Town of Sunset Beach Navigation Project Maintenance Dredging of South Jinks Creek, the Bay Area, & the Feeder Channel Project Narrative

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BACKGROUND

The Town of Sunset Beach (Town) requests federal authorization to conduct navigational dredging in the water bodies known as South Jinks Creek, the Bay Area, and the Feeder Channel system. Sunset Beach lies in Brunswick County, along the southern coastal border of North Carolina, adjacent to Ocean Isle Beach (Figure 1). The proposed dredging project will occur along the eastern border of Sunset Beach, within the interior waters of Tubbs Inlet.

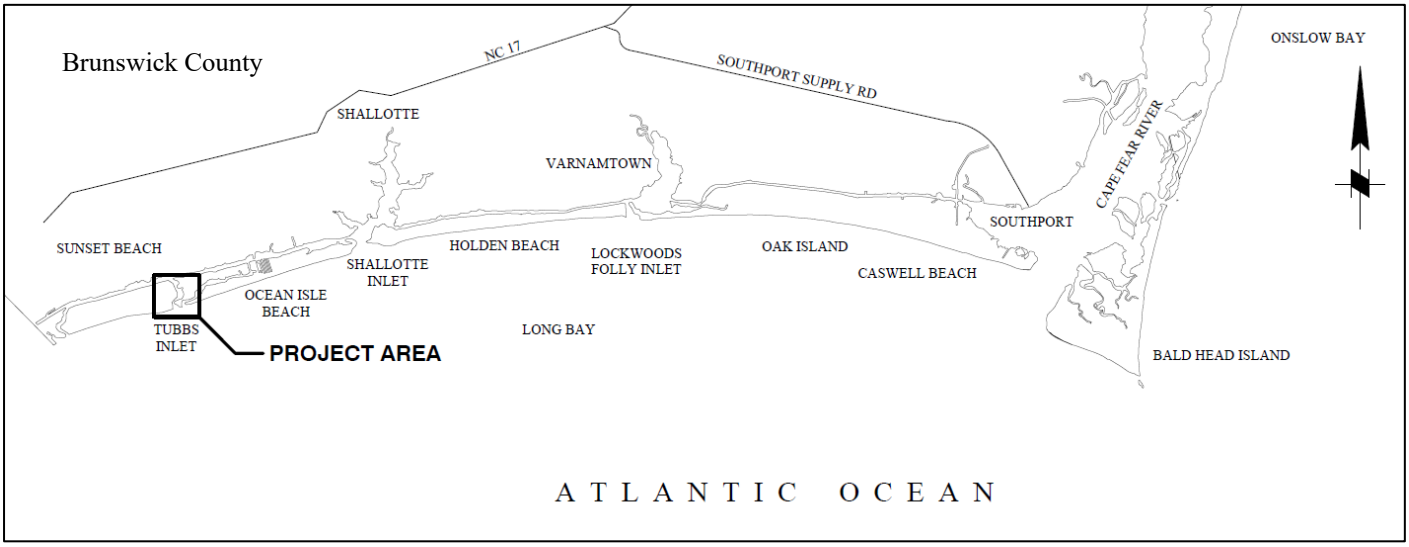

Figure 1. Project Vicinity Map

South Jinks Creek comprises a portion of the Jinks Creek connector channel that extends from the Atlantic Intracoastal Waterway (AIWW) to Tubbs Inlet and the Atlantic Ocean. The navigation project in South Jinks Creek will also include the Bay Area and Feeder Channel system positioned in the east portion of Sunset Beach. The Bay Area entails one (1) residential canal and the Feeder Channel system includes one (1) main channel connected to four (4) residential finger canals referenced as Canals A – D. The project will help restore navigation access within these systems while also helping to restore access within South Jinks Creek, from the Feeder Channel to the Town's jurisdictional limits.

An estimated 40,500 cubic yards (CY) of beach compatible material will be dredged from S. Jinks Creek, and an additional 48,600 CY of non-compatible material will be removed from the Feeder Channel system and Bay Area. The beach compatible material will be hydraulically placed as beneficial reuse in the nearshore along approximately 2,000-ft of shoreline between 3rd Street and 13th Street on Sunset Beach. The beneficial reuse material will be placed in an approximate 200-ft wide template in water depths ranging between approximately -9-ft to -13-ft MLW. The final grade for the placed material will not exceed -6.0-ft MLW in height. The non-compatible substrate from the Feeder Channel and Bay Area will be mechanically dredged and placed at a permitted upland landfill facility. Figure 2 shows the work areas and estimated dredge volumes along the east end of Sunset Beach.

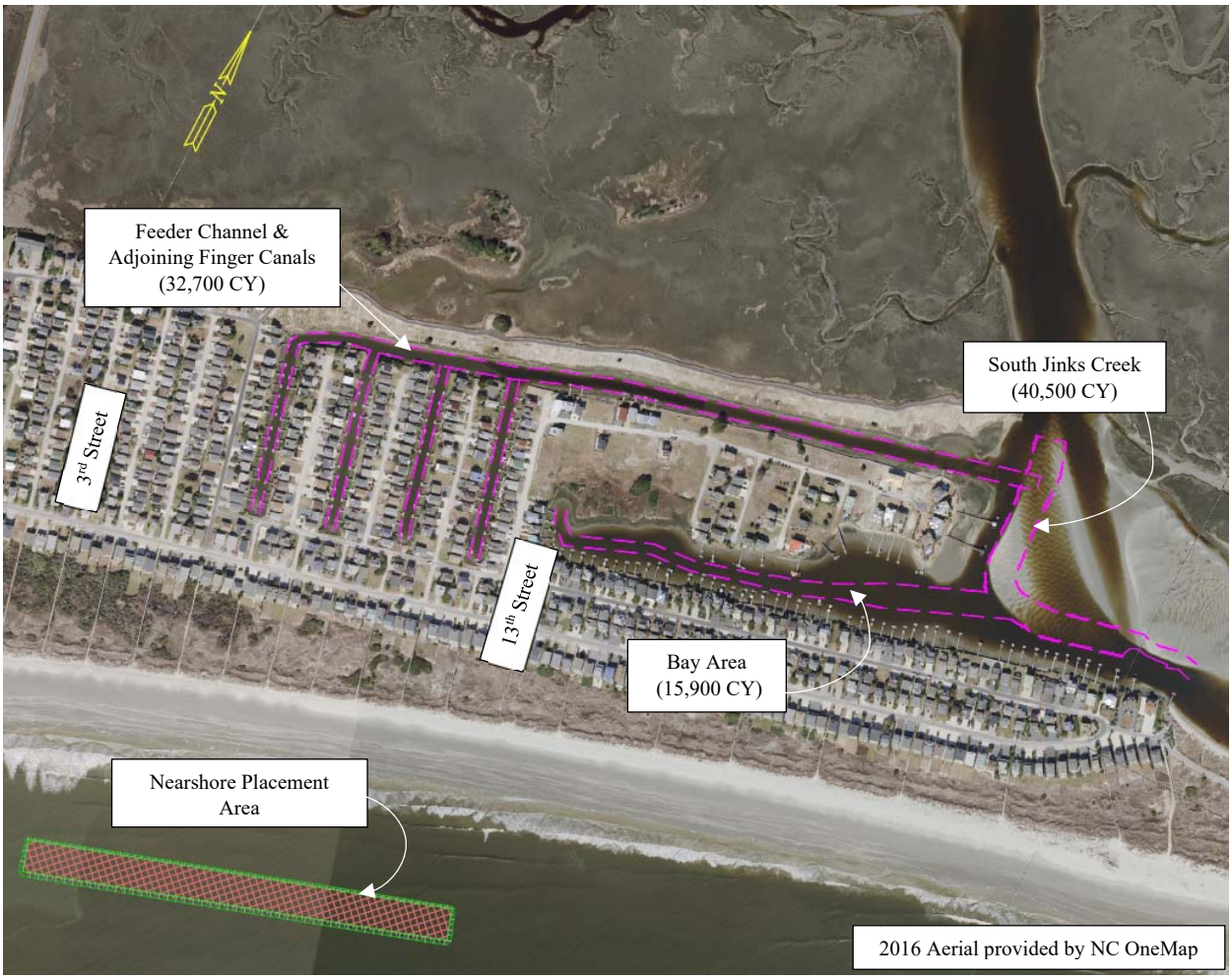

Figure 2. South Jinks Creek, the Bay Area, and Feeder Channel Work Area

PURPOSE & NEED

The primary purpose and need for this project is to provide the Town of Sunset Beach with a long-term management solution for maintaining navigation access throughout the east end of Sunset Beach. The project seeks to enhance and protect navigation access to residents and guests to waterways on the east side of Sunset Beach, near Tubbs Inlet. The maintenance dredging project will provide a long-term management solution to restore navigation access in South Jinks Creek, the Bay Area, and the Feeder Channel system. Restoring the navigation depths will provide sustainable recreational boating opportunities to visitors and residents of Sunset Beach while also helping to safeguard the small rental businesses and property values at risk within the project area. The maintenance dredging project will also provide a management tool for future land development through the establishment of a pier head alignment.

Since approximately 2010, the Town of Sunset Beach has been diligently working to establish and maintain a navigable channel within the project area. In recent years, South Jinks Creek has incurred significant shoaling perceivably from sediment transport entering Tubbs Inlet. In addition, the Bay Area and Feeder Channel system, which were developed for recreational boating access, have been subject to infilling from adjacent upland run-off and erosion as well as wind and wave action. The shoaling and material infilling experienced by each waterbody has constricted navigable access regarding the available width and depth.

The current governing width of South Jinks Creek for navigation equals approximately 10-ft and the governing depth is above MLW. The Feeder Channel system and Bay Area are generally not constricted by width, but both maintain a governing depth between -2-ft and -3-ft MLW. The current shoaling patterns appear likely to continue and will eventually sever recreational access in each of the referenced work areas.

Figure 3 shows a comparison of the navigable widths estimated from 2012 and 2016 aerial photography. The measurements shown in Figure 3 provide the change in navigable widths in South Jinks Creek on 100-ft intervals during lower tide stages. The measurements indicate South Jinks Creek has expereinced a reduction in navigable access averaging approximately -14.8-ft per year. The pinch piont in the navigable waterway, adjacent to a residential dock, experienced an approximate -11.8-ft annual reduciton over the 4-year period (47-ft / 4- yr = 11.8 ft/yr).

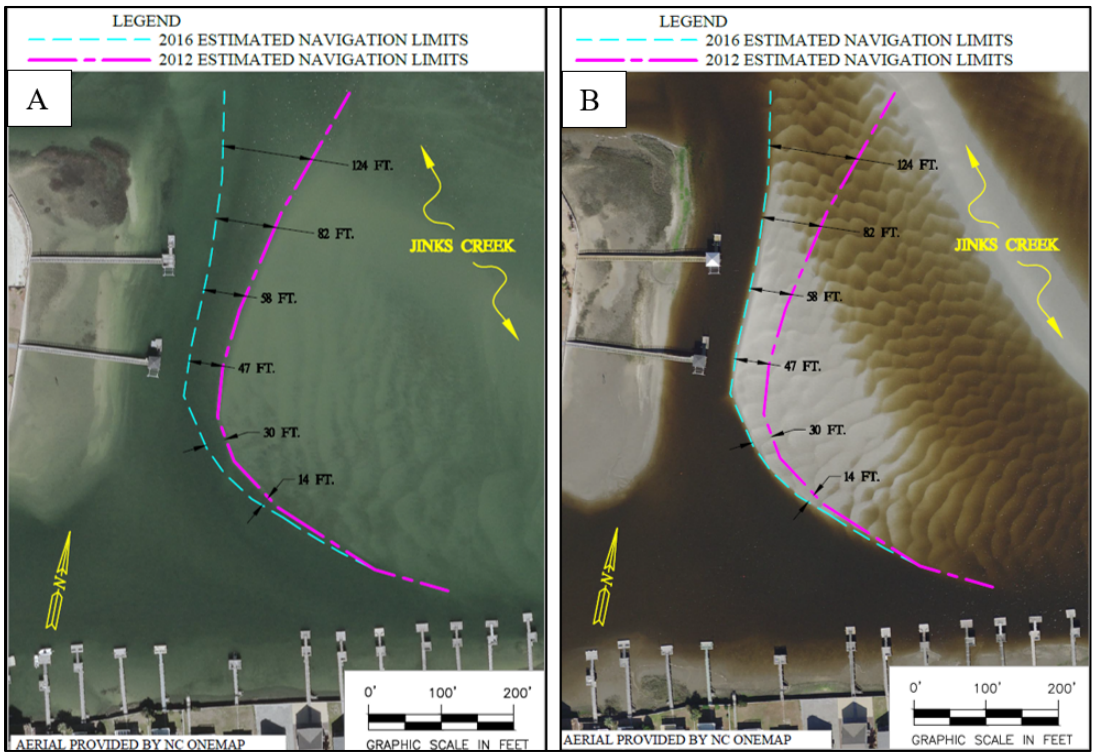

Figure 3. Estimated Navigational Limits of South Jinks Creek (A) February 2012, (B) February 2016

More recent photos captured in July 2020 show the navigable waterway in South Jinks Creek has minimized to unsafe conditions. Figure 4 shows a ground level image of the pinch point referenced above encompassing two (2) dock structures in South Jinks Creek. Figure 4 (a) shows the sediment shoaling has extended closer to the dock structures as compared to the 2016 aerial image shown in Figure 3. Figure 4 (b) shows small vessel navigation has been forced to travel through or under the dock system in efforts to find sufficient water depths during low tide events.

The reduced navigable pathway has already impacted the Sunset Beach local economy as annual renters have declined to return to the vacation destination due to the lack of recreational boating access. The deteriorating conditions have become common knowledge for some potential renters and local fishermen who have historically enjoyed the opportunity and environment offered by Sunset Beach. In order to ensure that all parties understand these current conditions, rental agencies are now notifying potential renters interested in boating of the limited access[1]. If left unmanaged, the continued shoaling will bring greater impacts on investment and quality of life for the residents and visitors of Sunset Beach as navigation access

will be completely severed. As the shoaling continues to accumulate, the habitat will transform to a more intertidal to supratidal condition. As the new habitat forms, maintenance opportunities may diminish due to the transformation and establishment of coastal grasses and similar resources which are protected under the North Carolina Dredge and Fill Law and the Coastal Area Management Act (CAMA).

The proposed project would restore navigable passage through South Jinks Creek to conditions similar to 2008. Figure 5 shows a plan view image of South Jinks Creek from October 2008. The increased channel widths from current conditions, will provide access through South Jinks Creek within the municipal limits of Sunset Beach. This will promote recreational fishing and navigation in the area, which in turn will help sustain the local economy of Sunset Beach under similar conditions as those prior to the 2010 shoaling events.

Figure 4. July 2020 South Jinks Creek Conditions [Photo (a) shows sediment shoaling near the fixed docks in South Jinks Creek and photo (b) shows boaters forced to travel under or through a dock system to obtain sufficient navigation depth.]

As part of the project evaluation, the Town conducted hydrographic surveys of the proposed dredge areas. Tab Q (Survey Report) provides the survey report compiled as part of this effort. During the data collection process s*inglebeam sonar soundings were collected from a 21 ft catamaran, the RV Echo, with a digital Odom CV100, 200 kHz ultra-shallow water sonar system. Real-time horizontal and vertical control for singlebeam data acquisition was provided by the NCGS RTK-VRS network. Topographical data was collected using a backpack and a Trimble R7 GNSS receiver. All singlebeam and topographic data was processed using HYPACK software and developed into a DEM using Surfer and ArcGIS. All data was cross-checked and verified using Hypack and ArcGIS 10.3 software*. The data was originally collected in reference to the North American Vertical Datum established in 1988 (NAVD88) in accordance with the North Carolina Administrative Code (NCAC), specifically 15A NCAC 07H.0312 (2) c. However, to provide a more relative reference for local boaters, the data was converted to represent the elevations at Mean Low Water (MLW) using NOAA tidal station 8659182, Oak Island. For epoch 1983-2001, the conversion factor was determined as 2.94-ft between NAVD and MLW.

