepening allows for a saltwater wedge to move further upriver. Model studies indicate that surface waters near Wilmington will increase in salinity by 1 ppt but that waters along the bottom of the river will increase by up to 5 ppt. The USACE will need to perform hydrologic models to determine any project impacts on wetlands adjacent to the river and tributaries. This will involve mitigation determinations as well.

Salinity changes have already led to changing ecosystems along the river and up its tributaries including the NECFR, Smith Creek, Town Creek and more. Ghost forests are an obvious indicator of salinity increase. However, the insidious migration of more salt tolerant plant species to replace freshwater tidal swamp forest and marshes has been recognized with the current deepening and will be even more significant with further deepening. As one example, bottomland swamp forests were lost and converted to marsh grasses for a 2 mile stretch along Town Creek from 2006 to 2021. Much of this is likely a result of increased salinity following the deepening to 42 feet in the early 2000s. Migration of these communities may only progress so far upstream as increasing elevations may preclude further migration.

Salinity increases are also changing the fauna within the river to more brackish forms. For instance, Blue Crabs are moving further up the estuary.

One other factor that should also be considered with salinity change is that “saltier” waters lead to the breakdown of freshwater organics/mud in the soils. This could of course lead to even more erosion and subsidence in the adjacent land areas dominated by the freshwater marshes. An increase of 1 – 5 ppt of salinity is important and modeling must provide details on the impacts to the flora and fauna at the river bottom, within the water column, and in areas adjacent to the river, including tributaries and wetlands.

Habitat, Vegetation, and Primary Nursery Ground Changes. Estimates in the 203-Study were that vegetation changes may include the loss or modification of 242 acres of tidal swamp forest, 98 acres of tidal freshwater marsh, and 62 acres of cattail dominated marsh. In addition, 33 acres of significant Primary Nursery Grounds will be impacted. Primary Nursery Grounds occur all along the Cape Fear Estuary including at and upstream of the Ports. These are critical to our finfish and shellfish. One of the studies that will need to be done will be to assess the impact of deepening on threatened and endangered species such as the Atlantic and Short-nosed Sturgeons, and for that matter, all of the species such as anadromous fish species in the river. And at the lower end of the estuary turtles and birds could be impacted with the dredging activities and the placement of sand on the beaches.

Of note, there have been minimal studies within the Cape Fear River estuary to look at hard bottoms, soft bottoms, shellfish, and if there is any submerged aquatic vegetation present. This is stated for review in the EIS but was not fully addressed in discussions in the USACE forums on the topic. Remember, there will be a very large volume of sediment and rock removed from the river if dredged to 47 feet, and this will change habitat and foraging for multiple species.

Sea Level Rise. The USACE is including a wider range of sea level rise estimates in their EIS than that used in the 203-Study – this is a good thing. Low to high levels from NOAA and USACE will be used even up to 6 feet by 2100. This is necessary as our tide gauge data illustrates an acceleration of sea level rise along the East Coast

and even a higher rise here in Wilmington. And there are factors with our changing climate that may lead to very high increases. Sea level rise is one of the compound flood issues for our area, but higher water will also impact the ports and infrastructure needed for the port.

Climate Change. It goes without saying that climate change is impacting many things we do as well as hazards that we are facing. This is true of the Cape Fear Estuary. But for this project we need to look at the future state of and vulnerability of the estuary to changes that may occur. We have seen the impact of 500 and even 1000-year flood events in our area that have been caused by heavier rainfall events; warm air holds more moisture. And when coupled with the higher tides, storm surge, and sea level rise, our area businesses, property, and lives are even more at risk.

Florence is used by the USACE as the storm of record for our area with its associated flooding and rainfall. It is certainly our “disaster storm” of record. However, it is important to note that Isaias in 2020 actually had a 9-inch higher flood stage at downtown Wilmington. As the Zurich Insurance Group said, “think how bad it can be and plan for worse”.

Dredge Material and Use of Dredge Material. As mentioned previously, deepening of the river to the currently preferred alternative of 47/49 feet will lead to the removal of a large volume of material from the riverbed: 4.2 million cubic yards of rock and 22.7 million cubic yards of sediment. Studies are underway to determine the location and properties of sediment and rock along the river, but more needs to be done in my opinion to fully analyze potential use and/or harm.

Excavation may of course lead to some issues for habitat and species as discussed above, but it also leads to issues of what to do with the material. Past dredging has led to placement of material onto the south end of Eagles Island in the dredge spoil area, some placement on islands within the river, and placement of some material on beaches and on borrow sites offshore. Part of the sediment/rock may be placed in some of these locations again. However, there has been discussions by the USACE to consider “beneficial uses” of the dredge materials. What might these be and what are the concerns?