Figure 5. October 2008 Aerial of South Jinks Creek

The dredging will also help the Town of Sunset Beach to control or manage future development. The documented channel alignment represented in the permit package will serve towards a pier head alignment. The pier head alignment will allow the Town to monitor future dock construction, so the structures do not impede navigation access. Unregulated dock construction can result in non-uniform structures when residents build to accommodate migrating deep water paths. However, with an established pier head alignment, all future docks will maintain consistency with the established channel limits.

ALTERNATIVE ANALYSIS

NEPA requires discussion of a reasonable range of alternatives, including the no action alternative, and the potential effects of all alternatives. Under the Section 404(b)(1) Guidelines, practicability of alternatives is taken into consideration, and no alternative may be permitted if there is a less environmentally damaging practicable alternative. In order to be practicable, an alternative must be available, achieve the overall project purpose, and be practicable when considering cost, logistics, and existing technology. The practicability of alternatives must be presented in order to determine that all alternatives were considered for environmental impacts and practicability.

The Town of Sunset Beach evaluated several alternatives to formulate the current project plan. The first step of the evaluation strived to determine if adverse hydrodynamic impacts would be likely from dredging any portion of the work area. The hydrodynamic analysis assumed a comprehensive approach to evaluate if the navigation project would create adverse shoaling or flooding impacts due to changes in the tidal velocities or prism entering the work area. The Town then advanced the least environmentally damaging practicable alternative determined from the hydrodynamic analysis to a wide-ranging evaluation of possible modifications to further minimize or avoid potential construction impacts.

NO-ACTION ALTERNATIVE

The initial dredging of South Jinks Creek, the Feeder Channel system, and the Bay Area presumably occurred as part of a relocation project for Tubbs Inlet and the development of Sunset Beach in the early 1970's[2]. The action occurred prior to 1974 and prior to the establishment of the Coastal Area Management Act, so the dredging did not require a CAMA major permit authorization. Figures 6 and 7 show aerial photographs from 1966 and 1974 depicting before and after conditions of the initial dredging event.

Since the original development of South Jinks Creek, the Feeder Channel system, and the Bay Area, the Town has conducted limited maintenance activities. The Town performed maintenance dredging of the Feeder Channel in 1985 under CAMA permit 211-85. A subsequent maintenance occurred in 2002 under CAMA 45-02. Tab D (Previous Permits) provides a copy of CAMA permit 45-02. The Town has not conducted any maintenance dredging in the Bay Area or South Jinks Creek.

Figure 6. Tubbs Inlet 1966[3]

Figure 7. Tubbs Inlet 1974[3]

The current shoaling trends show navigation access will be lost if maintenance dredging does not occur within South Jinks Creek. The complete shoaling of South Jinks Creek will further change the habitat and environment of Sunset Beach beyond the current patterns of exposed lands at low tides. The decreased flushing and tidal flows could also add to or create the degradation of water quality in the Feeder Channel

system and Bay Area. Without appropriate tidal exchange occurring within the Bay Area and Feeder Channel, the systems may become unsuitable for marine resource as dissolved oxygen levels decrease in the stagnant waters. The accumulation of pollutants and debris can also be expected in the Bay Area and Feeder Channel system as tidal flushing decreases from shoaling in South Jinks Creek. The shoaling experienced since 2012 in South Jinks Creek demonstrates how the impacts are likely to continue and will disconnect tidal exchange from traversing South Jinks Creek during low tidal periods. For this reason, the Town must act in the best interest of the residents and guests of Sunset Beach to maintain navigable access or the Town will be faced with environmental impacts in addition to loss of navigation. Therefore, the No-Action Alternative was not considered practicable.

ACTION ALTERNATIVES

Each channel alternative evaluated for the final selection included the maintenance dredging of South Jinks Creek, the Feeder Channel system, and the Bay Area to improve navigation. The respective alternatives branched from South Jinks Creek to provide a consistent depth connection to adjacent waters. For South Jinks Creek, adjacent waters stipulate either the AIWW or the Atlantic Ocean in terms of regulatory requirements. These alternatives include options for end-use material placement, channel alignments, and channel depths as listed below:

DREDGE OPTIONS

Dredge Alternative 1 – Deep Water Connection through North Jinks Creek

The Town of Sunset Beach originally considered a preferred channel as connecting the Bay Area and Feeder Channel systems to the Atlantic Intracoastal Waterway (AIWW) through North Jinks Creek. The North Jinks Creek connection would provide a continuous maintained navigation route to a deep-water system. However, the Town conducted a shellfish survey in 2017 that identified oyster, clam, and mussel species throughout North Jinks Creek. Due to the density of the shellfish habitat, most notably at the AIWW confluence with Jinks Creek, any dredging connecting the AIWW with South Jinks Creek would require mitigation efforts due to unavoidable impacts. The Town coordinated extensively with resource agencies, including three (3) in-person meetings and one (1) on-site meeting, to work through the permitting process. The prevailing consensus from these coordination efforts was that removing North Jinks Creek from the dredging plan would result in a more acceptable project from the resource agencies in terms of potential environmental impacts.

Removing North Jinks Creek from the dredging plan would leave high spots or shoaled areas within the navigation path to the AIWW. Thus, navigators would need to be mindful of the conditions present in North Jinks Creek. Although leaving an unmanaged navigation segment between the project area and deep-water access remains undesirable, the resource agencies felt this alternative was much more amenable than incurring the shellfish impacts likely to occur through dredging. The resource agencies recommended through informal consultation that the Town to request a variance from the State of North Carolina Coastal Resources Commission from the North Carolina Administrative Code (NCAC) as a design alternative for consideration. The variance would allow the Town to dredge the work area to a deeper depth than the connecting waters. 15A NCAC 07H.208(b)1(f) states “any canal or boat basin shall be excavated no deeper than the depth of the connecting waters”. Tab E provides the meeting summary notes from the April 9, 2018 agency coordination meeting and details the permitting strategy discussion for North Jinks Creek and the agency support for removing the segment from the dredging plan.

For reference, Tab F provides the Jinks Creek shellfish survey report and shows the results indicate North Jinks Creek supports on the order of 1,200 oysters per acre ranging from spat (152), sublegal (812), and legal (231) size classifications. The majority of the oyster resources fall along the shoreline in the intertidal region. However, the survey identified several oyster resources within the subtidal region. Generally, the oyster resources identified within the deeper regions of the creek occurred within the upper 1,400 ft of Jinks Creek, near the AIWW confluence. In this area, the resource density most likely prohibits the navigation project from avoiding all potential impacts. Minimization efforts can help reduce the potential for impacts; however, the survey results show the oyster resources may be too diverse to completely avoid.

Within the remaining portion of North Jinks Creek, outside of the northern 1,400 ft, oyster species generally coagulate along the shoreline and should not face any direct impacts from the navigation dredging of the evaluated alternatives. However, the creek substrate through the lower portion of North Jinks Creek seems capable of sustaining oyster habitat. Based on these findings, the proposed navigation project could affect an estimated 12,810 oysters by dredging the 10.7-acre footprint shown in lower portion of North Jinks Creek. Reviewing the overall densities for each oyster size category, the potential impacts could affect approximately 1,629 spat, 8,705 sublegal and 2,476 legal oysters.

The shellfish survey also identified approximately 1,288 clam resources, including 1,008 small clams and 280 large clams in North Jinks Creek. The clam resources extended further south within the subtidal region of North Jinks Creek compared to the oyster resources identified. The survey identified clam resources through the complete area of North Jinks Creek; however, the placement density decreased significantly in the lower creek regions. Relocation efforts would minimize the potential for adverse impacts to the clam resources. However, with the low water visibility and the clam's tendency to bury within the sediment, complete removal of all clam resources seems unlikely.

The survey also identified several mussel resources in addition to the clam and oyster species. The mussel species generally existed underneath oyster clumps located along the shoreline or channel banks. Direct impacts to the mussel species appear unlikely due to their presence along the shoreline. The proposed navigation project strives to avoid the shoreline region and generally follows the existing thalweg of Jinks Creek. However, the survey results recognize dredging North Jinks Creek may potentially affect approximately 213 mussel resources during the construction process.

Therefore, while cost and logistics would not necessarily eliminate this alternative from further consideration, in consideration of the agency input, environmental concerns, and overall project goals, the North Jinks Creek alternative was not considered the most practicable altenative.

Dredge Alternative 2 – Deep Water Connection Through Eastern Channel (Behind Ocean Isle Beach)

The Town evaluated channel alternatives traversing through Eastern Channel, located on the back side of Ocean Isle Beach, to provide navigation access to 'deep water'. The Town included this option in an effort to remain compliant with North Carolina Administrative Code (NCAC). 15A NCAC 07H.0208(b)(1)(F) requires that dredge areas be excavated no deeper than the depth of connecting waters. Therefore, the navigation route would need to be at least as deep as South Jinks Creek until the route entered the Atlantic Ocean or AIWW. The option to connect to deep water through Eastern Channel also appears unlikely due to objections from property owners along Eastern Channel.

With respect to Eastern Channel, the Town of Ocean Isle Beach (OIB) initiated the planning process to conduct navigation dredging through Eastern Channel in 2019. However, due to opposition from property

owners, the plan excluded a connection to Jinks Creek. Therefore, since the property owners opposed dredging Eastern Channel under OIB's project authority, Sunset Beach ascertained this alternative as 'not likely' for their project. It should also be noted that this alternative would also likely increase the amount of beach-compatible material that would need to be disposed of.

Based on the analysis of a channel alternative connecting Eastern Channel to the project area, the Town determined the Eastern Channel option would not provide a viable alternative to satisfy their purpose or need for the project, and therefore would not be considered a practicable alternative.

Dredge Alternative 3 – Deep Water Connection through Tubbs Inlet

The Town evaluated channel alternatives traversing through Tubbs Inlet to provide navigation access to 'deep water'. The Town included this option in an effort to remain compliant with North Carolina Administrative Code (NCAC). 15A NCAC 07H.0208(b)(1)(F) requires that dredge areas be excavated no deeper than the depth of connecting waters. Therefore, the navigation route would need to be at least as deep as South Jinks Creek until the route entered the Atlantic Ocean or AIWW. The alternative analysis suggests the inclusion of Tubbs Inlet provides a significant potential for adverse impacts and escalated construction costs and would not provide significantly increased navigational access.

Establishing a connection through Tubbs Inlet would satisfy 15A NCAC 07H.0208(b)(1)(F) for providing a consistent depth to deep water. However, the anticipated construction and maintenance costs associated with inlet management make the option less attractive compared to a connection to the AIWW. Typical inlet maintenance projects along the North Carolina coast require an investment reaching approximately $1 million per year as an average annual cost. The Town anticipates a much lower annual cost to maintain a navigation path to the AIWW as previous maintenance operations have spanned over at least a seven (7) year period. Considering a seven (7) year maintenance interval, expectations for the current project suggest an annual cost of approximately $450,000, or less than half of the cost to maintain Tubbs Inlet. In addition, the majority of boaters within eastern Sunset Beach navigate inland waters through the AIWW. Therefore, access to the Atlantic Ocean would not directly benefit the primary users of South Jinks Creek.

Based upon the potential for environmental impacts, construction costs, and limited improvements to traditional navigational patterns, the Town determined this alternative did not provide a viable alternative to satisfy their purpose or need for the project. This alternative was therefore not considered practicable.

Dredge Alternative 4 – South Jinks Creek Only

Through coordination meetings with regulatory staff, the Town developed an alternative to only dredge South Jinks Creek, the Feeder Channel system, and the Bay Area. This alternative addresses the immediate need to restore navigation depths within the project area and allows the Town to finalize a pier head alignment. The alternative would require a variance from the NCAC, which could be granted through the Coastal Resources Commission. Tab E shows the April 9, 2018 meeting summary where most agency staff believed the most practicable permitting path included focusing only on South Jinks Creek, the Feeder Channel system, and the Bay Area. Agencies represented at the meeting include the following:

- DMF
- DCM
- DWR
- USACE
- NMFS

Based on the agency feedback and alternative evaluation, the Town elected to proceed with a dredge alternative focusing only on South Jinks Creek, the Feeder Channel, and Bay Area. The Town chose this alternative as a balance between providing navigational access along the eastern portion of Sunset Beach and helping to address the resource habitat concerns within North Jinks Creek. Although the State of North Carolina already recognizes Jinks Creek as a connecting channel for navigation between Tubbs Inlet and the AIWW[4], the Town recognizes the concern for resource impacts as a result of any dredging in North Jinks Creek.

The Town of Sunset Beach shares the state's concern and consideration towards avoiding adverse impacts to the extent reasonable, while also maintaining navigation access. As previously referenced, the Town consulted with multiple resource agencies to identify a least impactful alternative that avoids or minimizes potential adverse impacts to aquatic resources while also satisfying the project's purpose and need to a reasonable measure. To date, several state and federal permitting agencies have commented on this proposed alternative without expressing significant concerns. Tab G (Agency Correspondence) provides the comments provided by the review agencies and includes the following:

- CAMA Major Permit No. 79-19 from the N.C. Division of Coastal Management (DCM) issued on March 3, 2020, with inclusion of the variance approval from the Coastal Resources Commission to dredge deeper than connecting waters.
- 401 Water Quality Certification from the North Carolina Division of Water Resources (DWR) (August 01, 2019).
- Memorandum from the North Carolina Division of Marine Fisheries (DMF) to DCM providing no objection to the project (July 19, 2019).
- National Marine Fisheries Service (NMFS) letter offering no additional EFH (Essential Fish Habitat) conservation measures (August 2, 2019).
- US Fish & Wildlife Service (USFWS) letter accepting the reasonable and prudent measures (RPM's) and terms and conditions (T&C's) proposed for the project with only a request for coordination with FWS and the North Carolina Wildlife Resources Commission (WRC) during construction to avoid potential impacts to wintering and nesting shorebirds and their habitat (July 29, 2019).
- WRC letter providing comments on the project requesting only to limit beach placement to between November 16 and March 31 (August 9, 2019).

Dredge Alternative 4A – Dredge Channel to Only -2 MLW (connecting depth or North Jinks Creek)

The Town evaluated the option of a -2-ft MLW maximum dredge depth in attempts to maintain consistency with 15A NCAC 07H.0208(B)(1)(F), which states " any canal or boat basin shall be excavated no deeper than the depth of connecting waters". However, the Town determined this alternative would not provide an economically feasible, or reasonably constructible alternative for maintaining the navigable waterways.

The referenced North Carolina administrative code requires the connecting waterbodies of a maintained navigation channel to be at least as deep as the dredge area. Since the controlling depth in South Jinks Creek is above MLW and the controlling depth in North Jinks Creek equals approximately -2-ft MLW, the Town would require a variance from the North Carolina Coastal Resources Commission to dredge deeper than -2-ft MLW. However, if the maximum dredge depth was restricted to -2-ft MLW, the project would have a resulting navigable depth of -1-ft MLW. Thus, the navigable depth during the average low tide period would be 1-foot. This could be interpreted as approximately half of the low tide events since the datum represents

the average or "mean" low water elevation recorded during the most recent epoch. Thus, without considering the impacts of material shoaling, the navigation depth would be less than 1-ft during the remaining periods, or approximately half of all low tide events.

The analysis depicts -1-ft MLW as the controlling navigation depth if the project selects -2-ft MLW as the maximum (deepest) dredge depth due to the construction process. The discrepancies between these elevations stem from the channel design elevation always being shallower than the maximum dredge elevation. Due to the dredging equipment and processes used, channel designs allow an overdredge tolerance. The overdredge tolerance provides a buffer between the minimum acceptable project requirements and the maximum excavation depths allowed by permit. If the project did not provide a minimum requirement, the Town would have no method to verify the project construction occurred as designed. A contractor could collect mobilization payments and never have to conduct any work. Also, the minimum project requirements and the maximum allowable dredge depths cannot be the same as it is not feasible to expect the dredge equipment to maintain that level of accuracy. Therefore, the project would not be constructible if some type of overdredge tolerance was not provided. A 1-foot overdredge tolerance follows generally accepted construction standards for a sheltered project similar to this initiative. As noted in the construction drawings, this project allows a 1-ft overdredge tolerance for all portions of the work area. Figure 8 shows a typical dredge section providing the 1-ft overdredge tolerance and Tab H (Permit Drawings) shows the typical dredge section designed for this project.

Another issue related to limiting the maximum dredge depth to -2-ft MLW relates to the construction equipment access to the site. The barge and floating platforms necessary to conduct hydraulic dredging or bucket-to-barge operations draft approximately 4-feet. Therefore, limiting the excavation depth to -2-ft MLW would limit the equipment's operating time and thus, increase project costs and the construction period. Sunset Beach experiences an approximate 5-ft tidal variation, so the equipment would be able to work some of the time. However, if the maximum dredge depth could not exceed -2-ft MLW and the design or minimum project requirements require excavation to at least -1-ft MLW, construction could take place less than half of the normal expected time. Since the dredge equipment drafts four (4) feet, the tidal stage would need to meet or exceed three (3) feet above MLW (+3-ft above MLW +1 ft below MLW) to ensure the construction equipment could work. Assuming a uniform fluctuation in tide, this would more than double the construction window and therefore the cost for the complete project.

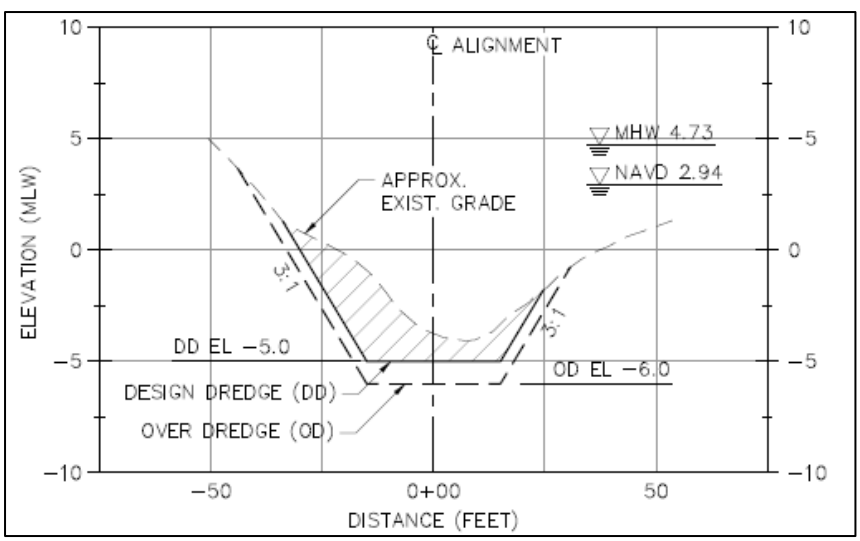

Figure 8. Typical Dredge Section Allowing a 1-ft Overdredge Tolerance Below the Design Depth

Maintaining South Jinks Creek, the Bay Area, and the Feeder Channel system at the elevation of only -2-ft MLW also does not allow the Town to provide a navigable waterway in accordance with recommended standards from national engineering agencies. The ASCE[5] (American Society of Civil Engineers) and PIANC[6] (The World Association for Waterborne Transport Infrastructure) recommends 3-ft under keel (MLLW) clearance plus 10% as a design depth in sheltered waters for vessel motion. The design analysis considered 18-inches (1.5-ft) as a typical depth for vessels just to allow the props or motors to float. Applying the recommended 3-ft clearance below the 1.5-ft draft requirement for the equipment equals a minimum design depth of -4.5-ft MLW. The preferred alternative design adds an additional 0.5-ft to account for vessel squat, or pitch and roll conditions responding from other vessel wakes, and tidal stages less than the average conditions.

Based upon the limited improvements to traditional navigational patterns resulting from this alternative, as well as constructability issues, the Town determined this alternative did not provide a viable alternative to satisfy their purpose or need for the project. This alternative was therefore not considered practicable.

Dredge Alternative 4B – Varying Dredge Depths

Varying the dredge depths within the project area helps to meet the purpose and need of the project by providing a long-term navigation corridor. The alternative also balances the potential environmental impacts feasible from a dredging project by minimizing the proposed dredge depth compared to other maintained navigable channels. The varying depth design considers the potential impacts that may occur as a result of the dredging with the economic requirements necessary to complete a major construction project.

Typical design depths for connecting channels between the Atlantic Ocean and the AIWW reach -6-ft MLW or deeper. This holds true for most connecting channels maintained in North Carolina, including Lockwoods Folly Inlet, Carolina Beach Inlet, and Topsail Banks Channel. Mason's Creek by Mason's Inlet is also maintained at a depth greater than -6-ft MLW, however, Mason's Creek is maintained for environmental restoration as opposed to navigation.

In efforts to minimize the potential impacts in South Jinks Creek, the design depth does not exceed -5-ft MLW. Although Jinks Creek serves as a connecting channel between the Atlantic Ocean and the AIWW, the project does not join to either waterbody. Therefore, the design minimized the dredging depth to consider the safety recommendations from the ASCE and PIANC, but did not attempt to reach the typical design depth of -6-ft MLW or deeper, maintained by other connecting channels. The design depth of -5-ft MLW, coupled with a maximum dredge depth of -6-ft MLW provides a similar template as other small recreational navigation channels such as Pelletier Creek in Morehead City, and Cedar Bush Cut in Onslow County.

The deign depth of -5-ft MLW also provides a constructible project in terms of allowing sufficient depth for the work boats to access. As referenced, typically the minimum draft required for a small hydraulic dredge or bucket-to-barge operation equals approximately 4 feet. Providing a design depth of -5-ft MLW generally ensures the available draft will be greater than 4-ft, even when low water tide stages fall below the 0-ft datum. A tidal buffer of 1-ft will still remain within the completed work area during low tide events to account for any deviations in the water level or draft requirements.

Dredge Alternative 5 – Only Dredge Feeder Channel System & Bay Area

This alternative does not meet purpose and need, does not address the most restrictive shoaling area, does not restore navigation access to South Jinks Creek (if South Jinks Creek is not dredged, it would become very difficult to access Bay Area). Therefore, this alternative was eliminated from further consideration.

DREDGE MATERIAL DISPOSAL OPTIONS

The Town has conducted several searches to identify suitable material placement sites for the beach compatible material identified in South Jinks Creek. These include discussions with OIB, the navigation branch of the U.S. Army Corps of Engineers (USACE) – Wilmington District, the Town of Oak Island, DCM, and residents of Sunset Beach. However, in accordance with North Carolina General Statutes (NCGS) 113-229(h1) and 113-229(h2), beach-quality sand may be placed on the affected downdrift ocean beaches or, if placed elsewhere, an equivalent quality and quantity of sand from another location shall be placed on the downdrift ocean beaches. Clean, beach quality material dredged from navigational channels within the active nearshore, beach or inlet shoal systems shall not be removed permanently from the active nearshore, beach or inlet shoal system. This dredged material shall be disposed of on the ocean beach or shallow active nearshore area where it is environmentally acceptable and compatible with other uses of the beach.

Several conversations and interpretations have been offered towards implementation of the referenced NCGS. Therefore, to ensure evaluation of the appropriate actions or alternatives, the Town requested a legal interpretation of the referenced NCGS. The North Carolina Division of Coastal Management provided the following response:

"*The language in the NC Dredge and Fill Law at 113-229(h2) is very clear that: "Clean, beach quality material dredged from navigational channels within the active nearshore, beach or inlet shoal systems shall not be removed permanently from the active nearshore, beach or inlet shoal system. This dredged material shall be disposed of on the ocean beach or shallow active nearshore area where it is environmentally acceptable and compatible with other uses of the beach*."

"*We do not interpret subsection (h1) to be allow flexibility with respect to the mandate in (h2). However, as we have previously suggested, we may be able to allow temporary storage of the beach-compatible sand on high ground until it can be beneficially placed on an eroding beach or nearshore area in the same inlet system. Because the D&F language says "the" active nearshore, beach or inlet shoal system, we interpret this to mean that the sand must stay in the system where the dredging is occurring*".[7]

Therefore, the beach compatible material must be maintained in the Tubbs Inlet littoral complex to provide consistency with the NCGS. The NCGS does allow for the temporary stockpiling of the beach compatible material in an upland facility. However, the material must be maintained and eventually returned to the Tubbs Inlet littoral complex.

Disposal Alternative 1 – Temporary Stockpile of Beach Compatible Material in a Federal Dredge Material Placement Facility (DMPF)

As part of the alternative analysis the Town evaluated stockpiling the compatible material in a USACE material placement facility (DMPF). The Town proposed to place material in DA311, along the AIWW until a beach placement use could be identified. However, federal guidance issued in February 2017

prohibits the Town from utilizing this historically available placement option. Tab I (DMPF Usage Guidance) provides the correspondence denying use of any federally managed DMPFs. The USACE has recently indicated the Town may place material in DA311 but would first have to remove 125% of the volume proposed for placement, or 50,625 CY. Therefore, stockpiling material in a federally managed DMPF would significantly increase the project cost due to the triple handling of material. The increased cost result from (1) removing the initial 125% of the proposed volume to become eligible to use the federal DMPF, (2) placing the estimated 40,500 CY of beach compatible material dredged from South Jinks Creek, and (3) eventually returning the 40,500 CY of beach compatible material back to the Tubbs Inlet littoral zone as required by NCGS 113-229, referenced above.

Current estimates suggest this option would increase the project costs by an estimated $3.5 million, inclusive of a $5.75 tipping fee necessary to dispose of the 50,625 CY required by the USACE to be removed in accordance with the 2017 federal guidance. Considering current estimates suggest a construction cost of approximately $850,000 for nearshore placement, the option would create a significant hardship of an approximate 400% increase in project costs. This estimate assumes the placement cost for the South Jinks Creek beach compatible material in the federal DMPF would be similar to the nearshore placement costs at $850,000. However, the analysis does not consider potential additional costs necessary for improvements to the DMPF for usage, such as dike improvements, tree and debris removal, or spillway construction. As such, this alternative is not considered practicable because it does not provide an economically feasible project compared with the preferred alternative of direct nearshore placement of the compatible material. Table 1 provides a summary of the additional cost estimated for stockpiling beach compatible material in a federal DMPF.

Table 1. Estimated Additional Cost for Stockpiling Material in a Federal DMPF

Action	Volume	Unit Cost	Total Cost
Initial Removal & Disposal of 125% of Dredge Volume from Federal DMPF	50,625 CY	$40.75*	$2,063,000
Hydraulic Dredge & Placement of Beach Compatible Material in the Federal DMPF	40,500 CY	$21.00**	$850,000
Future Return of Beach Compatible Material to the Tubbs Inlet Littoral Zone	40,500 CY	$35.00	$1,417,500
Total			$4,330,500
Cost Increase from Direct Nearshore Placement ($850,000)			$3,480,500
% Increase from Direct Nearshore Placement			**400 %**

*Unit costs include a $5.75 tipping fee required for placement of non-compatible material in the identified upland placement site.
** Cost includes mobilization for a hydraulic dredge for dredge and placement.

Disposal Alternative 2 – Temporary Stockpile of Beach Compatible Material in Upland Site

The Town of Sunset Beach also investigated the alternative of stockpiling beach compatible material in an upland (non-federal) storage facility. The Town has a standing agreement to dispose of non-beach compatible material in a permitted 42-acre facility located on Old Georgetown Road. Tab J (Consent Agreements) provides the use agreement authorizing the non-compatible material placement and the facility location, which falls approximately 10 miles from the project area.

Negotiations with the site owner indicate the beach compatible material could be stored at the facility for an initial tipping fee of $3.00 per cubic yard and an additional storage fee of $5,000 per year thereafter. However, similar to stockpiling material in the federal DMPF, this alternative does not avoid the NCGS requirement to ultimately return the beach sand to the Tubbs Inlet littoral zone. The alternative would only

increase the project cost while postponing any final resolution. The project cost could be expected to increase approximately $2.5 million, or approximately 200%, and may also require additional maintenance needs to preserve the beach compatible material sufficiently for beach placement. The additional $2.5 million estimate stems from the transportation cost necessary to truck haul the material to the upland facility and then back to the Tubbs Inlet littoral zone. The estimated cost also includes the initial $3.00 per cubic yard tipping fee but does not include the $5,000 per year storage fees. Table 2 provides a summary of the additional costs.

Table 2. Estimated Additional Cost for Stockpiling Material in an Upland Facility (Non-Federal)

Action	Volume	Unit Cost	Total Cost
Mechanical Dredge & Truck Haul Material to Upland Facility	40,500 CY	$45.00*	$1,822,500
Future Return of Beach Compatible Material to the Tubbs Inlet Littoral Zone	40,500 CY	$35.00	$1,417,500
Total			$3,240,000
Cost Increase from Direct Nearshore Placement ($850,000)			$2,390,000
% Increase from Direct Nearshore Placement			**281%**

*Estimate includes a $3.00/CY tipping fee required for beach compatible material acceptance at the upland facility.

The Town continues to look at options of stockpiling compatible material at alternate sites, but this option most likely would require the purchase of lands as an additional expenditure. As previously stated, stockpiling the material also does not provide a final resolution to the project and only delays returning the beach sand to the active littoral zone of Tubbs Inlet. Whereas nearshore placement allows the beneficial reuse of the compatible material in a fashion similar to multiple USACE-Wilmington District navigation projects and maintains the material in accordance with state law. Therefore, this disposal option was not considered to be practicable.

Disposal Alternative 3 - Beach Placement

The Town of Sunset Beach also evaluated multiple beach placement options for the sandy material proposed to be removed from South Jinks Creek. The alternatives include placement along Sunset Beach or Ocean Isle beach, within the Tubbs Inlet littoral zone, and placement along adjacent beaches outside of the Tubbs Inlet zone. The Town abandoned the alternatives considered for placement along Sunset Beach or Ocean Isle Beach primarily due to property ownership concerns. Specifically, residents were unwilling to risk how the state may enforce NCGS 146-6(d), which states "…*the title to land in or immediately along the Atlantic Ocean raised above the mean high water mark by publicly financed projects which involve hydraulic dredging or other deposition of spoil materials or sand vests in the State*." Since state grants would help finance this project, upland property owners felt they would lose the designation of "beach front" ownership if they allowed material placement on their property. As a result, the property owners refused to provide temporary construction easements allowing equipment and personnel on their property to complete the work.

The referenced NCGS does not apply for projects that do not receive public funding. However, public assistance on this project equals 2/3rds of the overall costs, including engineering, construction, and monitoring. For the construction cost to dredge South Jinks Creek alone the grant funding is estimated at approximately $570,000, and that figure excludes the engineering and monitoring costs.

The Town also considered transporting the beach sand from South Jinks Creek to an adjacent beach, such as Oak Island or the eastern end of Ocean Isle Beach. However, DCM considered these placement areas would not be consistent with NCGS 113-229 and therefore could not be allowed. As referenced above,

NCGS 113-229 states "*Clean, beach quality material dredged from navigational channels within the active nearshore, beach or inlet shoal systems shall not be removed permanently from the active nearshore, beach or inlet shoal system"*.

Therefore, the Town determined that the alternative for beach placement was not practicable because (1) it could not be constructed based on the unwillingness for beach front owners within the Tubbs Inlet littoral zone to grant easements to allow the project to be constructed, and (2) the option to place the beach clean sand material outside of the Tubbs Inlet littoral zone is not consistent with State law. (The Town considered requesting a variance from the CRC for this action; however, the CRC can only grant variances to the administrative code, not a state statute.)