One potential use of dredge material would be to expand and/or raise the level of some of the islands in the river. These could include the important bird sanctuary islands in the lower estuary such as Pelican, Ferry Slip, Battery, etc. Of course, this would require lots of planning and discussion with the Audubon Society that manages these important bird habitats. Other uses of some of the sediment could be for renourishment on beaches at the mouth of the river. And as for the rock, some of it could potentially be used for rip-rap and for Snow’s Cut, which is currently being studied by the USACE for cliff stabilization. Erosion has led to hazardous conditions and loss of land along the Cut. Some have even suggested some of the rock could be used along the river for living shorelines for mitigation of wave action and erosion that is generated by these ever-larger ships’ vessel wake. Wave run-up and erosion is occurring along the river edge in multiple locations and will be worse with larger ships. One notable erosion site is near Brunswick Town.

One other beneficial use that the USACE is considering is for thin or thick bed placement of sediment in areas such as marshes. The idea is to raise the elevation of the marshes to match rising water levels to maintain marsh function. There have been some examples of this (<https://coastalscience.noaa.gov/news/thin-layer-sediment-placement-boosts-marsh-growth-in-new-experimental-study/>). However, we need to know the properties of the area that is being considered as well as any areas that should be eliminated from this type of deposition. For instance, knowledge of the presence of historically significant rice canals is essential. One other consideration is what are the properties of the sediment such as containing toxic substances (see below for water quality).

One consideration that many people want to know is: what is the impact of blasting rock from the river bottom. This is of course of concern but, done right, the impacts are minimal if the blasting is confined. This may be done with controlled blasting that minimizes the impacts by drilling the hole and setting the explosive and capping that with gravel to confine the blast to the subsurface as much as possible. The USACE will evaluate potential effects, though, including any impacts to ecological or cultural resources.

Water Quality. Comparison of before and after water quality is an essential component of the assessment. We know there will be salinity changes but other properties such as turbidity (cloudiness of the water that will lower sunlight penetration and, in some cases, make filter feeding more problematic), temperature, and dissolved oxygen may be impacted. Dredging will definitely lead to turbidity issues, at least in the short term.

But one aspect that we know little about is what is in the sediment/rock that will be removed. We know that toxic substances such as PFAS have been found in soils and sediments along the Cape Fear. We need to know what is in the materials that will be dredged. This is of course important for two reasons. First, will toxic substances be released into the river that may impact species in the river. And second, if we do use some of these sediments for thin-bed application in marshes, do they contain toxic substances that will be spread on marshes or other habitat restoration areas. We would not want to place contaminated sediments on sensitive areas.

One other consideration is that additional maintenance dredging will be needed to maintain these deeper depths. These sediments will continue to potentially have high levels of toxic materials such as PFAS. There is still PFAS in the river and sediments. One other potential source of more concentrated PFAS in the river is that the Brunswick County Northwest Water Treatment Plant will soon have a reverse osmosis treatment facility in operation. Reverse osmosis effectively removes toxins from the drinking water, but the effluent will be more concentrated in PFAS. The effluent will be dumped into the Cape Fear River. CFPWA's GAC treatment facility removes the PFAS but it is not dumped back into the Cape Fear.

Groundwater. Part of the Cape Fear River Estuary is already "grounded" in the Castle Hayne Limestone as some rock was removed in the 2000 – 2002 dredging operation. With the proposed 5 feet of further deepening, there is some concern that the groundwater will be impacted. One of the largest concerns is saltwater intrusion into the aquifers but groundwater levels and flow direction changes with pressure changes are also considerations. The USACE plans to do a detailed groundwater model to predict these impacts that will include river level increases with sea level rise and what may occur with future changes in water well withdrawals. Although our area gets most of its water from the river at Lock and Dam #1, a large and growing number of people rely on groundwater as their source of water. This will be a complex and large model study, but this assessment is critical.

Cultural, Historical, and Environmental Justice Considerations. There has been minimal coverage of these topics other than to list these as socioeconomic resources. But it is very important that we safeguard these resources and our heritage. There are many aspects to this that may be impacted including our maritime artifacts and Gullah Geechee corridor and rice culture that includes the many historic rice canals that line the river and tributaries.

In summary, this is not intended to be an exhaustive look at or in depth scientific assessment of the 203 study nor of the USACE's Wilmington Harbor 403 scoping letter and EIS. It is only to bring the issue to the attention of the community to help you stay involved in the process. It is a long process but an important one for our economy and environment.