Disposal Alternative 4 – Nearshore Placement of Beach Compatible Material

Although nearshore placement is not a widely used option for non-federal stakeholders, the alternative provides a beneficial reuse option for placement of the beach material from South Jinks Creek. Nearshore placement also provides an environmentally acceptable and least cost alternative that meets the purpose and need of the project. The Town evaluated nearshore placement as a last resort for balancing the property owner concerns with beach placement and maintaining consistency with NCGS 113-229.

The USACE Wilmington District conducts nearshore placement of beach compatible material at nearby Lockwoods Folly Inlet and Carolina Beach Inlet. The USACE implements nearshore placement as the most effective available option for maintaining the navigable channels of the referenced inlets. Figure 9 shows the location of Lockwoods Folly Inlet in relation to Sunset Beach. Lockwoods Folly Inlet lies between Oak Island to the east, and Holden Beach to the west. Other sites in North Carolina where nearshore placement routinely occurs under federal authority include Morehead City Harbor, Oregon Inlet, and Hatteras Inlet.

Figure 9. Lockwoods Folly Inlet Location in Relation to Sunset Beach

In efforts to identify the most beneficial location for the nearshore placement, the Town of Sunset Beach evaluated recent hurricane impacts. The Town experienced noticeable erosion impacts in the beach and

dune system along their central shoreline position extending between 3rd Street and 13th Street on Sunset Beach. Although the Town did not document the beach and shoreline impacts, data obtained from the DCM corroborates the general consensus of erosion concerns in the area of 3rd through 13th Streets. Figure 10 shows long-term erosion rates calculated by DCM for the Sunset Beach shoreline. The DCM calculated rates show the shoreline between 3rd Street and 15th Street experienced a landward shoreline recession between 1981 and 2016. Although the recession rate experienced seems minimal, the data shows the shoreline between 3rd Street and 15th Street as the most susceptible to erosion forces. Therefore, the Town elected to place the nearshore material seaward of this shoreline in efforts of providing a secondary benefit from the navigation project. The beach sand placed in the nearshore will add to the sediment supply in the active profile and increase the protection level afforded against wave and current driven shoreline erosion.

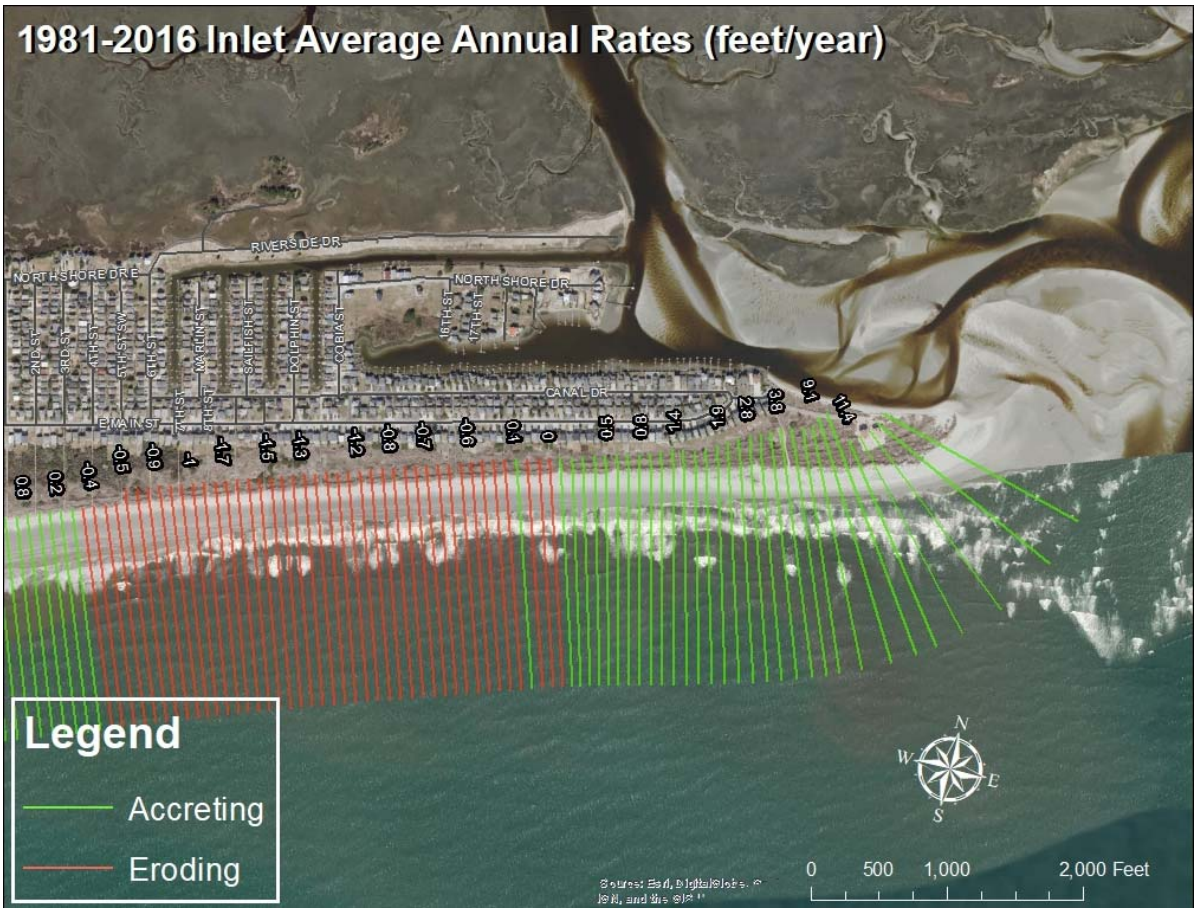

Figure 10. DCM Shoreline Migration Rates for the East End of Sunset Beach (1981-2016)[8]

Figure 16 shows the nearshore placement area in relation to the Sunset Beach shoreline and Tubbs Inlet. The placement area initiates approximately 6,000-ft west of Tubbs Inlet and 600-ft offshore of the MHW contour. The placement site lies in the nearshore region between 3rd Street and 13th Street on Sunset Beach. The placed material can be expected to migrate in a westward direction as a function of the wave driven transport. Historically the dominant long-shore transport for Sunset Beach has progressed to the west, towards Little River Inlet. Figure 11 shows the historical wave directions and significant height offshore of Sunset Beach through a wave rose with the frequency of occurrence designated by the circular bars on the figure. The USACE maintains the publicly available data represented in the wave rose diagram. The wave rose shows that approximately 60% of the wave cases observed in 2014 propagated towards the west, with

the largest percentage coming from the south southeast and southeast direction. If portions of the nearshore material migrated back to Tubbs Inlet, it could not be distinguished from the existing sediment supply already available in the ebb shoal system and nearshore area closer to Tubbs Inlet. Therefore, the relatively small quantity of material proposed for nearshore placement will not create adverse shoaling impacts for Tubbs Inlet or erosion impacts along Sunset Beach.

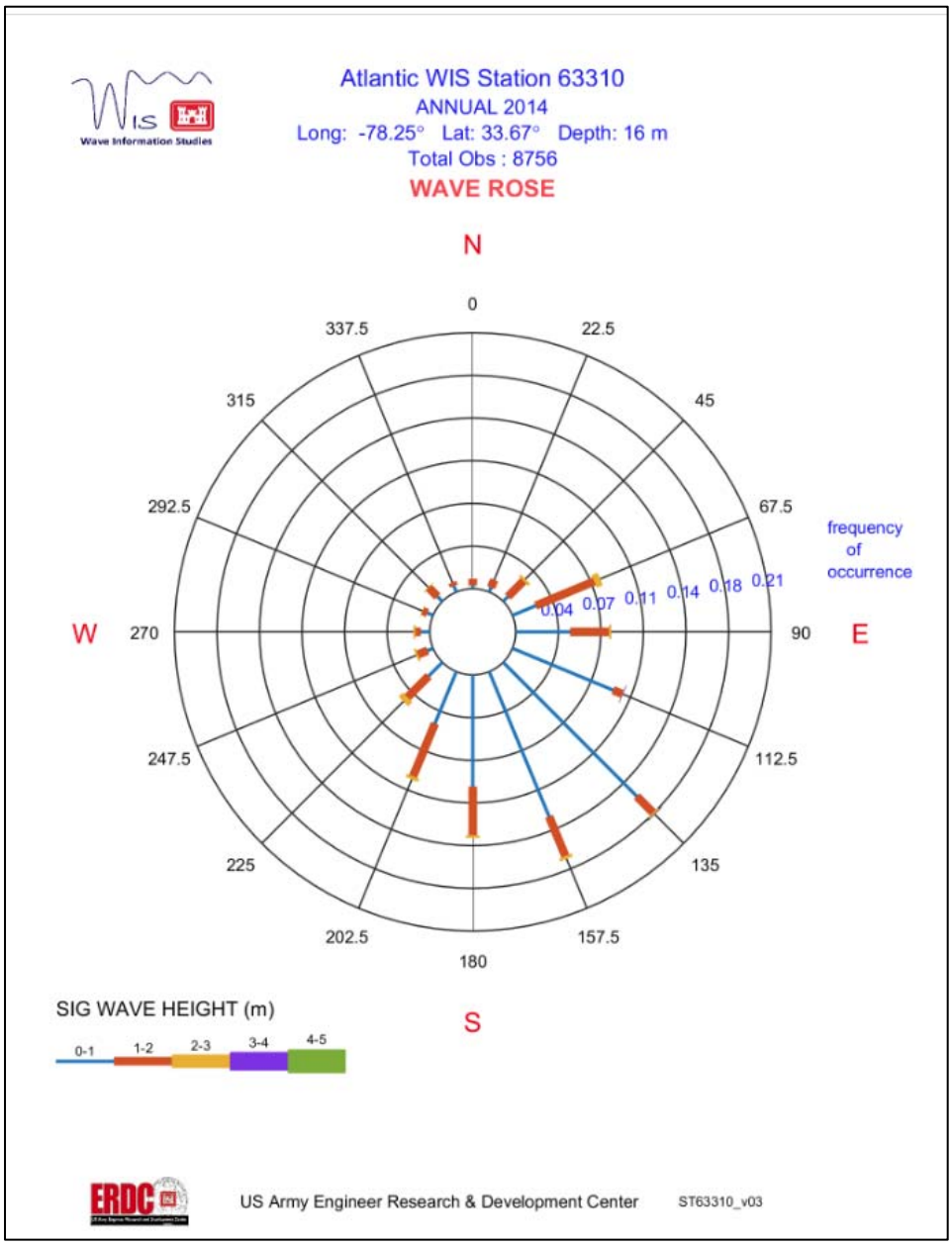

Figure 11. Wave Rose for Sunset Beach

PREFERRED ALTERNATIVE

The following section describes the preferred alternative for the navigation dredging project (Dredging Alternative 4B and Disposal Alternative 4) and the construction process anticipated. The section describes the preferred alternative in terms of the proposed dredge depth and width, or template, as well the end-use placement sites for the compatible beach material and the non-compatible material. The preferred alternative for the maintenance dredging work strives to balance the navigation need for the dredging with the potential adverse impacts that could occur from a construction event.

Proposed Dredge Template

The average depth in the Feeder Channel and Bay Area systems will be increased from approximately -2 to -3 MLW to -5 (-4+1-foot overdredge allowance) and -6 (-5+1) MLW. The Feeder Channel and Bay Area will be dredged to a depth of -6 (-5+1) MLW and finger canals A-D will be dredged to -5 (-4+1) MLW. The Feeder Channel extends approximately 3,500-ft and each of the four (4) finger canals A-D extend approximately 800 feet (3,200-ft total). The Feeder Channel dredge template varies in width between 30-ft and 40-ft, excluding the 3:1 side slope. The Feeder Channel commences with a 40-ft width at the confluence with South Jinks Creek and reduces to a 30-ft width approximately 1,200 feet within the channel. The Feeder Channel maintains the 30-ft width for approximately 2,300 linear feet, and then transitions into Finger Canal A. Each of the four (4) finger canals maintain a constant width of 20-ft and 3H:1V side slopes. Like the Feeder Channel, the Bay Area template maintains a 3H:1V side slope throughout its full 2,200-ft length. The Bay Area template maintains an 80-ft width for approximately 600-ft and then transitions to a 40-ft width over approximately 200 feet. The template continues at the 40-ft width for approximately 300-ft and then transitions to a 20-ft width for the remaining approximate 1,100 linear feet of the template.

South Jinks Creek will be dredged to a depth of -6-ft (-5+1) MLW while maintaining a 100-ft base width. The South Jinks Creek template will differ from the Feeder Channel and Bay Area in respect to the side slopes. The South Jinks Creek template side slopes will maintain a 5H:1V grade throughout its approximate 1,750-ft length. The change in slope for South Jinks Creek stems from the angle of repose anticipated from a non-cohesive sediment such as beach sand. The dredge template strives to mimic the anticipate behavior the sediment will take post construction. This action will expedite the equilibration process and reduce the potential for sediment sloughing from the channel sides and creating unnecessary shoaling in the newly dredged channel. Table 3 provides a summary of the dredge templates for South Jinks Creek, the Bay Area, and the Feeder Channel system and Tab H provides the proposed dredge alignments as part of the permit drawings.

The proposed side slopes for South Jinks Creek show a 5:1 gradient based on the type of material expected and the potential for additional storage capacity. Based on similar projects, non-cohesive sandy material may not provide a stable slope with a more aggressive gradient. Attempts to dredge or force the steeper slope may result in material sloughing or collapsing. This action would force material into the channel footprint and create a premature need for additional future maintenance dredging. A 5:1 slope helps to provide a stable incline that would be less susceptible to material sloughing.

A 5:1 slope also provides additional capacity to contain future sediment shoaling and increase the maintenance interval for future dredging events. Assuming a six (6-ft) foot infilling area between -6 MLW and 0 MLW, the 5:1 side slope provides an additional 2.7 cy/lf (cubic yard per lineal foot) storage capacity along the channel side slopes compared to a 3:1 slope. Over the approximate 1,750 lf channel in South Jinks Creek, this could amount to an additional storage capacity of 4,725 cubic yards (CY), or roughly 12% of

the proposed 40,500 CY dredge volume. Therefore, providing the 5:1 side slope could help extend future maintenance intervals and reduce unnecessary construction impacts.

Material Placement Locations

The Town conducted a significant effort to determine the sediment composition of the dredge material in South Jinks Creek, the Bay Area, and the Feeder Channel system. The Town also sampled the native material along the shorefront to determine the compatibility of the South Jinks Creek material. The effort entailed collection of multiple vibracores spaced on approximate five-hundred-foot intervals throughout the dredge area, as well as collected grab samples along the beach face in accordance with the requirements of 15A NCAC 07H.0312. Figure 12 shows the sediment sample locations in the respective work areas.

Table 3. Dredge Template Descriptions

Area	Existing Avg. Depth (MLW-ft)	Proposed Depth (MLW-ft)	Length (ft)	Width (ft)	Side Slope (H:V)	Est. Volume (CY)	Placement Location
Feeder Channel	-3 MLW	-6 (-5+1) MLW	3,500	30 – 40	3:1	22,000	Landfill
Finger Canals A-D	-2 MLW	-5 (-4+1) MLW	3,200	20	3:1	10,700	Landfill
Bay Area	-2 MLW	-6 (-5+1) MLW	2,200	20 – 80	3:1	15,900	Landfill
S. Jinks Creek	- 1.5 MLW	-6 (-5+1) MLW	1,750	100	5:1	40,500	Nearshore Placement (3rd–13th St)
TOTAL			**10,650**	**Varies**	**Varies**	**89,100**	**Varies**

The vibracore samples were collected and photographed to provide a visual reference for the material composition. The grain size characteristics were then analyzed for each vibracore sample. Discrete sediment samples were selected from each vibracore to define the individual sediment stratums determined within the material layers expected to be dredged. The sediment analysis then combined the grain size characteristic from each respective dredge area to determine if the material met beach compatibility guidelines or if the material would need to be placed in an upland facility. Composite results of the shorefront samples provided the basis for comparison to determine beach compatibility.

Tab K provides the sediment analysis results for the project area. The results indicate the material within the Feeder Channel system and Bay Area do not meet the compatibility standards of the North Carolina Administrative Code (NCAC). Specifically, 15A NCAC 07H.0312 provides the following guidelines for determining if material dredged from navigation projects may be placed on the beach or in the nearshore as a project alternative;

- The average percentage by weight of fine-grained sediment (less than 0.0625 millimeters) shall not exceed the average percentage by weight of fine-grained sediment of the recipient beach characterization plus five percent;
- The average percentage by weight of granular sediment (greater than or equal to 2 millimeters and less than 4.76 millimeters) shall not exceed the average percentage by weight of coarse-sand sediment of the recipient beach characterization plus 10 percent;

- The average percentage by weight of gravel (greater than or equal to 4.76 millimeters and less than 76 millimeters) in a borrow site shall not exceed the average percentage by weight of gravel-sized sediment for the recipient beach characterization plus five percent;
- The average percentage by weight of calcium carbonate in a borrow site shall not exceed the average percentage by weight of calcium carbonate of the recipient beach characterization plus 15 percent; and,
- Sediment and shell material with a diameter greater than or equal to three inches (76 millimeters) is considered incompatible if it has been placed on the beach during the beach fill project, is observed between MLW and the frontal dune toe, and is in excess of twice the background value of material of the same size along any 50,000-square-foot (4,645 square meter) section of beach.

Based on the grain size analysis conducted for the individual dredge areas, the material within the Feeder Channel system and Bay Area does not meet the criteria for beach placement. However, the material within South Jinks Creek must be considered as beach compatible. The navigation project will remove approximately 48,600 CY from the Feeder Channel system and Bay Area and an additional 40,500 CY from South Jinks Creek.

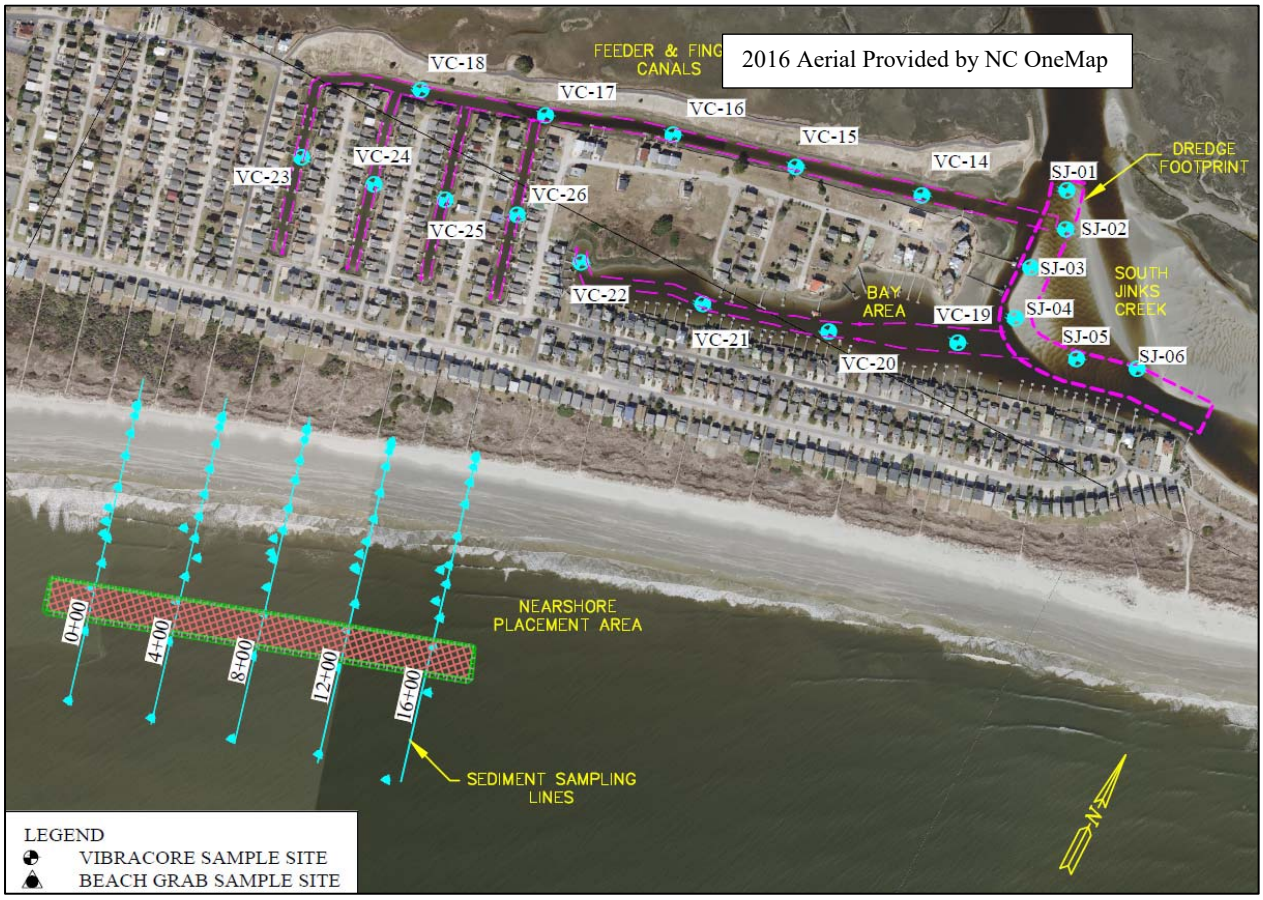

Figure 12. Sediment Sampling Locations

Non-Compatible Material Placement

Dredging operations in the Feeder Channel, including the adjoining finger canals A-D, and the Bay Area will be conducted by a clamshell or bucket dredge/excavator between November 16th and March 30th. Dredging activities for the mechanical equipment will extend through daylight hours but will not entail nighttime operations. Material will be dredged from the respective waterbody and placed on a barge or other floating work plant. The material will be transported to an offloading site designated at the end of Cobia Street within the Feeder Channel. The material will then be placed in a truck or carrying apparatus for transportation to the upland landfill facility. A backhoe or excavator will move the material from the barge to the truck or other hauling equipment. The trucks or hauling equipment will be configured to prohibit spillage during material transport. The roadways or travel ways used for material transport shall be inspected during and after each delivery to the landfill site. Any spillage noted shall be immediately cleaned and removed from the roadways. In addition, any equipment found to be continuously leaking material onto public roadways shall be removed from the project until such time repairs or modifications can be made to facilitate clean and spill fill material transport.

Figure 13 shows the material offloading site on Cobia Street. The material offloading site entails a Town owned road and the Town supports its use for the project. In addition, Tab E (Permit Drawings) shows the final material placement site and permitted landfill on Old Georgetown Road (State Road 1154). Tab G (Consent Agreement) provides a consent of use letter for the landfill site. As indicated in Tab G (Consent Agreement), a formal and legally binding agreement will be negotiated between the Town and the facility owner prior to project commencement.

A delineation of waters on the disposal site has not been conducted by the Town of Sunset Beach. However, in accordance with CAMA permit 79-19, no excavated materials shall be deposited, even temporarily, within 30-ft of any normal high-water line. All excavated materials shall be confined above normal low water level and landward of regularly or irregularly flooded marsh, behind adequate dikes or other retaining structures to prevent spillover of solids into any marsh or surrounding waters. Prior to delivering any non-compatible material to the landfill facility, the USACE and the DCM will be invited to inspect the site and the erosion control measures intended to support the non-compatible material placement.

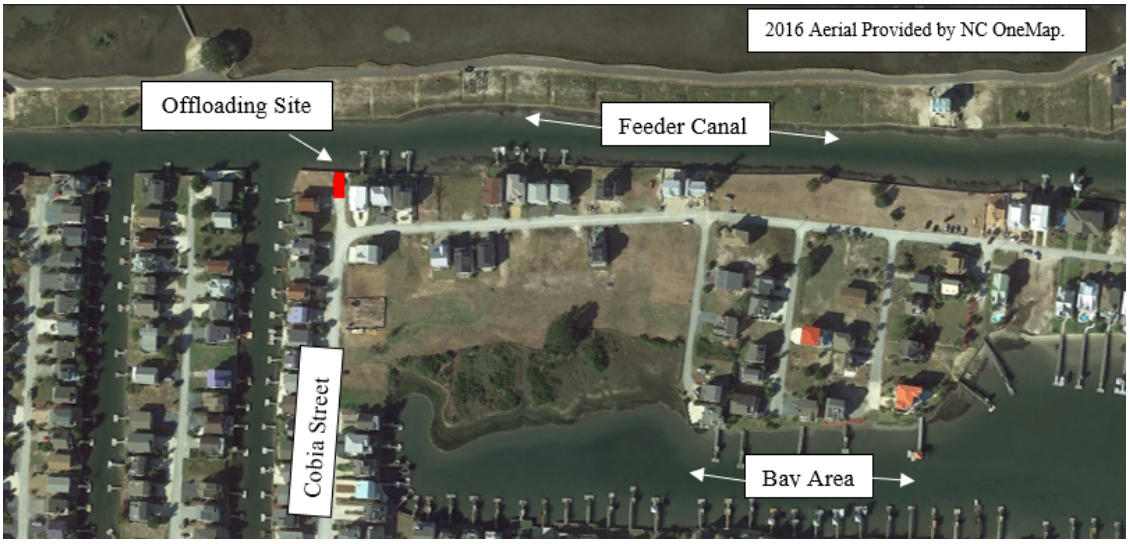

Figure 13. Non-Compatible Material Offloading Site

Since the non-compatible material does not meet the state standards for beach compatibility, the only available option for material disposal entails placement in an upland site. Although other sites may be available, the site chosen provides the closest site identified in the design process. The chosen site also maintains a successful history of providing an end-use placement site for non-compatible material. The site has previously received non-compatible debris removed as part of recovery efforts from Hurricane Matthew.

The Town could have evaluated material placement in a USACE material placement island; however, this alternative would still require the Town to dispose of additional non-compatible material in an upland site. The USACE requires a non-federal entity to remove 125% of the material volume proposed for placement prior to using a federally maintained dredge material management site. Therefore, use of a federal site would only increase the project cost and not alleviate the need for an upland disposal area.

Beach Compatible Material Placement

The material within South Jinks Creek will be hydraulically dredged and placed in the nearshore approximately between 3rd Street and 13th Street on Sunset Beach. The material will be placed along a 2,000-ft long by approximately 200-ft wide template in water depths ranging from approximately -9-ft MLW to -13-ft MLW. The material will be placed to a maximum elevation of -6.0-ft MLW. The South Jinks Creek material meets the minimum standards required for beneficial reuse in accordance with the NC standards for beach compatibility. A total of 6 sediment samples were collected from the proposed dredge area (borrow area) in efforts to define the beach compatible material. The calculated sediment characteristics from the dredge area were compared with composite characteristics of 65 samples analyzed from the recipient beach. Table 4 below shows the analysis results for the dredge material and recipient beach in accordance with the 15A NCAC 07H.0312. Tab K (Sediment Analysis) shows additional detail for the grain size analysis including the sediment collection sites and individual gain size analyses for each sample.

Table 4. Sediment Comparison (South Jinks Creek & Nearshore Site)

Analysis Area	Gravel (%)	Granular (%)	Sand (%)	Fines (%)	Calcium Carbonate
South Jinks Creek	0.00%	0.01%	98.38%	1.60 %	5%
Recipient Beach	0.07 %	0.55 %	98.15%	1.23%	2%

Note: Sediment classifications determined in accordance with NCAC 15a07h.0312.

The hydraulic dredging work will be conducted on a 24-hr per day schedule by a cutterhead dredge between November 16th and March 31st, in accordance with the USFWS August 2017 Statewide Programmatic Biological Opinion (SPBO). The beneficial reuse material will be transported through an approximate 7,000-ft hydraulic pipeline for nearshore placement. The pipeline will most likely be anchored within South Jinks Creek immediately behind the hydraulic dredge plant and shall be marked with reflective buoys as recommended by the USCG. Once the floating pipeline traverses landward of the MHW line, it will not be allowed to meander back into navigable waters. However, the shore pipe may be forced to cross navigable waterways at the Bay Area and Feeder Channel confluence with Jinks Creek. The pipeline will be anchored to the channel bottom to avoid creating a marine hazard at each crossing. The pipeline will also cross the waterways perpendicular to the directions of travel to minimize the pipeline length within the navigation channel. The pipeline will be anchored in the deepest depth available to avoid blocking navigation and will have buoys attached approximately every 25-feet within South Jinks Creek. Signage will also be provided and visible from both directions of navigation to mark the pipeline crossing.

Along the beachfront, the pipeline will be located as close to the dune as reasonable without traversing over beach grass or other established vegetation. Markings shall be installed along the pipe to warn beach goers to use caution around the pipeline and to remain off the equipment. Sand ramps will also be constructed for pedestrian crossings. The ramps may also be used for emergency beach access by the Town or construction related access for the Contractor. At least one (1) sand ramp will be constructed and maintained where the pipeline turns to enter the Atlantic Ocean. The sand ramp location, as well as the final pipeline location, will be coordinated with USFWS staff and the NCWRC to identify the best path for avoiding shorebird habitat.

The pipeline will traverse across the beach along the shortest reasonable path to enter the Atlantic Ocean. The pipeline will be anchored once it passes the breaker zone in the nearshore to prevent unnecessary movement in the pipe. The pipeline route in the Atlantic Ocean shall be marked with reflective buoys on approximate 500-ft intervals. Smaller spacings may be used if pedestrian use of the nearshore area is likely.

The pipeline will traverse to a barge anchored in the placement area. An excavator may be mounted on the barge to help control and maneuver the pipeline outfall. Regardless, the pipeline will be secured to the barge with the outfall positioned overboard. The pipeline will face into the placement area. As material placement occurs, the barge will be maneuvered through the placement area by anchors secured along the four (4) corners of the barge. Placement operations will occur across the approximate 200-ft wide template prior to moving the barge west or parallel to the beach in the placement area.

Placement operations will not be allowed to move east or back over an area that has already received material without measuring the current material height. The material will not be placed higher than -6-ft MLW at any time. If material accumulates at a stage higher than -6-ft MLW, excess material shall be removed immediately and prior to advancing further with the placement operations.

Hydrographic surveys shall be conducted before and after nearshore placement occurs. The surveys shall be conducted in perpendicular and parallel directions to the beach. The surveys will be used to verify material placement did not encroach above the -6-ft MLW contour. Any deviation found where material placement occurs above the -6-ft MLW contour shall be remediated by leveling the material with an excavator positioned on the barge or through other mechanical means. Hydraulic dredging shall not be allowed as a measure to fix or remediate the material accumulation.

The nearshore placement will strive to maintain a placement density no greater than 25 CY per foot. This will provide a low-density placement option that allows the placed material to blend into the existing contours within a six (6) to 18-month period. The low-density placement will also help avoid visual impacts to the upland properties, as the material will disburse in the nearshore zone and not accumulate along the beachfront. The material is anticipated to provide additional storm protection, but the benefit should be minimal due to the low-density placement.

Monitoring Initiatives

The Town of Sunset Beach will implement construction and physical monitoring efforts to document the project performance. Since nearshore placement remains a rare or infrequent practice for non-federal entities, the monitoring results may assist in guiding future projects. Turbidity monitoring shall be conducted during the construction efforts and physical monitoring will help confirm the long-term project performance.

Turbidity Monitoring

During nearshore placement operations, the Town of Sunset Beach will monitor the turbidity impacts of the nearshore placement efforts. Turbidity measurements shall be taken every 4 hours during nearshore placement operations. Samples will be collected within a 2,000-ft mixing zone extending from the nearshore placement area in the downdrift direction. A sample will also be collected at the entrance to Tubbs Inlet during flood tide events. The samples will be collected within the densest portion of any noticeable plume identified at the mixing zone boundary. The results of the turbidity tests will be compared with background conditions collected up-current of the placement operations.

Samples will be collected at the surface, mid-depth, and bottom at each test location. If the samples taken in the mixing zone exceed 20 Nephelometric Turbidity Units (NTU's), or the background measurements (whichever is greater), placement operations will cease until the measurements return to background conditions. If turbidity readings frequently exceed the monitoring protocols, the pipeline outfall used for the nearshore placement may be lowered to the ocean floor to help minimize suspended solids. If the pipeline is lowered, the Town will raise the pipeline at least once every four (4) hours to observe the material coming out of the pipe. This will help to reduce the potential for non-compatible material placement in the nearshore.

Physical Monitoring

The Town will also conduct physical monitoring on an annual schedule to track the project performance. The monitoring will entail hydrographic surveys of the dredge areas and the nearshore placement locations. The monitoring will identify the sediment infilling rate within South Jinks Creek, the Bay Area, and the Feeder Channel system. The infilling rate will be reported as an annual shoaling rate for comparison with other monitoring results. The physical monitoring will assist the Town in forecasting the performance life of the maintenance project. Surveys will also be collected in Tubbs Inlet and North Jinks Creek to document if increased sediment shoaling occurs as a result of the maintenance project. Surveys of the nearshore placement area will be used to investigate how the placed material disperses into the existing nearshore sediment.

The monitoring efforts will be conducted annually for a minimum of three (3) years to establish a shoaling rate across the dredge area. Surveys within the dredge area may continue past the three (3) year timeframe at the Town's discretion. Surveys of the nearshore placement area will continue annually as long as traces of the placed sediment remain. The monitoring will evaluate if sediment remains by evaluating if the contours of the placement area have returned to pre-construction conditions. The monitoring will also identify the most likely migration of the placed sediment.

Construction Costs

A significant factor for any capital project entails the estimated construction costs. The Town of Sunset Beach considered the estimated costs associated with the construction of each reasonable option evaluated to help provide the most prudent path forward. Table 5 provides the estimated construction cost for the overall navigation project. The estimated costs stem from similar projects conducted along the North Carolina coast between 2016 and the present. The costs also include estimates for the maintenance dredging of Mary's and Turtle Creek, which are not part of this alternative analysis but remain a vital component of the overall navigation project. The estimated costs assume mobilization fees and other general costs will be allocated to each project component, or work area, in accordance with the volume of material dredged.

Table 5. Preferred Alternative - Estimated Construction Cost

	Dredge & Fill					Tipping Fee		Total (w/ 15% Contingency)
Site	Dredge Volume (CY)	Unit Costs ($/CY)	Sub-Total ($)	Spoil Island Improvements ($)	Mobilization & Bonds[2]	Unit Costs ($/CY)	Sub-Total ($)	
Mary's Creek	8,100	$ 42.00	$ 340,200	$ -	$ 10,576	$ 5.75	$ 46,575.00	$ 456,953.65
Turtle Creek	7,800	$ 42.00	$ 327,600	$ -	$ 10,184	$ 5.75	$ 44,850.00	$ 440,029.10
Feeder Canal & Finger Canals	32,700	$ 42.00	$ 1,373,400	$ -	$ 42,695	$ 5.75	$ 188,025.00	$ 1,844,738.00
Bay Area	15,900	$ 42.00	$ 667,800	$ -	$ 20,760	$ 5.75	$ 91,425.00	$ 896,982.75
Jinks Creek (Non-Compatible)		$ 6.75	$ -	$ -	$ -	$ -	$ -	$ -
Jinks Creek (Compatible)	40,500	$ 9.50	$ 384,750		$355,785	$ -	$ -	$ 851,615.25
Total	105,000		$ 3,093,750		$ 440,000		$ 370,875	$ 4,490,318.75

HYRODYNAMIC IMPACT ANALYSIS

The design process considered several alternatives and their potential to change the hydrodynamic patterns of the work area a result of the project prior to selecting the preferred alternative as the most environmentally acceptable and economically feasible. The design evaluated the following hydrodynamic properties to determine the most practical path forward:

- Change in tidal velocities & flow rates
- Increased flooding potential

Tidal Velocities Evaluation

The design evaluation used numerical modeling software to assist in determining how the proposed project may affect the existing tidal velocities in South Jinks Creek. A change in tidal velocity could be expected to change the shoaling or scour potential along the Jinks Creek shoreline, or at one of the entrances to Jinks Creek. Tab L provides the modeling report along with a digital copy of the supporting files used in the RMA2 hydrodynamic modeling analysis. The modeling effort evaluated how tidal velocities may change along 10 transects established approximate to the work area. Figure 14 provides an aerial view of the transect locations positioned within the AIWW, Jinks Creek, and Tubbs Inlet.

The modeling analysis evaluated three (3) design alignments to investigate how the dredging event may change the tidal velocities entering Jinks Creek through either Tubbs Inlet or the AIWW. The alignments varied in proposed dredge depths, widths, and lengths for the analysis as shown below:

- Conceptual - 100' Wide @ -7 MLW (entire channel)
- Maximum - 100' Wide @ -7 MLW (entire channel & Tubbs Inlet)
- Preferred - 40' ~ 50' Wide @ -5 MLW (northern Jinks Creek)
  80'~100' Wide @ -7 MLW (southern Jinks Creek).

Note: The design removed northern Jinks Creek from the preferred alignment and minimized the dredge depth in south Jinks Creek to -6 MLW after the completion of the modeling analysis.

The results indicate the preferred alignment would not create a significant change in the tidal patterns for Jinks Creek and the surrounding waters. The change in tidal velocities should range below three (3%) percent for normal or spring tide conditions and extreme storm scenarios. Based on the data transects sampled, the modeling indicates the largest increase in maximum velocities would equal approximately 2.6% (0.07 ft/sec) and would occur approximate to the AIWW confluence with Jinks Creek. The modeling

suggested the maximum velocity change would occur during normal or spring tide conditions as opposed to extreme storm conditions. The spring tide modeling also suggested the maximum velocities traveling towards Ocean Isle Beach from Tubbs Inlet would experience a slight decrease in magnitude. Table 6 shows the estimated changes in the maximum velocities for both the spring tide and extreme storm conditions.

The largest increase in the maximum velocities estimated under the extreme storm conditions also occurs at the Jinks Creek and AIWW confluence. The modeling estimated the increase equaled approximately 0.05 ft/sec at Transect T3 for the extreme storm condition scenario. Although the greatest increase in velocity occurs during the spring tide conditions, the storm condition velocities reach higher magnitudes due to the abrupt tidal forcing. Storm surge created from a major hurricane will encapsulate interior coastal waterways considerably quicker than a normal astronomical tide. This creates a steeper velocity gradient and overall greater velocity magnitude compared to a normal astronomical tide. However, the analysis estimates the greatest change or increase in maximum velocities generated through the preferred alignment would occur during spring tide conditions.

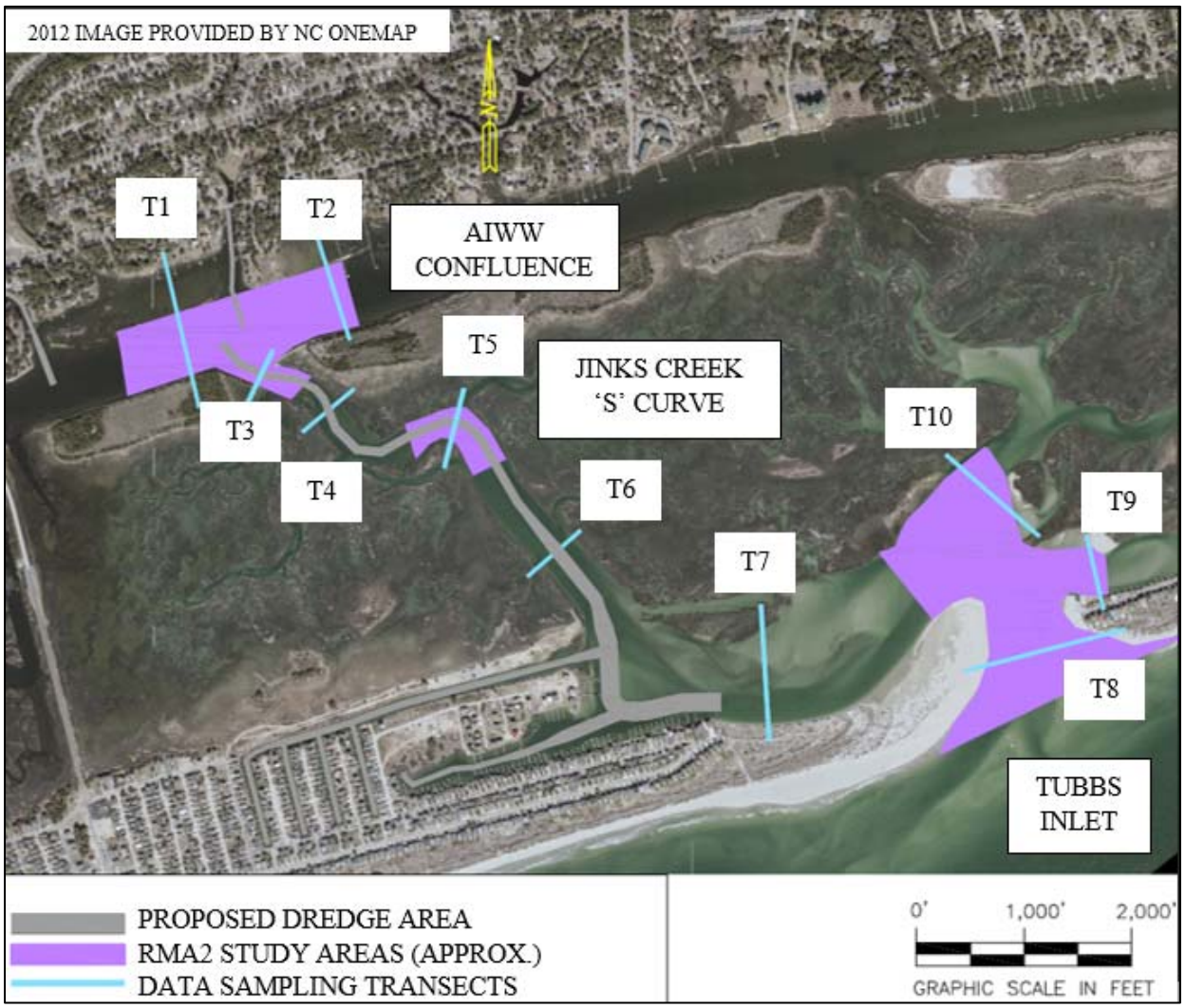

Figure 14. RMA Transects Established Approximate to the South Jinks Creek

Table 6. Maximum Velocities for the Preferred Alignment

Transect		Spring Tide Conditions			Extreme Storm Conditions		
		2016 Existing Conditions	Preferred Alignment	Percent Change (%)	2016 Existing Conditions	Preferred Alignment	Percent Change (%)
AIWW Confluence	T1	1.53 ft/sec	1.56 ft/sec	1.6%	-	-	-
	T2	1.05 ft/sec	1.06 ft/sec	0.8 %	-	-	-
	T3	2.75 ft/sec	2.82 ft/sec	2.6%	2.02	2.07	2.4%
'S' Curve Alignment	T4	3.45 ft/sec	3.46 ft/sec	0.3%	-	-	-
	T5	2.86 ft/sec	2.88 ft/sec	0.7%	3.07	3.11	1.3%
	T6	3.01 ft/sec	3.02 ft/sec	0.3%	-	-	-
Tubbs Inlet	T7	2.28 ft/sec	2.30 ft/sec	0.9%	3.41	3.45	1.2%
	T8	4.72 ft/sec	4.74 ft/sec	0.4%	-	-	-
	T9	3.69 ft/sec	3.68 ft/sec	-0.3%	-	-	-
	T10	2.45 ft/sec	2.44 ft/sec	-0.4%	-	-	-

1. Spring tide conditions simulated from Nov. 13, 2004 (13:15) to Nov. 20, 2004 (13:15).
2. Extreme storm conditions simulated from Sept. 20, 1989 (10:30) to Sept. 22, 1989 (18:29).
3. (-) indicates transect was not included in the analysis.
4. Values are depth averaged.

Flow Rate Evaluation

The modeling also evaluated potential changes in the flow rate or volume of water the proposed dredging would allow through Jinks Creek. A change in the volume of water, or tidal prism, traversing through Jinks Creek could also be expected to alter the shoaling or scour potential in Jinks Creek. The flow rate measurements determined from the modeling suggest the preferred alignment will not significantly change the shoaling or scouring patterns within the study area. Table 7 provides the percent increase in flow rate measured at each transect in the modeling analysis. The largest increase in the flow rate occurs during the spring tide analysis adjacent to the Jinks Creek 'S' curve alignment (T4) and equals approximately 3.2% for the flood tide cycle. Although generally the ebb tide flow rates experience a higher percent change at all transects, the flood tide flow rates remain significantly higher in magnitude. Therefore, the analysis considers the changes experienced during the flood tide cycle as the controlling values. The analysis also evaluated how the flow rates may change during extreme storm conditions and found similar results compared to the spring tide analysis shown in Table 7. The largest percent increase in flow rates calculated during an extreme storm condition occurs adjacent to the AIWW confluence (T3) and equals approximately 1.9%.

Flooding Potential

The RMA numerical model also assisted in evaluating the flooding potential or change in water surface elevation expected under an extreme storm condition, with the proposed dredging. The modeling showed a negligible increase in water surface elevations could be expected as a result of constructing the preferred alternative. The modeling estimated the maximum increase to occur in southern Jinks Creek and may equal on the order of 1/64th of an inch. The increase estimated for the remaining project area ranged between 0 and 1/100th of an inch. Figure 15 shows the estimated change in maximum water surface elevations for the extreme storm condition.

Table 7. Average Flow Rate for the Preferred Alignment (Flood Tide Cycle)

Transect		Spring Tide Conditions			Extreme Storm Conditions		
		2016 Existing Conditions	Preferred Alignment	Percent Change (%)	2016 Existing Conditions	Preferred Alignment	Percent Change (%)
AIWW Confluence	T1	3,140 cfs	3,190 cfs	1.6%	-	-	-
	T2	1,450 cfs	1,440 cfs	-0.7%	-	-	-
	T3	2,450 cfs	2,520 cfs	2.9%	3,720 cfs	3,790	1.9%
'S' Curve Alignment	T4	2,790 cfs	2,880 cfs	3.2%	-	-	-
	T5	3,230 cfs	3,300 cfs	2.2%	5,680 cfs	5,770 cfs	1.5%
	T6	4,220 cfs	4,290 cfs	1.7%	-	-	-
Tubbs Inlet	T7[1]	5,740 cfs	5,840 cfs	1.7%	13,090 cfs	13,270 cfs	1.4%
	T8	12,110 cfs	12,200 cfs	1.0%	-	-	-
	T9	1,230 cfs	1,230 cfs	0.0%	-	-	-
	T10	2,180 cfs	2,170 cfs	-0.5%	-	-	-

1. Flood tide flow rates are considered the governing values and therefore, the ebb flow values have been removed for clarity, except for Transect T7. Along this transect the ebb tide flow rates provide the governing conditions.
2. Spring tide conditions simulated from Nov. 13, 2004 (13:15) to Nov. 20, 2004 (13:15).
3. Extreme storm conditions simulated from Sept. 20, 1989 (10:30) to Sept. 22, 1989 (18:29).
4. (-) indicates transect was not included in the analysis.

Figure 15. Preferred Alignment – Maximum Water Surface Elevation Change (Extreme Storm Condition)

Changes in Preferred Alternative

As noted, the hydrodynamic impact analysis evaluated a preferred alternative that extended through north Jinks Creek and maintained a depth of -7-ft MLW in south Jinks Creek. However, due to avoidance and minimization efforts discussed herein, the Town elected to reduce the preferred alternative after completion

of the modeling analysis. The reduction in the preferred alternative entails removing north Jinks Creek from the project and raising the dredge elevation in south Jinks Creek to -6-ft MLW. Since the modeling showed no significant impacts resulting from the larger alternative, the revised dredge alignment will also not create any adverse hydrodynamic impacts.

The changes in the preferred alignment also provide additional support that no adverse hydrodynamic impacts should be anticipated. By removing north Jinks Creek from the project, the proposed dredging will not encroach on the critical cross-section governing tidal flow into Jinks Creek from the AIWW or Atlantic Ocean. The critical cross-section (A_c) defines the channel segment having the narrowest base and navigational depth. The critical cross-section governs the volume and velocity of tidal currents entering a system through a tidal event. Tab M provides cross-sections of Jinks Creek on 200-ft intervals. The information shows the critical cross-section for north Jinks Creek exists approximate to the AIWW confluence, between stations 2+00 and 6+00, where the controlling depth equals approximately -2-ft MLW. Although Tab M does not include cross-sections of Tubbs Inlet, Figure 16 shows the aerial view of the dredge area in relation to Tubbs Inlet. The aerial shows sediment shoaling between the inlet and the proposed dredge area approaches MLW elevation and creates the controlling alignment for tidal flows. Therefore, since dredging will not impose on either of these areas, the tidal velocities traversing Jinks Creek will not experience a significant change.

Figure 16. Tubbs Inlet Vicinity to the South Jinks Creek, Feeder Channel, and Bay Area Work Sites

CUMULATIVE IMPACT ANALYSIS

Cumulative impacts are impacts on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future. Cumulative impacts can result from individually minor direct and indirect but collectively significant actions taking place over a period of time. A cumulative effects assessment should consider how the direct and indirect environmental effects caused by the proposed activity requiring Department of the Army (DA) authorization contribute to cumulative effects, and whether that incremental contribution is significant or not.

This analysis follows the 11-step process outlined by the CEQ in the 1997 publication Considering Cumulative Effects Under the National Environmental Policy Act (Table 8).

Table 8. Steps in the Cumulative Effects Analysis (as adapted from CEQ 1997).

Environmental Impact Assessment Components	CEA Steps
I. Scoping	a. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals. b. Establish the geographic scope for the analysis. c. Establish the time frame for the analysis. d. Identify other actions affecting the resources, ecosystems, and human communities of concern.
II. Describing the Affected Environment	a. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stresses. b. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds. c. Define a baseline condition for the resources, ecosystems, and human communities.
III. Determining the Environmental Consequences	a. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities. b. Determine the magnitude and significance of the cumulative effects. c. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects. d. Monitor the cumulative effects of the selected alternative and adapt management

Significant Cumulative Effects Issues

This assessment of cumulative impacts will focus on significant coastal and estuarine resources and the impacts associated with dredging maintenance activities within an estuarine environment and the disposal of beach compatible sediment within the nearshore of Sunset Beach.

Cumulative effects analysis is an iterative process in which consequences are assessed repeatedly following incorporation of avoidance, minimization, and mitigation measures into the alternatives considered. Monitoring is the last step in determining the cumulative effects that ultimately results from the action. The

significance of cumulative effects depends upon the ecosystem, resource baseline conditions, and relevant resource stress thresholds (CEQ, 1997).

Cumulative impacts result from spatial (concentration of a multiple impacts in a given area) and temporal (repeated occurrence of impacts in a given area) crowding of environmental perturbations. In general, many environmental effects could be considered as cumulative and almost all systems have already been modified, degraded, or enhanced, through anthropogenic actions.

Resource Issues and Assessment

The proposed project, in addition to past projects and any reasonably foreseeable future actions (RFFA), primarily affects the following resources:

1. Shellfish and their habitats (including benthic communities),
2. Finfish (including federally managed species) and their habitats,
3. Water quality, and
4. Human communities.

These resources may be affected by the interaction and/or additive effects of one or more projects over time within the geographic scope. Types of cumulative effects include temporal crowding (i.e. frequent and repetitive effects), space crowding (i.e. concentration of multiple stressors in a given area), and compounding effects of space and temporal crowding.

Geographic Scope

This analysis will consider the impacts associated with navigational dredging in South Jinks Creek, the Bay Area, and the Feeder Channel system. It will focus on cumulative impacts within the project area since the affected waters under the current proposal have been dredged in the past. The navigation project in South Jinks Creek will also include the Bay Area and Feeder Channel system positioned in the east portion of Sunset Beach. South Jinks Creek is part of the Jinks Creek connector channel that extends from the Intracoastal Waterway (AIWW) to Tubbs Inlet and the Atlantic Ocean. The Bay Area entails one (1) residential canal and the Feeder Channel system includes one (1) main channel connected to four (4) residential finger canals referenced as Canals A – D.

Time Frame

This analysis considers past, present, and reasonably foreseeable future sand placements and maintenance dredging on a project vicinity scale over a 15-year period from 2015 to 2030. The time period was selected due to the navigational restoration usage this project presents, and the existing high levels of build-out that currently exists on Sunset Beach. Because this project will be restoring the navigational usage of South Jinks Creek, the Bay Area, and the Feeder Channel system, this project should be considered to have minimal "growth inducing" potential. This project is being completed by Sunset Beach to restore the navigational access that was present in the past, and this dredging project should not lead to an increased level of upland development on the island. In addition, most (but not all) portions of the Sunset Beach area are already close to or at full build-out capacity. With these factors in mind, a shorter time period for the study (i.e. 5 years past and 10 years future) was chosen.

Actions Affecting Resources of Concern

This analysis of cumulative effects of the proposed action will focus on the impacts of dredging from the proposed navigational channel sites and nearshore placement of sand material on the beach. Sources of beach impacts include local beach maintenance activities (i.e. sand placement), and disposal of dredged material from maintenance of navigation channels. Of particular concern are macroinvertebrate, fisheries, shorebird, and sea turtle species that utilize or occur in or adjacent to nearshore environments. These resources are also impacted by natural events and anthropogenic activities that are unrelated to disposal of sand on the beach as discussed below.

Federal (USACE) Navigation Beach Disposal

Maintenance material from dredging the AIWW, inlets, and connecting channels in the vicinity of the study area has historically been disposed within authorized disposal limits along the beach. Throughout North Carolina, a total of approximately 41 miles of beach (~13% of North Carolina beaches) are authorized for disposal of beach quality dredged material from maintenance dredging of navigation channels. However, not all these projects are routinely dredged, and a majority of the authorized disposal limits are not actually disposed on to the full extent. Additionally, many of the authorized disposal limits overlap with existing federal or non-federal beach projects. Therefore, without double counting for overlapping beach projects, navigation dredged material is placed along approximately 19 miles, or 6% of North Carolina beaches. The Wilmington District currently uses about 50 percent of the length of beach in North Carolina that is approved for this purpose and does not anticipate significant increases in beach disposal in the foreseeable future.

Beach quality sand is a valuable resource that is highly sought by beach communities to provide wide beaches for recreation and tourism, as well as to provide hurricane and wave protection for public and private property in these communities. When beach quality sand is dredged from navigation projects, it has become common practice of the USACE to make this resource available to beach communities when applicable laws, regulations, funding and other considerations allow. Placement of this sand on beaches represents return of sediment to the littoral system. The design of beach placement sites generally extends the elevation of the natural berm seaward.

Significant Resources

Based on scoping comments from resource agencies and stakeholders, the primary concerns with the proposed dredging and beach disposal are direct and indirect impacts to macro-invertebrates, fish, shorebirds, and threatened and endangered species. Federally listed threatened or endangered species which could be present along the North Carolina coast are the blue whale, finback whale, humpback whale, North Atlantic right whale, sei whale, sperm whale, West Indian Manatee, Green Sea Turtle, Hawksbill Sea Turtle, Kemp's Ridley Sea Turtle, Leatherback Sea Turtle, Loggerhead Sea Turtle, Shortnose Sturgeon, Atlantic Sturgeon, Seabeach Amaranth, and Piping Plover. Impacts to listed species are not expected to occur as a result of this project and are documented in the **Biological Assessment** (Tab N) for this project.

Nearshore Zones

Dredging of navigational channels typically introduce fill into nearshore waters out to a specified depth of closure, usually from about –20 to –25 feet NGVD. Benthic species, phytoplankton, and seaweeds are the major primary producers in this community. Many species of fish-eating birds are typically found in this

area including gulls, terns, cormorants, loons, and grebes. Marine mammals and sea turtles also are frequently seen in this area.

In the project area, the material within South Jinks Creek will be hydraulically dredged and placed in the nearshore between approximate 3rd Street and 13th Street on Sunset Beach. The material will be placed along a 2,000-ft by approximately 200-ft wide template in water depths ranging from approximately -9-ft MLW to -13-ft MLW. The material will be placed to a maximum (highest) elevation of -6.0-ft MLW.

Estuarine Zone

The estuarine zone includes Essential Fish Habitat areas such as: estuarine soft bottom, estuarine water column. South Jinks Creek, the Feeder Channel, and the Bay Area in Sunset Beach, are all inclusive of the Estuarine Zone.

Estuarine soft bottom habitats in the project area include the soft bottom substrate occurring in Sunset Beach. This habitat type is comprised of sand as well as inorganic muds, organic muds, and peat. Nutrients are typically provided by riverine sources and transported via wind tides in addition to lunar tidal exchange.

The estuarine water column extends from the estuarine bottom to the surface waters and is especially important as it directly affects all other estuarine aquatic habitats. This habitat is characterized by the oligohaline (estuarine) waters present in Sunset Beach with seasonally variable salinity levels. Distinct zones within the water column can be defined by parameters such as salinity, temperature, and dissolved oxygen. Water column zonation continually fluctuates and is a function of tidal dynamics, season, nutrient levels, and ocean proximity.

Dredge area vegetation includes Spartina sp. along waterway edges and banks, with some sparse trees and maintained/disturbed lawns within residential lots along these channels. According to NOAA tide charts, the tidal range is approximately five feet or greater. Habitat within the channels targeted for dredging is considered shallow subtidal and intertidal. The deposition of sand at various locations in the channels targeted for dredging has resulted in the random formation of shoals and shallow areas that affect vessel mobility. Channel substrate consists of muck, shell, sand, and anoxic mucky sediments. Jinks Creek, which serves as the central link between the finger canal/open ocean areas to the south and the AIWW to the north, in most areas is considered to contain the EFH habitats (estuarine soft bottom and estuarine water column). The Feeder Channel, as well as the Bay Area, are also inclusive to these habitats. While there will be dredging along the estuarine soft bottom, and turbidity will increase in the water column, the impacts will be short-term and localized. These species are highly mobile organisms, and would most likely disperse from the area, upon construction, and return upon completion

Shoreline and Sand Transport

The drivers of sand transport both along shore and cross shore include wind, waves, and currents. For the proposed project along Sunset Beach, the project will not modify these drivers. The project does not include placement of sand within the inlet complexes and it is not anticipated that the small relative quantities from the project would influence the large-scale physical drivers of the inlet system.

Resource Capacity to Withstand Stress and Regulatory Thresholds

There are no known thresholds relating to the extent of ocean bottom that can be disturbed without significant population level impacts to fisheries and benthic species. Therefore, a comparison of cumulative impacts to established thresholds is not made. However, the potential impact area of the proposed project

is small relative to the area of available similar habitat on a local, vicinity, and statewide basis and the quick recovery rate of opportunistic species. It is expected that there is a low risk that the direct and cumulative impacts of the proposed action and other known similar activities would reach a threshold with potential for population level impacts on important commercial or recreational fish stocks. Regarding physical habitat alterations it is expected that alterations in depths and bottom sediment may occur and be persistent for some borrow areas. However, site modifications should be within the range of tolerance by these species and, although man-altered, consistent with natural variations in depth and sediment within the geographic range of EFH for local commercial fish species. Although this project aims to dredge from navigation channels, rather than an offshore borrow site, Byrnes et al. 2003[9] provided an assessment of potential impacts to benthic organisms from dredging. The Final Report, Collection of Environmental Data Within Sand Resource Areas Offshore North Carolina and The Environmental Implications of Sand Removal for Coastal and Beach Restoration (Byrnes et al. 2003):

Because the sedimentary regime of North Carolina sand source areas is vertically uniform, recolonization of surficial sediments by later successional stages likely will proceed even if dredged shoals are not completely reestablished. Furthermore, dredging of only a small portion of the area within each of the resource areas will ensure that a supply of non-transitional, motile taxa will be available for rapid migration into dredged sites. While community composition may differ for a period of time after the last dredging, the infaunal assemblage type that exists in mined areas will be similar to naturally occurring assemblages in the study area, particularly those assemblages inhabiting inter-ridge troughs. Based on previous observations of infaunal reestablishment in dredged sites, the infaunal community in dredged sites most likely will become reestablished within 2 years, and will exhibit levels of infaunal abundance, diversity, and composition comparable to nearby non-dredged sites.

While the proposed disposal may impact benthic macrofauna, these organisms are highly resilient and any effects should be localized, short-term, and reversible.

Magnitude and Significance of Resource Impacts

Site Specific Impacts

Construction activities will produce noise, turbidity, and siltation, thereby creating short-term, localized impacts to the project area. Dredging activities could create a short-term decrease in dissolved oxygen. Many, if not all, of the fish species within the project area would be expected to escape the area during construction activities, and construction disturbances would not be expected to be lethal to any fish species within the project area.

Information from the North Carolina Coastal Habitat Protection Plan[10] found the following, when considering impacts on benthic organisms in the project area:

Offshore sand bottom communities along the North Carolina coast are relatively diverse habitats containing over a hundred polychaete taxa (Lindquist et al. 1994; Posey and Ambrose 1994). Tube dwellers and permanent burrow dwellers are important benthic prey for fish and epibenthic invertebrates. These species are also most susceptible to sediment deposition, turbidity, erosion, or changes in sediment structure associated with sand mining activities, compared to other more mobile polychaetes (Hackney et al. 1996). Polychaetes and amphipods were the most abundant, although oligochaetes, bivalves, and crabs were also highly represented (Van Dolah et al. 1994). On ebb tide deltas, polychaetes, crustaceans (primarily amphipods), and mollusks (primarily bivalves) were the most abundant infauna, while decapod crustaceans and echinoderms (sand dollars) dominated the epifauna. Because periodic storms can affect benthic

communities along the Atlantic coast to a depth of about 115 ft (35 m), the soft bottom community tends to be dominated by opportunistic taxa that are adapted to recover relatively quickly from disturbance (Posey and Alphin 2001).

At the ecosystem level, increased turbidity could result in reduced ecosystem productivity (ability of the ecosystem to produce and export energy) and nursery value by elimination of organisms that cannot easily flee construction activities, and the displacement of mobile organisms. For individual organisms, turbidity can impair visual predation success, predator avoidance, and an organism's ability to take in oxygen through clogging of respiratory organs. Siltation could alter invertebrate animal communities within the project area. Again, these potential impacts are expected to be short-term and temporary in nature. Mobile animals would likely avoid the area during the construction phase, but likely return once construction is complete and pre-construction conditions return. Benthic organisms would likely recover rapidly post-construction, as most benthic communities are resilient and recolonize quickly after short-term impacts.

Nearshore Areas

Regarding federal initiatives, the USACE Wilmington District conducts nearshore placement of beach compatible material at nearby Lockwoods Folly Inlet and Carolina Beach Inlet. The USACE implements nearshore placement as the most effective available option for maintaining the navigable channels of the referenced inlets. Since approximately 2010, the Town of Sunset Beach has been working to establish and maintain a navigable channel within the project area. Other sites in North Carolina where nearshore placement routinely occurs under federal authority include Morehead City Harbor, Oregon Inlet, and Hatteras Inlet.

In efforts to identify the most beneficial location for the nearshore placement, the Town of Sunset Beach evaluated recent hurricane impacts. The Town experienced noticeable erosion impacts in the beach and dune system along their central shoreline region extending between 3rd Street and 13th Street on Sunset Beach. Although the Town did not document the beach and shoreline impacts, data obtained from the DCM corroborates the consensus of erosion concerns in the area of 3rd through 13th Streets. The DCM calculated rates show the shoreline between 3rd Street and 15th Street experienced a landward shoreline recession between 1981 and 2016. Although the recession rate experienced seems minimal, the data shows the shoreline between 3rd Street and 15th Street as the most susceptible to erosion forces. Therefore, the Town elected to place the nearshore material seaward of this shoreline in efforts of providing a secondary benefit from the navigation project. The placement of beach-compatible sand placed in the nearshore will add to the sediment supply in the active profile and increase the protection level afforded against wave and current driven shoreline erosion.

If portions of the nearshore material migrated back to Tubbs Inlet, it would not be distinguished from the existing sediment supply already available in the ebb shoal system and nearshore area closer to Tubbs Inlet. Therefore, the relatively small quantity of material proposed for nearshore placement should not create adverse shoaling impacts for Tubbs Inlet or erosion impacts along Sunset Beach. Furthermore, the grain size distribution of the dredged material is considered beach compatible, therefore placing this material in the nearshore zone should have no impacts on native grain size distribution.

Project Level Impacts

In regard to cumulative impacts, this navigation project should be considered as having independent utility and does not force any future construction activity. Nor will the project encourage future development within the project vicinity beyond what is already reasonably expected. The authorization requested seeks

a single use permit to allow navigation dredging to manage the shoaling patterns currently experienced in South Jinks Creek. Any future project expansion would require a new environmental review and approval and should be based on the conditions at that time. The project would also not have any significant impacts on traffic along Sunset Beach, nor the levels of dune vegetation present. However, the project would be expected to enhance navigational usage of public trust waters due to the dredging project.

The Preferred Alternative includes the dredging of approximately 89,100 CY from navigation channels in the Town of Sunset Beach. The Preferred Alternative would likely result in primarily short-term, localized, and temporary adverse effects to some fish species, but project design, implementation, and construction measures under consideration would keep these impacts to a minimum, as well as reduce the possibility of any permanent, long-term impacts. Short-term impacts will include increased turbidity, siltation, and noise from construction activities, but most managed species found in this area are highly mobile and likely be able to escape construction disturbance temporarily, eventually returning to the area post-construction.

While dredging construction activities and placement of dredged material will create short-term and localized impacts within the project area, long-term and permanent impacts are expected to be minimal for the Preferred Alternative. The area has been dredged historically without noticeable long-term or permanent impacts. Furthermore, areas across the state will continue to require beach disposal activities for protection of infrastructure.

In addition, the project may increase traffic on roads along Sunset Beach, due to the hauling of non-compatible beach material to upland disposal sites. Traffic increase will be short-term and will return to normal levels post construction. Therefore, no significant long-term impacts are expected.

Finally, there will be no increase or alteration to current dune or beach vegetation. The dredged, beach-compatible material will be placed along the nearshore environment. Therefore, there will be no impacts to dune or beach communities.

Actions to Reduce Cumulative Impacts

The Monitoring Initiatives Section includes environmental commitments and monitoring proposed to minimize project impacts. These actions will also reduce any cumulative impacts related to beach nourishment and offshore borrow activities.

AVOIDANCE AND MINIMIZATION MEASURES

Due to the nature of this project, it is not possible to achieve total avoidance of impacts to Waters of the U.S. The Town of Sunset Beach has worked with the resource agencies to avoid and minimize potential impacts that could reasonably be associated with the project since 2016, including four (4) coordination meetings and one (1) on-site discussion. The Town minimized the dredging footprint to avoid potential impacts to shellfish and adjacent Primary Nursery Areas (PNA) by removing North Jinks Creek from the proposed project. Through this action, the Town focused on addressing the areas of primary shoaling and removed the areas believed to be experiencing milder shoaling patterns. This required the Town to request and receive a variance from the Coastal Resources Commission to allow for the final dredge depth to be deeper than connecting water depths.

15A NCAC 07H.0208(b)(1)(F) requires that dredging not create an area that is deeper than connecting water depths. However, in response to potential shellfish impacts in North Jinks Creek, and coordination efforts with the DMF, DWR, USACE, and DCM, the Town removed North Jinks Creek from the project area. This dredge footprint resulting from the removal of the North Jinks Creek component required a

variance from the NCAC, which was granted on February 12, 2020 by the North Carolina Coastal Resources Commission (Tab H).

The hydrodynamic impact analysis evaluated a preferred alternative that extended through North Jinks Creek and maintained a depth of -7-ft MLW in South Jinks Creek. However, due to avoidance and minimization measures, the Town elected to reduce the preferred alternative after completion of the modeling analysis. The reduction in the preferred alternative entails removing North Jinks Creek from the project and raising the dredge elevation in South Jinks Creek to -6-ft MLW. Because the modeling showed no significant impacts resulting from this alternative, the revised dredge alignment will also not create any adverse hydrodynamic impacts.

The changes in the preferred alignment also provide additional support that no adverse hydrodynamic impacts should be anticipated. By removing North Jinks Creek from the project, the proposed dredging will not encroach on the critical cross-section governing tidal flow into Jinks Creek from the AIWW or Atlantic Ocean. The critical cross-section (A_c) defines the channel segment having the narrowest base and navigational depth. The critical cross-section governs the volume and velocity of tidal currents entering a system through a tidal event. Tab M provides cross-sections of Jinks Creek on 200-ft intervals. The information shows the critical cross-section for North Jinks Creek exists approximate to the AIWW confluence, between stations 2+00 and 6+00, where the controlling depth equals approximately -2-ft MLW. Although Tab M does not include cross-sections of Tubbs Inlet, Figure 16 shows the aerial view of the dredge area in relation to Tubbs Inlet. The aerial shows sediment shoaling between the inlet and the proposed dredge area approaches MLW elevation and creates the controlling alignment for tidal flows. Therefore, since dredging will not impose on either of these areas, the tidal velocities traversing Jinks Creek will not experience a significant change.

By removing North Jinks Creek from the project, the Town may now focus on the navigable waters experiencing the highest or most prominent shoaling trends. South Jinks Creek has experienced shoaling, presumably from Tubbs Inlet, resulting in a constricted channel width approaching 10-ft wide during low tide periods. Dredging in this area will provide access through heavily shoaled areas and help facilitate recreational navigation to the AIWW.

The Town is also pursuing a long-term solution to remedy the stormwater runoff that has created the sediment impoundments in the Bay Area and the Feeder Channel system. Tab P (Stormwater Master Plan) provides the comprehensive stormwater plan for Sunset Beach and shows the efforts planned that will alleviate a majority of the sediment shoaling. Although the stormwater plan cannot assist in removing sediment already accumulated in the navigation system, the plan provides a tool for limiting future maintenance needs.

The Town has also limited the dredging operations to the months of November 16th thru March 31st to reduce the potential for environmental impacts. In addition, the Town will provide a minimum 10-ft dredge footprint buffer from any coastal wetland identified at the time of construction. This will assist in maintaining the valuable habitat provided by the grasses established along the channel banks. The approximate 7,000-ft hydraulic pipeline carrying the nearshore placement material dredged from South Jinks Creek will also be positioned away from any established dune or beach vegetation. The final pipeline placement location will be coordinated with the USFWS and NCWRC prior to the initiation of dredging operations. The Town will also monitor turbidity created by the nearshore placement to help evaluate if impacts occur as a result of the sediment placement. Post-construction physical monitoring will also document the nearshore material placement performance for a period of at least three (3) years. In addition,

project construction will follow Federal guidelines designed to protect the Manatee, sea turtles, and Smalltooth Sawfish. These items are a few of the precautions proposed to help minimize the potential for environmental impacts on this project.

Specifically identified in the permit application for avoidance, minimization, and compensation measures include maintaining buffers from coastal wetland and avoiding channel areas with potential high concentrations of shellfish habitat; restricting dredging operations to between November 16 through March 31; coordinating with the WRC for beach pipeline placement; abiding by USFWS guidelines for avoiding the West Indian manatee; and following NOAA recommendations for avoiding sea turtles and Smalltooth Sawfish populations.

The above avoidance and minimization measures, along with those committed to by the Town through federal and state coordination, provides a balanced project that does not require compensatory mitigation. This is further reflected by the review of multiple state and federal agencies tasked with managing the coastal and estuarine environments of North Carolina. To date, no environmental agency has provided any indication the proposed project creates a significant concern for adverse impacts. This is demonstrated through review of the attached referenced documents (Tab G):

- CAMA Major Permit No. 79-19 from the DCM (10/28/19)
- 401 Water Quality Certification from the DWR (August 1, 2019)
- Memorandum from the DMF to DCM providing no objection to the project (July 19, 2019)
- NMFS letter offering no additional Essential Fish Habitat (EFH) conservation measures (August 2, 2019)
- USFWS letter accepting the reasonable and prudent measures (RPM's) and terms and conditions (T&C's) proposed for the project with only a request for coordination with USFWS and the WRC during construction to avoid potential impacts to wintering and nesting shorebirds and their habitat (July 29, 2019)
- WRC letter providing comments on the project requesting only to limit beach placement to between November 16 and March 31 (August 9, 2019).

AGENCY CONSULTATIONS/CORRESPONDENCE

On March 24, 2016, a shoreline management and pre-dredge analysis agency coordination meeting was held. Representatives from the Town, DCM, DMF, DWR, NCWRC, NMFS, USACE, USFWS, and Moffatt and Nichol were present. The meeting objective was established to develop the most efficient and acceptable path forward for permitting the approximate 3.5 miles of initial and maintenance dredging in the Town of Sunset Beach. The permitting process was determined to be a joint CAMA-USACE (RGP 198000291) permit application, with DCM as the lead agency for processing.

On October 8, 2016, a public information meeting was held. A project Frequently Asked Questions (FAQ) was generated as the handout to be given out to the public. Information contained within the FAQ handout included the project purpose, why Jinks Creek was included, the proposed project design depths, state regulations allowing the dredging, environmental surveys of Jinks Creek, addressing the meaning of deep water, addressing why the dredging in 1996 of an unrelated Jinks Creek was denied, etc.

On May 5, 2017, a third agency coordination meeting was held. Representatives from the Town, DCM, DWR, WRC, USACE, USFWS, and Moffatt and Nichol were present. The second agency coordination

meeting was requested to discuss the items of concern the agencies voiced from the initial meeting identified as:

- Jinks Creek Hydrodynamic Modeling Analysis requested by DMF and USACE addressing the projects potential scour and shoaling impacts to the Jinks Creek confluence with the AIWW, the "S" curve alignment in Jinks Creek, and Tubb's Inlet;
- Shellfish Survey of Turtle and Mary's Creek

Additional discussion points included:

- Evaluation of sediment compatibility in Jinks Creek;
- Beneficial reuse material placement on the west end of Ocean Isle Beach; and
- The most probable path forward for permitting the project.

On July 21, 2017, a Sunset Beach Pre-Dredge Analysis Jinks Creek Agency Site Meeting was held in the field. Attendees included representatives from DMF, NMFS, DCM, USACE, WRC, the Town, and Moffatt and Nichol. The purpose of this meeting was to review the initial shellfish survey results and sampling techniques and conduct a general review of site conditions and areas of interest/concern for resource agencies.

On April 9, 2018, a third agency coordination meeting was held. Representatives from the Town, DMF, DCM, DWR, WRC, NMFS, USACE, USFWS, North Carolina Coastal Federation, and Moffatt and Nichol were present. The discussion consisted of talking through the following items of concern:

- Confirmation on compliance measures necessary for 15A NCAC 07H.0208(b)(1)(F) in terms of how DCM would evaluate Jinks Creek in its entirety as a connecting waterbody;
- Jinks Creek Shellfish Survey Results;
- Minimization and Avoidance measures proposed for North Jinks Creek; and
- The agency recommended permitting strategy for North. Jinks Creek.

Additional concerns from the Town Council were also brought up and addressed during this agency coordination meeting regarding mitigation requirements, primary nursery area determinations for Jinks Creek, and the Sunset Beach CAMA Land Use Vision Statement.

On March 4, 2020, a USACE coordination meeting was held at the New Hanover County Public Library. In attendance were Jan Harris, Town of Sunset Beach Councilwoman; Tom Bormann, Town of Sunset Beach Councilman; Hiram Marziano, Town of Sunset Beach Administrator; Scott McLendon, USACE; Mickey Sugg, USACE; Tyler Crumbley, USACE; Greg Currey, USACE; Dawn York, Moffatt and Nichol; and Robert Neal, Moffatt and Nichol.

On June 30, 2020, a virtual conference call was held to discuss the Sunset Beach (Jinks Creek) nearshore disposal placement option. Representatives from the Town, USACE, DCM, DWR, DMF, WRC, NMFS, USFWS, and Moffatt and Nichol were present. A new project manager for the USACE Corps was introduced, Greg Currey. Tara MacPherson with DCM shared that she would handle the field representative duties for the project as well. The goal of the meeting would be to receive initial input from the agencies regarding potential concerns with nearshore placement of beach compatible material from the proposed dredging. State permits have already been received, but the original plan for disposal was no longer a viable option due to the difficulty in obtaining needed easements from property owners. However, due to the requirements of the State Dredge and Fill Law (113-229(h2)), beach compatible material must be placed

on the beachfront or nearshore area within the same inlet system where the dredging is occurring. Several other placement options have since been explored. M&N detailed the design considerations for the offshore placement area and discussion of all the options presented followed.

CONCLUSION

The Town of Sunset Beach intends to maintenance dredge South Jinks Creek, the Bay Area, and the Feeder Channel to restore navigational access to the residential canal systems. The project provides a key element for the Town and residents to manage the established navigation corridors on the east end of Sunset Beach. The proposed work follows a similar scope as previously authorized in 2002 for maintenance of the Feeder Channel and will be the first permitted dredging event for South Jinks Creek and the Bay Area. The dredge material will be hydraulically placed as nearshore material or mechanically transported to a nearby upland facility for storage or permanent placement. Approximately 40,500 CY will be placed in the nearshore as beneficial reuse material from South Jinks Creek along a 2,000-ft long by 250-ft wide stretch between 3rd Street and 13th Street. In addition, approximately 32,700 CY will be removed from the Feeder Channel system and 15,900 CY from the Bay Area for upland placement. The maintenance of South Jinks Creek will be conducted by a hydraulic pipeline dredge while the Feeder Channel and Bay Area will be dredged by a mechanical excavator.

The project will help restore navigation access to the waterway systems on the east end of Sunset Beach. The maximum dredge depth will range from -5-ft (-4+1) MLW for the finger canals to -6-ft (-5+1) MLW for the Feeder Channel, the Bay Area, and South Jinks Creek. The dredging will provide a buffer zone between the work area and any coastal marsh to reduce the potential for impacts. The work will also follow additional guidelines and recommendations provided by FWS and NOAA to further minimize the potential for environmental impacts during construction. This includes constructing during the cooler winter period of November 16th through April 30th. Furthermore, the project will follow Federal guidelines designed to protect manatee, sea turtle, and smalltooth sawfish.

To conduct the work as proposed, the Town has obtained a variance from the Coastal Resources Commission to satisfy the requirements of 15A NCAC 07H.208 (b)(1)(F). The current plan avoids dredging the connecting waters in North Jinks Creek to evade potential impacts to shellfish resources. The Town also does not intend to dredge Tubbs Inlet due to the potential for environmental impacts and increased cost. As such, the current plan will not provide a connection to the AIWW or the Atlantic Ocean at a depth equal to or greater than the proposed dredge areas.

Although the maintenance project does not provide a consistent depth to a ‘deep water’ connection, the project clears most of the navigation impediments in South Jinks Creek. The remaining high spots or shoal areas still present a navigation hazard. However, the Town believes avoiding the environmental impacts associated with the dredging of North Jinks Creek provides a reasonable alternative while still satisfying the comprehensive goal of restoring navigable access to the residents and guests of Sunset Beach.

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